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Computer-Aided Self-Exposure Therapy for Phobia/ Panic Disorder: A Pilot Economic Evaluation

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Abstract. Phobia/panic disorder is common. It improves with exposure therapy, even when guided mainly by a computer self-help system such as *FearFighter* (FF), but such therapy must also demonstrate cost-effectiveness. This study compares the cost-effectiveness of FF with computed-aided relaxation and clinician-led exposure. Data were obtained on patients from a randomised controlled trial of FF. Economic analyses used pretreatment and 1-month follow-up self-ratings of the main problem and global phobia. Clinician costs were calculated using the number of therapist hours and the cost of FF. Incremental cost-effectiveness ratios were calculated and cost-effectiveness acceptability curves were produced. Data were available on 62 patients with main problem ratings and 60 with global phobia ratings. FF and clinician-led exposure were more effective than relaxation but more expensive. Compared with relaxation, producing an extra unit of improvement on the main problem scale cost £64 with FF and £100 with clinician-led exposure. FF appeared to be more cost-effective using the global phobia rating (£112 per extra unit of improvement vs. £128 for clinician-led exposure). The cost-effectiveness of FF could be enhanced if users had less highly trained supporters. FF would be less cost-effective if face-to-face therapy was delivered by less qualified professionals. Caution is urged regarding these indicative findings given that these were secondary analyses. *Key words: health care costs; economic evaluation; cognitive behaviour therapy.*

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Panic and other phobic disorders are common and lead to substantial health care and lost production costs. Recently in the Netherlands, Batelaan et al. (2007) reported the average annual costs (in 2003 prices) of panic disorder and subthreshold panic disorder to be €10269 and €6384, respectively, compared with €2400 for other anxiety disorders. In England, anxiety disorders as a whole have been estimated to cost £8.9 billion (2005–2006 prices); 87% of these cases were due to lost employment (McCrone, Dhanasiri, Patel, Knapp, & Lawton-Smith, 2008). Panic and phobia may improve with self-exposure therapy guided by either face-to-face therapy or phone or computer support (Ghosh, Marks, & Carr, 1988). In a recent meta-analysis, Spek et al. (2007) found that Internet-based CBT resulted in large mean effect sizes for anxiety but small mean effect sizes for depression.

Relatively few economic evaluations of computer-aided self-help have been published, although it did appear to be cost-effective in depression/anxiety (McCrone et al., 2004) and

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obsessive–compulsive disorder (McCrone et al., 2007). In two early studies, exposure and other behaviour therapy given by nurse-therapists for neuroses (mainly phobias) reduced distress over time more so than routine care from a general practitioner and was less expensive (Ginsberg & Marks, 1977; Ginsberg, Marks, & Waters, 1984). A US study of patients with panic disorder compared acute treatment plus imipramine with acute treatment plus maintenance therapy with either half-dose (1.1 mg/kg/day) or full-dose (2.25 mg/kg/day) imipramine (Mavissakalian, Schmier, Flynn, & Revicki, 2000). Using a model based on previous research and clinical judgment, acute treatment plus either half-dose or full-dose maintenance therapy improved outcomes slightly more than acute therapy alone and led to reduced health care costs. In another, Australian study, Heuzenroeder et al. (2004) estimated that, compared with usual care, it would cost A$6800 to save one disability-adjusted life-year in panic disorder using publicly-funded psychologist-delivered cognitive behaviour therapy (CBT). This was less than that of CBT provided in other ways or of drug therapy. Another randomised controlled trial (RCT) compared patient education plus integrated primary and secondary care with usual primary care for panic-disordered patients (Katon, Roy-Byrne, Russo, & Cowley, 2002). Treatment focused on medication for panic disorder. Over a 12-month follow-up, the intervention led to more anxiety-free days but cost slightly more, although the cost per anxiety-free day was fairly low, suggesting that treatment was cost-effective. Trained CBT therapists are scarce in many countries, including the United Kingdom. Effective CBT could be made more widely available by harnessing computer-aided self-help. In their RCT of 20 panic-disordered patients, Newman, Kenardy, Herman, and Taylor (1997) compared two combinations of therapy: therapist-led CBT and mini-computer (hand-held)-aided CBT. The combinations had similar levels of effectiveness at 6-months follow-up, but costs for computer-aided CBT were estimated to be less.

