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# The efficacy of problem-solving treatments after deliberate self-harm: meta-analysis of randomized controlled trials with respect to depression, hopelessness and improvement in problems

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## ABSTRACT

**Background.** Brief problem-solving therapy is regarded as a pragmatic treatment for deliberate self-harm (DSH) patients. A recent meta-analysis of randomized controlled trials (RCTs) evaluating this approach indicated a trend towards reduced repetition of DSH but the pooled odds ratio was not statistically significant. We have now examined other important outcomes using this procedure, namely depression, hopelessness and improvement in problems.

**Method.** Six trials in which problem-solving therapy was compared with control treatment were identified from an extensive literature review of RCTs of treatments for DSH patients. Data concerning depression, hopelessness and improvement in problems were extracted. Where relevant statistical data (e.g. standard deviations) were missing these were imputed using various statistical methods. Results were pooled using meta-analytical procedures.

**Results.** At follow-up, patients who were offered problem-solving therapy had significantly greater improvement in scores for depression (standardized mean difference =  $-0.36$ ; 95% CI  $-0.61$  to  $-0.11$ ) and hopelessness (weighted mean difference =  $-3.2$ ; 95% CI  $-4.0$  to  $-2.41$ ), and significantly more reported improvement in their problems (odds ratio =  $2.31$ ; 95% CI  $1.29$  to  $4.13$ ), than patients who were in the control treatment groups.

**Conclusions.** Problem-solving therapy for DSH patients appears to produce better results than control treatment with regard to improvement in depression, hopelessness and problems. It is desirable that this finding is confirmed in a large trial, which will also allow adequate testing of the impact of this treatment on repetition of DSH.

## INTRODUCTION

Several types of problems may be identified in deliberate self-harm (DSH) patients. These commonly include interpersonal difficulties (especi-

ally with partners and family members), unemployment, financial and housing problems and social isolation (Paykel *et al.* 1975; Bancroft *et al.* 1977; Gibbons *et al.* 1978; Hawton *et al.* 1997; Williams & Pollock, 2000).

There is also mounting evidence to suggest that many DSH patients demonstrate specific deficits in the ability to solve the problems they

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face (e.g. Linehan *et al.* 1987; McLeavey *et al.* 1987; Schotte & Clum, 1987; Williams & Pollock, 2000). Hopelessness is thought to be a crucial factor in the development of suicidal ideas in depressed patients (Dyer & Kreitman, 1984), probably specifically by mediating the relationship between problem appraisal and suicidal ideation (Dixon *et al.* 1994; Rudd & Dahm, 1994; Wilson *et al.* 1995). Hopelessness is also associated with increased risk of suicide in DSH patients (Dahlsgaard *et al.* 1998). Mood disturbances are also associated with problem-solving and other cognitive deficits (Mitchell & Madigan, 1984; Seibert & Ellis, 1991; Kingsbury *et al.* 1999). Therefore, therapeutic interventions based on problem solving are regarded as a pragmatic approach for helping many people with suicidal behaviour (or emotional disorders) (Hawton & Catalan, 1987; Gath & Mynors-Wallis, 1997; Heard, 2000).

In treatment trials of DSH it is important to assess repetition of DSH as an outcome because it is common (Bancroft & Marsack, 1977; Sakinofsky, 2000) and has a strong association with eventual suicide (Ovenstone & Kreitman, 1974; Hawton & Fagg, 1988; Foster *et al.* 1997; Sakinofsky, 2000). In a recent systematic review of problem-solving interventions for DSH patients, repetition was used as the outcome in a meta-analysis of the results of these treatments (Hawton *et al.* 1998, 2000). Data concerning repetition was available in all but one study. Problem-solving treatments appeared to be more effective than control treatment in terms of preventing repetition of DSH (15.5% repetition in problem-solving treatment *v.* 19.2% repetition for control treatments). However, this difference was not statistically significant (odds ratio = 0.70, 95% confidence interval 0.45 to 1.11), which may be due to the insufficient numbers of participants in the individual trials and even overall (Hawton *et al.* 2000).