In a further RCT (Marks, Kenwright, McDonough, Whittaker, & Mataix-Cols, 2004), computer-aided self-exposure (*Fear Fighter* [FF]) was more effective than a relaxation placebo and just as effective as therapist-led exposure. The current study uses data from the Marks et al. RCT to compare the cost-effectiveness of FF and of a relaxation placebo (each used in the RCT on a stand-alone computer in a clinic) with clinician-guided exposure in the clinic.

Method

Study background

The RCT is detailed in Marks et al. (2004), including details of the interventions. Patients with a *Diagnostic and Statistical Manual of Mental Disorders* (fourth edition; American Psychiatric Association, 1994) diagnosis of panic or phobic disorder were referred by professionals or themselves to the Behavioural Psychotherapy Outpatient Unit at Maudsley Hospital in London. Suitable referrals were randomised in a 2:2:1 ratio to 10 weeks of (1) mainly computer-guided self-exposure (FF), (2) entirely clinician-guided self-exposure, or (3) mainly computer-guided relaxation. All sessions were held at the outpatient unit; patients in the two computer conditions used a stand-alone computer there. FF users went through nine self-exposure steps guided in six computer sessions. The steps covered issues such as the rationale for self-exposure therapy, identifying triggers for panic, the setting of individualised exposure tasks, and coping tactics. Clinician-led exposure consisted of similar self-exposure guidance given entirely in six face-to-face sessions, each to last around 1 hr. Both of these interventions involved homework. Relaxation-placebo patients were guided in six computer sessions. Patients were advised to engage in daily relaxation homework. FF and relaxation patients had appropriate brief face-to-face support by a clinician at the start and end of sessions (mean total time of 76 min in all over 10 weeks). The clinicians were CBT therapists.

Outcomes and costs

The primary outcome measures used in the RCT and for this economic evaluation were the self-rated main problem (Marks, 1986) and global phobia item of the Fear Questionnaire (Marks & Mathews, 1979). For the first of these measures, patients specify their main phobia and then assign a score of 0 (*would not avoid it*) to 8 (*always avoid it*) to this problem. The global phobia

rating also is scored 0 (*no phobias present*) to 8 (*very severely disturbing/disabling*). These one-item outcome measures are reliable scales that have proved valid in many studies of phobia/panic disorder (e.g. Alkubaisy et al., 1992; Marks et al., 1993). Improvement in those scales is reflected by reduction in panic, given its close association with agoraphobia.

Change in these scores from Weeks 0 to 14 (1-month follow-up) was multiplied by −1 so that positive and negative scores denoted clinical improvement and worsening, respectively. Only cases for which baseline and follow-up scores were available were included.

The RCT had not aimed to assess the cost-effectiveness of FF, so the use of other health and social care services was not measured, but data were recorded on the number of minutes clinicians spent with patients. In an independent review of computer-aided psychotherapy, the cost of FF was estimated at £196 per patient if used in one general practice and at £111 if used throughout a primary care trust containing several general practices (National Institute for Health and Clinical Excellence [NICE], 2005); these costs were used in this evaluation. Therapist input cost was estimated by combining the unit cost of psychological treatment (£69/hr; Curtis & Netten, 2004) with the amount of time therapists spent with patients in each of the three randomised groups. Relaxation was a placebo, so we did not include the cost of this group's use of the computer, although we did include the cost of clinician support for relaxation because we assumed this would reflect usual care.

Analysis

In these intention-to-treat analyses, we analysed patients in the group to which they were originally randomised (Everitt, 1994). Longitudinal data were analysed for all randomised patients for whom postbaseline data were available. Where postbaseline data were unavailable, baseline data were not carried forward in the manner often done, because it is unlikely that scores remained frozen at their last observed value (Everitt, 1998). Mean differences in the cost of the treatments (including clinician support time for FF and for relaxation) were compared and significance was tested using bootstrapping (because of the nonnormal distribution of the cost data).

Cost-effectiveness was assessed in two ways. First, incremental cost-effectiveness ratios were constructed by dividing the difference in cost between two groups by the difference in outcomes. This then reveals the extra cost incurred to secure an extra unit of improvement in outcomes. Second, we used the net-benefit approach. This assumes a societal value of an improvement in someone's health status and a cost of achieving that improvement (e.g. clinician input, use of the computer system). A net benefit is achieved if the monetised societal value of the improvement exceeds the cost incurred in producing it, as in the equation $NB=(E\lambda)-SC$, where NB=net benefit, E=effectiveness, λ=societal value of a one-unit improvement in effectiveness, and SC=service costs. Because we do not know how much society values a unit improvement in outcome (λ is unknown), we used a range of values for λ (£0–200 in £10 increments). For each of these values of λ, a regression analysis was used to estimate the mean difference in net benefit among (1) FF and relaxation, (2) clinician-led exposure and relaxation, and (3) clinician-led exposure and FF. For each model, 1000 regression coefficients for the group variable were generated using bootstrapping, and the proportion of these that were greater than 0 indicated the probability that FF or clinician-led exposure was cost-effective compared with relaxation (i.e. it yielded a mean incremental net benefit >0). These probabilities were then used to generate cost-effectiveness acceptability curves. This procedure was repeated for each outcome measure and for both licence costs of FF. As noted, psychologists were assumed to provide treatment at a cost of £69/hr. A sensitivity analysis was done by assuming that practice nurses would provide treatment at a cost of £27/hr (Curtis & Netten, 2004).

Results

Sample

Of the 90 patients included in the study, 62 were women and 28 were men (mean age=38 years, $SD=13$). Agoraphobia was the primary diagnosis for 27 patients, social phobia for 24, and a specific phobia for 39. The mean duration of the phobia was 17 years ($SD=12$). Five patients were referred by mental health professionals and 15 by general

practitioners; 70 were self-referrals. Costs and outcomes at posttreatment were available for 62 patients with main problem ratings and 60 with global phobia ratings. More dropouts, however, were from the FF group (15) compared with clinician-led exposure (9) or relaxation (1) groups. Those with main problem ratings at posttreatment were more likely to be female (n=47 [76%]) than those without these ratings (n=15 [54%]; Pearson's chi-square p=.035). The same was true for the global phobia rating: 46 (77%) of those with ratings were female compared with 16 (53%) of those without ratings (Pearson's chi-square p=.024). Dropouts did not differ significantly from those with posttreatment ratings on any of the other measures mentioned previously, although about twice the proportion of patients with ratings had agoraphobia compared with those without ratings.

Effects and costs

The mean improvement on the main problem ratings (rated on a scale from 0–8) was as follows: FF, 3.95 (2.16 *SD*); clinician-led exposure, 3.93 (1.62 *SD*); relaxation, 0.71 (1.20 *SD*). Mean improvement on global phobia rating (rated on a scale from 0–8) was as follows: FF, 2.95 (1.84 *SD*); clinician-led exposure, 3.59 (1.87 *SD*); relaxation, 1.07 (1.86). Thus, FF and clinician-led exposure had similar effectiveness (differences not significant), and both were superior to relaxation (details in Marks et al., 2004). Table 1 shows the mean costs. Compared with relaxation, total costs were significantly higher for FF (at a price of £196 or £111) and for clinician-led exposure. FF cost significantly less than clinician-led exposure. Confidence intervals of the cost differences were similar whether the analysis concerned the whole sample or just those with valid outcome scores.

Cost-effectiveness

For the main problem rating, the incremental cost-effectiveness of FF over relaxation was £64 (cost difference divided by outcomes difference). That is, it cost £64 for FF to achieve one extra unit of improvement compared with relaxation at an FF price of £196 per patient (and £37 at an FF price of £111 per patient). Conversely, the incremental cost-effectiveness ratio for clinician-led exposure compared with relaxation is £100. FF dominated clinician-led exposure in that it was more effective (although not significantly so) and less expensive.

For the global phobia rating, the incremental cost-effectiveness ratio for FF compared with relaxation is £112, falling to £67 with the lower price of FF. The incremental cost-effectiveness ratio for clinician-led exposure over relaxation is £128. Clinician-led exposure was nonsignificantly more effective than FF but more expensive. The incremental cost-effectiveness ratio of clinician-led exposure over FF is £175, or £308 if the lower price of FF is used.