As House and colleagues (1992) highlighted when reviewing treatment in this field, it is also important to assess other outcomes in addition to repetition of DSH. Given the associations between poor problem-solving ability and both hopelessness and mood disturbance noted above, it is clearly important to examine the impact of problem-solving treatments on these cognitive and affective correlates of suicidal

behaviour. It is also important to assess outcome in terms of the extent to which treatment results in reduction of patients' problems. Unfortunately, there was considerable variation between the trials of problem solving identified in the review in terms of the types of outcome measures used. This, combined with the fact that vital information (e.g. means and standard deviations) are often missing from reports, makes the pooling of these data difficult. We have attempted to synthesize the results of the published studies in relation to the impact of problem-solving therapy on mood, hopelessness and problem outcome. We have used a variety of statistical techniques to achieve this because of the problems we encountered in extracting data from trial reports.

## METHOD

### Identification of relevant trials

In producing this review we followed the standardized reviewing procedure adopted by the Cochrane Collaboration (Clarke & Oxman, 1999). Briefly, we conducted an extensive electronic (Embase; PsycLit; Medline; Cochrane Controlled Trials Register and the Cochrane Collaboration Depression, Anxiety, and Neurosis Trials Register) and hand search of the worldwide literature on DSH. One reviewer screened the abstracts of all publications which had been identified by the electronic search strategy. The original articles reporting the eligible studies were screened to determine their status as randomized controlled trials, and whether they were relevant for the purpose of the review. The eligibility of the trials for inclusion in the study was based upon independent assessment by two members of the review group.

In the main review (Hawton *et al.* 1998, 2000) we sought to identify all randomized controlled trials of specific psychosocial and psychopharmacological treatments *versus* any control intervention (e.g. standard or less intensive types of aftercare) in the treatment of DSH. This paper is solely concerned with outcomes in the trials of problem-solving therapy that we identified, that is five of the original 20 trials reported in the meta-analysis of repetition data by Hawton *et al.* (2000), plus the trial by Patsiokas

& Clum (1985). Data from the Patsiokas & Clum (1985) trial were not included in the original review as repetition of DSH during follow-up was not included as an outcome measure. The authors of the review tried unsuccessfully to obtain data on repetition from the trialists.

Participants in eligible trials were males and females of all ages, who shortly before entering the study had all engaged in deliberate self-poisoning or self-injury. We did not include trials in which some or all of the participants were suicide ideators (without self-harm) or those of people with depression in which DSH was an outcome variable. The details of the six randomized controlled trials included in this report are shown in Table 1.

Problem-solving therapy is intended primarily to help patients tackle their current problems, with a secondary aim of equipping them with skills to address future problems. More specifically, it usually first involves assisting patients to define their problems in detail. Thus, for example, specific behaviours (or lack of them) and emotions and the situations in which they occur are identified in order to define problems operationally rather than through general terms such as 'relationship' or 'work' problems. Patients are then helped to decide on appropriate goals, described in similar detail. Then patients are encouraged to use a stepwise approach to try to achieve improvement in their problems and work towards their chosen goals. Cognitive strategies are used to identify dysfunctional thoughts and beliefs which obstruct this process (Hawton & Kirk 1989), although the extent to which these were explicitly described in the trials in this review varied between the studies. In three of the trials the descriptions of treatment were very similar (Patsiokas & Clum, 1985; Hawton *et al.* 1987; Salkovskis *et al.* 1990). In Gibbons *et al.* (1978) the treatment (task-centred casework) focused on working on a single key problem. In McLeavey *et al.* (1994) particular attention was paid to improving problem-solving skills in general as well as tackling current problems. Evans *et al.* (1999) provided a self-help manual for patients and included basic cognitive techniques to manage emotions and negative thinking, in addition to problem-solving. Thus, the overall nature of treatment

varied somewhat between the trials but they all had problem-solving as the central therapeutic strategy.