Figure 1 shows that clinician-led exposure had at least a 50% chance of being more cost-effective than the relaxation placebo if a value of about £100 was placed on a unit improvement in the main problem. However, for FF to have a similar chance of being more cost-effective than relaxation placebo, a unit change only needs to be valued at £65 and as low as £35 if licensing to more providers leads to a lower price per person. For all values of λ, FF never has less chance of being cost-effective than clinician-led exposure. Figure 1 shows that beyond a certain point the curves flatten out, meaning that any further rise in λ has only a marginal impact on cost-effectiveness. If the computer cost of relaxation was nonzero, the curves would all shift to the left, indicating a greater level of cost-effectiveness for both exposure conditions compared with relaxation, but the difference between FF and clinician-led exposure would not change.

The cost-effectiveness acceptability curves using the global phobia rating are shown in Figure 2. Clinician-led exposure has a 50% chance of being more cost-effective than the relaxation placebo when a value of about £130 is placed on a unit improvement in the global phobia. For FF to have a 50% chance of being more cost-effective than relaxation, a unit change only needs to be valued at £115, or £65 if FF is used at the primary care trust level. Clinician-led exposure has a slightly higher probability of being cost-effective than FF at values of λ beyond about £160.

Sensitivity analyses

If a lower cost of clinician time is used (£27/hr), then, using the main problem rating, the incremental cost-effectiveness ratio for FF over relaxation is £62, or £35 if the lower licence cost is used, whereas the incremental

Table 1. *Mean (standard deviation) intervention costs*

Group	*FF* @ £196/patient	*FF* @ £111/patient	Therapist-led exposure	Relaxation	90% CI of cost difference
Whole sample (n=89)[a]	281 (88)	201 (73)	363 (158)	110 (33)	*FF* (£196) vs. relaxation: £143 to £198 *FF* (£111) vs. relaxation: £66 to £114 *FF* (£196) vs. therapist-led exposure: −£129 to −£31 *FF* (£111) vs. therapist-led exposure: −£207 to −£115 Therapist-led exposure vs. relaxation: £207 to £294
Sample with main problem scores (n=62)	328 (35)	243 (35)	445 (65)	122 (21)	*FF* (£196) vs. relaxation: £192 to £221 *FF* (£111) vs. relaxation: £106 to £136 *FF* (£196) vs. therapist-led exposure: −£140 to −£92 *FF* (£111) vs. therapist-led exposure: −£226 to −£178 Therapist-led exposure vs. relaxation: £301 to £345
Sample with global phobia scores (n=60)	333 (28)	248 (28)	445 (65)	122 (21)	*FF* (£196) vs. relaxation: £198 to £225 *FF* (£111) vs. relaxation: £113 to £140 *FF* (£196) vs. therapist-led exposure: −£134 to −£89 *FF* (£111) vs. therapist-led exposure: −£220 to −£173 Therapist-led exposure vs. relaxation: £301 to £345