### Quality of trials

We used the recommended Cochrane criteria for quality assessment (Clarke & Oxman, 1999) to determine the quality of the RCTs. Each trial was rated by two independent reviewers blind to its authorship. This rating system is based on the finding that the quality of concealment of allocation to treatment can affect the results of trials (Schulz *et al.* 1995). Studies were assigned a quality rating from A (adequate concealment) to C (inadequate concealment). In cases where the raters disagreed the final rating was made by consensus, including the opinion of a third member of the group of reviewers. Using this scoring system, one trial (McLeavey *et al.* 1994) was rated as inadequately concealed (because randomization had involved reference being made to an open random number table) and was given a rating of C. In the five other trials (Gibbons *et al.* 1978; Patsiokas & Clum, 1985; Hawton *et al.* 1987; Salkovskis *et al.* 1990; Evans *et al.* 1999) adequate measures appeared to have been taken to conceal allocation (e.g. serially numbered, opaque, sealed envelopes) and were rated as A quality.

All the outcome measures reported here were either based on self-report scales or ratings by assessors blind to treatment condition (see Table 1).

### Data extraction

#### *Characteristics of trials and patients*

We extracted data from each eligible trial concerning the characteristics of the patients, the details of the interventions and the outcome measures used to evaluate the efficacy of the treatments. This was carried out by two reviewers independently of each other. Where disagreements occurred these were resolved through consensus discussions with a third member of the group of reviewers.

#### *Extraction of outcome data*

'Depression' was reported in four trials, (Gibbons *et al.* 1978; Hawton *et al.* 1987; Salkovskis *et al.* 1990; Evans *et al.* 1989); 'Hopelessness' in three trials (Patsiokas & Clum,

Table 1. *Characteristics of included trials*

	Characteristics of participants				Characteristics of interventions		
	Numbers		% F (Age)	Repetition %	Experimental	Control	Outcome measures for depression, hopelessness and problem improvement
	E	C					
Gibbons <i>et al.</i> 1978	200	200	71 ( $\geq 17$ )	Repeaters were included but proportion NS	Crisis-orientated, time-limited task-centered social work at home. Problem-solving intervention that lasted for 3 months. Patients received a mean number of around 9 sessions. Therapists = 2 social workers	Routine treatment (referral back to GP, psychiatric referral, other referral)	Beck Depression Inventory Improvement in problems
Patsiokas & Clum, 1985	5 (Plus 5 in a cognitive restructuring treatment—not included here)	5	NS (NS)	NS	Interpersonal problem-solving skills training (D'Zurilla & Godfried 1971). Ten 1-h sessions conducted over a 3-week period. Therapist = 1 clinical psychologist	Individual therapy with clinical psychologist (content not specified)	Beck Hopelessness Scale Number of problems* Means-Ends Problem-Solving* Alternate Uses Test of impersonal problem solving*
Hawton <i>et al.</i> 1987	41	39	66 ( $> 16$ )	31	Out-patient problem-orientated therapy (Hawton & Catalan, 1987). Up to eight 1-h sessions over an 8-week period. Therapists = 5 nurse counsellors	GP care: (e.g. individual support, marital therapy)	Beck Depression Inventory Beck Hopelessness Scale Improvement in problems
Salkovskis <i>et al.</i> 1990	12	8	50 (16–65)	100	Cognitive-behavioural problem-solving treatment at home. Five, 1-h sessions over a period of a month. Therapist = 1 community psychiatric nurse	Treatment as usual (not described)	Beck Depression Inventory Beck Hopelessness Scale Personal Questionnaire Rapid Scaling Technique: problem list*
McLeavey <i>et al.</i> 1994	19	20	74 (15–45)	35.6	Interpersonal problem-solving skills training (D'Zurilla & Godfried 1971). Five, 1-h sessions at weekly intervals. Mean no. sessions = 5.3. Therapists = clinical psychologists and registrars in psychiatry	Brief problem-solving therapy (Hawton & Catalan, 1982); regarded as standard aftercare. Mean no. sessions was 4.2	Beck Hopelessness Scale Means-Ends Problem-Solving* Number of problems pre- and post-test* Perceived ability to solve current problems* Optional Thinking pre- and post-test*
Evans <i>et al.</i> 1999	18	16	62 (16–50)	100	Manual Assisted Cognitive Behavioural Therapy (MACT) plus standard treatment. Manualized therapy for individuals with personality disorders developed by Davidson & Tyrer (1996). Treatment lasted between 2–6 sessions. Time period for treatment not stated. Therapists = 1 psychiatrist, 2 nurses, 2 social workers	Standard psychiatric treatment (e.g. psychiatrist, community mental health team, specialist social worker)	Hospital Anxiety and Depression Scale (Depression score)

\* Not included, i.e. data was not used in the analysis. E, Experimental; C, control; F, female; (Age, in years); NS, not stated.

1985; Salkovskis *et al.* 1990; McLeavey *et al.* 1994) and 'Improvement in problems' in two trials (Gibbons *et al.* 1978; Hawton *et al.* 1987). Hawton *et al.* (1987) measured 'Improvement in target problems' as defined and identified by the therapist as the focus of treatment. Two research assistants rated changes in relation to the problem and a high inter-rater reliability was reported. Gibbons *et al.* (1978) assessed change in problems in, first, personal relationships and, second, social relationships at follow up. Interviews were carried out by independent assessors blind to treatment condition to determine whether these problems had improved or worsened after treatment. We used the outcome data concerning changes in problems in personal relationships as nearly 70% of trial participants had listed this as a problem at the time of overdose compared to 45% reporting problems with social relations. Three further studies (Patsiokas & Clum, 1985; Salkovskis *et al.* 1990; McLeavey *et al.* 1994) included different measures of problem-solving that were not compatible with each other; only Gibbons *et al.* (1978) and Hawton *et al.* (1987) had used measures that could be reasonably combined (see Table 1 for further details). No other individual outcome variable (except repetition of DSH) had been measured in more than one trial. Much of the data needed to perform meta-analyses on these outcomes was missing from the reports (e.g. means and standard deviations), so we contacted the authors of trials seeking this information. Only one author was able to provide the original trial data we required (Hawton *et al.* 1987). For the other trials we adopted various strategies to impute missing data from information that was reported (e.g. from test statistics). These strategies are described below.

In two trials (Salkovskis *et al.* 1990; McLeavey *et al.* 1994), mean scores on some scales at follow-up were reported in graph format only. Two reviewers estimated means independently from the graphs. Where there was disagreement, consensus was reached with a third member of the review group.

Four of the trial reports had not included standard deviations (s.d.s) associated with mean test scores at follow-up. This was a considerable problem as standard deviations are critical to the meta-analytical procedures used to pool

continuous outcome measures from trials. One of the authors was able to provide the standard deviations from the original data (Hawton *et al.* 1987). For the Gibbons *et al.* (1978) trial, s.d.s associated with mean scores on the Beck Depression Inventory (Beck *et al.* 1961) at follow-up were imputed from *t* test statistics by rearranging the equation used to derive the value of *t*. In effect the *s* (standard deviation) and *t* are swapped in the formula for the *t* test (Green *et al.* 1998), giving

$$s = \frac{\bar{x}_1 - \bar{x}_2}{t \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

where  $\bar{x}_1$  and  $\bar{x}_2$ , are the mean values in groups of sizes  $n_1$  and  $n_2$ . This procedure can yield only the pooled s.d. (i.e. the same value in each group), but as we assume that the groups have the same true s.d. when performing the test, this is not an important issue.

Salkovskis *et al.* (1990) did not publish s.d.s for mean scores on the Beck Depression Inventory (BDI) (Beck *et al.* 1961) and Hopelessness Scale (HS) (Beck *et al.* 1974) at follow-up, but they did give *F* test statistics. The *F* test is precisely equivalent to the two-sample *t* test if there are only two groups to be compared (which is the case here), with  $F = t^2$ . Thus, the s.d.s in each treatment group were imputed using the equation given above.

McLeavey *et al.* (1994) also did not report s.d.s for mean scores on the Hopelessness Scale (Beck *et al.* 1974), but they gave means and s.d.s of change scores and these were used instead in the analysis.

### Meta-analytical procedures

In conducting the analyses we used the Cochrane Collaboration software Revman 3.1 (Review Manager, 1998). In all cases, our principle method of analysis was based on fixed effects but we also comment on findings based on random effects analysis.