Note. *CI=confidence interval.*

[a]*Therapist time was not available for one participant.*

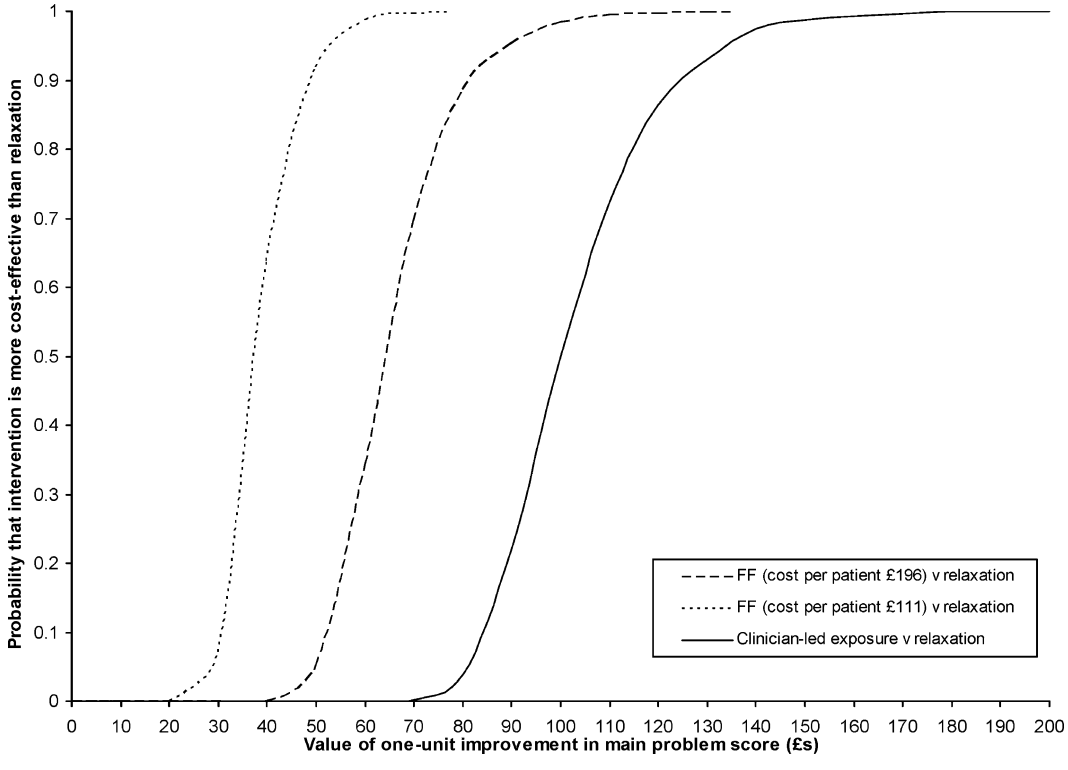

Figure 1. Cost-effectiveness acceptability curves showing probability that *FearFighter* (FF) and clinician-led exposure are more cost-effective than the relaxation placebo (based on main problem score).

cost-effectiveness ratio for clinician-led exposure over relaxation falls to £39. Using the global phobia rating, the incremental cost-effectiveness ratio for FF over relaxation is £107, and £62 with the lower licence fee, while the incremental cost-effectiveness ratio for clinician-led exposure falls to £50. Cost-effectiveness acceptability curves are not shown for these sensitivity analyses. With the main problem rating, the result would be to shift the curve comparing clinician-led exposure to relaxation to the left (i.e. higher probabilities of clinician-led exposure being more cost-effective than relaxation for lower value placed on unit improvements in outcome) to between the two curves. For the global phobia rating, the clinician-led exposure curve would shift to the left of both FF curves, indicating superior cost-effectiveness regardless of the level of the FF licence fee.

Discussion

The limited supply of trained therapists and the competing demands on their time renders computer-aided therapy a potential alternative. Previously, self-exposure using FF was as clinically effective as clinician-led exposure and significantly more clinically effective than a relaxation placebo in treating panic disorder and phobia. Here we found that FF is less expensive than clinician-led exposure, even when supplementary clinician input to the FF group is included. Although FF has cost implications, its incremental cost-effectiveness ratio compared with that of relaxation suggests that an extra unit of improvement on the rating of the patient's main problem (using a scale from 0–8) costs from £36 to £62. The cost-effectiveness acceptability curve indicates that FF may be cost-effective compared with relaxation as long as society values a unit improvement in the main problem rating at £80 or above. (However, the limited scope of the evaluation needs to be taken into account when making such a judgment.) For all values examined, FF appeared more cost-effective than clinician-led exposure compared with relaxation. FF does not appear as cost-effective when the global phobia rating is the