#### Continuous data

As two different scales (BDI, Beck *et al.* 1961; Hospital Anxiety and Depression Scale, Zigmond & Snaith, 1983) had been used to assess depression, Cohen's *d* (Standardized Mean Difference, SMD) was calculated. In simple

terms the standardized mean difference is the mean difference divided by the pooled sample standard deviation and the results are thus related to multiples of the standard deviation. As all trials had used the same scale to assess hopelessness (Beck *et al.* 1974) we calculated the Weighted Mean Difference (WMD).

#### *Dichotomous data*

Mantel-Haenszel odds ratios were calculated using Revman 3.1 for the improvement in problems outcome variable.

## RESULTS

The results of the meta-analyses of the data extracted relating to depression, hopelessness and problems from the problem-solving trials are shown in Fig. 1.

### Depression

Four trials measured depression as an outcome variable. Three of these (Gibbons *et al.* 1978; Hawton *et al.* 1987; Salkovskis *et al.* 1990) used the BDI and one (Evans *et al.* 1999) used the Hospital Anxiety and Depression Scale (only the depression scores are used here) (Zigmond & Snaith, 1983). These two instruments for measuring depression are conceptually if not numerically similar, so it was deemed appropriate to combine results from them using the SMD at follow-up evaluation. The resulting SMD for these trials indicated a significantly lower depression score condition of about one third of a standard deviation in the group of patients who were offered problem-solving treatment (SMD = -0.36; 95% CI -0.61 to -0.11 (fixed effects); SMD = -0.49, 95% CI -0.89 to -0.08 (random effects)).

### Hopelessness

All three of the trials that measured hopelessness (Patsiokas & Clum, 1985; Salkovskis *et al.* 1990; McLeavey *et al.* 1994) used the Hopelessness Scale (Beck *et al.* 1974). The WMD for these trials combined indicated a significantly lower hopelessness score at follow-up (of about three scale points on average) in the patients who were offered problem-solving treatment (WMD = -2.97; 95% CI -4.81 to -1.13; (fixed effects); WMD = -2.81; -5.68 to 0.07 (random effects)).