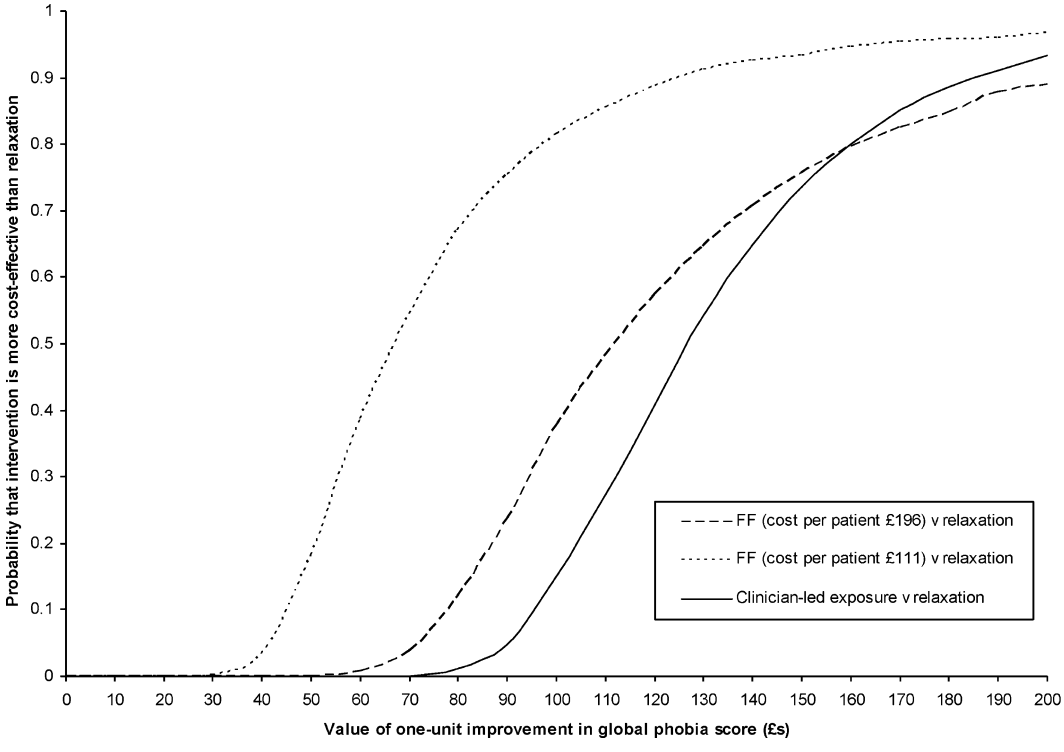

Figure 2. Cost-effectiveness acceptability curves showing probability that *FearFighter* (FF) and clinician-led exposure are more cost-effective than the relaxation placebo (based on global phobia score).

main outcome measure, but clinician-led exposure is only slightly more cost-effective if society values a unit improvement in the global phobia rating above £160.

The cost-effectiveness of FF is highly sensitive to the cost of clinician time either to give brief support to FF users or for entirely clinician-led therapy. We used the cost of a clinical psychologist in this study. Clearly, the advantage for FF would rise if less expensive professionals were the brief supporters of FF users and would fall if they provided the clinician-led therapy entirely. In some primary care trusts, less qualified staff currently support users of FF on the Internet or as main case managers. An economic evaluation of Internet-delivered FF at home or in other nonclinical settings (Schneider, Mataix-Cols, Marks, & Bachofen, 2005) was outside the scope of this study, but Internet delivery probably generates further cost savings for FF compared with face-to-face therapy by requiring less clinic space and fewer computers and by having less qualified staff support FF users by phone and e-mail.

The present study had limitations. First (and most important), it was essentially a secondary analysis of data collected to test the clinical effectiveness of FF. Because a cost-effectiveness analysis was not initially envisaged, data were not collected on the use of services other than the amount of clinician time used. However, the costs of clinician time and of FF itself are likely to be the key "cost drivers" in the short term. In addition, no data were collected on production losses, which may be important for this patient group. Second, the 1-month follow-up was short. The length of time that improvement was sustained would affect the need for booster therapy and have economic implications, although past computer-aided exposure for phobia/panic yielded improvement continuing to 6-month follow-up (Ghosh et al, 1988) and face-to-face exposure therapy yielded long-term improvement over a 1-year period (Fava, Ruini, Rafanelli, & Grandi, 2002). Third, although the sample size was sufficient to show significant clinical effects, a larger sample would enable us to have more

generalisable results. Fourth, our outcome measures were single-item scores, and some might prefer a multi-item scale. However, carefully crafted one-item scales can detect clinical change as robustly as multi-item measures (e.g. McKenzie & Marks, 1999) and are less likely to induce rating fatigue, which could loom when computer-aided self-help systems are used on a national scale (NICE, 2006). Finally, the dropout rate was greater for the FF patients. This may suggest that for some patients computer-aided therapy is less appropriate.

Because of the limited scope of this economic evaluation, these results should be seen as indicative rather than definitive. In effect, we have conducted a pilot study, and future work should collect resource use data in addition to clinical outcomes and do so for a reasonable period of time. Despite these limitations, this study indicated that computer-aided self-exposure using FF can be as effective as clinician-led exposure and less expensive. Further research is required to determine whether the cost-effectiveness ratios for FF are acceptable to policy-makers and society.

Acknowledgment

Declaration of interest: Isaac M. Marks has intellectual property rights in *FearFighter*.

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