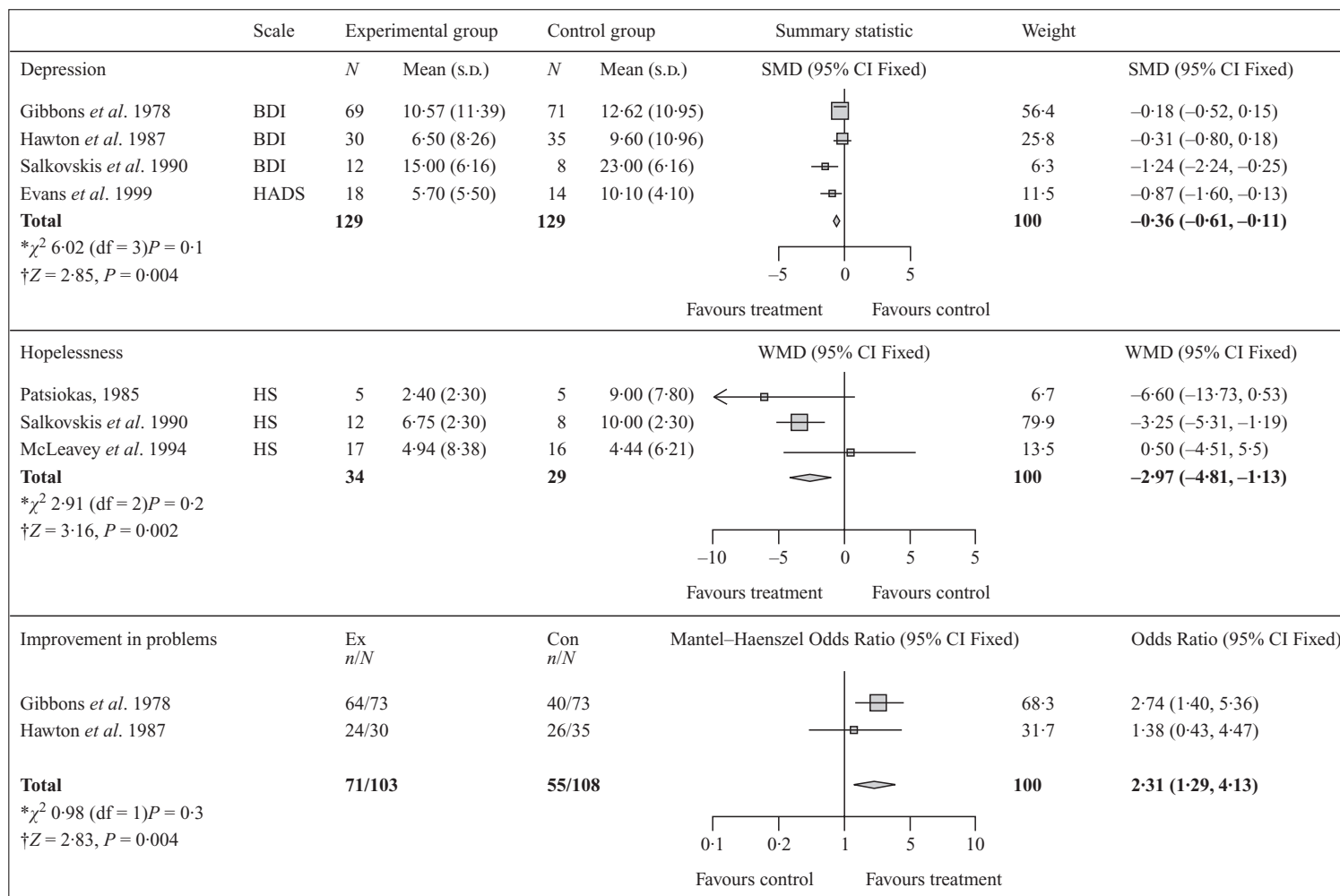
### Improvement in problems

The combined odds ratio for the two trials that measured whether problems had improved with treatment (Gibbons *et al.* 1978; Hawton *et al.* 1987) also indicated a significant difference at follow-up, with more patients in the problem-solving group having improved (OR = 2.31; 95% CI 1.29 to 4.13 (fixed effects); OR = 2.32; 1.30 to 4.15 (random effects)).

## DISCUSSION

The results of the meta-analyses conducted on the data for depression, hopelessness and problem improvement from RCTs evaluating the effects of problem-solving therapy in DSH patients were positive. Problem-solving therapy appeared to be more effective in improving levels of depression and hopelessness than control treatment. In addition, problem-solving treatment was also shown to be more effective in terms of improvement in problems. It is uncertain if these changes would mediate a reduction in repetition of DSH as there may be other confounding factors (e.g. interpersonal issues) which contribute to repetition. However, these results are in keeping with the directions of effect found by Hawton *et al.* (2000) for repetition of DSH (although this finding was not statistically significant).

While data from only two trials could be included in the meta-analysis concerning improvement in problems, it should be noted that three further trials reported other problem-solving outcome measures. Patients who received problem-solving therapy in the Patsiokas & Clum (1985) study had better scores on the Means-Ends Problem-Solving (MEPS) test (Platt & Spivack 1977) at the end of treatment than patients who had received either cognitive restructuring therapy or non-directive therapy. Similarly, McLeavey *et al.* (1994) showed significantly improved MEPS scores in people who received problem-solving therapy. We did not pool the results of the MEPS scores from the Patsiokas & Clum (1985) and McLeavey *et al.* (1994) trials in a meta-analysis due to the different ways in which the MEPS test can be scored. Salkovskis (1990) demonstrated that participants allocated to problem-solving therapy reported significant improvement in their



\*The  $\chi^2$  value (and *P* value) indicates whether there is statistically significant heterogeneity of treatment effects across studies.

†The *Z* value (and *P* value) indicates the strength of the difference in outcome in the two treatment groups pooled across studies.

FIG.1. Results of meta-analysis for depression, hopelessness and improvement in problems at final follow-up assessment.



three main problems as rated using the Personal Questionnaire Rapid Scaling Technique (Muhall, 1977).

Bias in the outcome findings is unlikely because the measures used were either based on patient self-reports or assessment ratings made by blind assessors. The findings are based on all trial participants for whom outcome data was obtained, irrespective of the extent of treatments received (i.e. on an intention-to-treat basis).

The comparison treatment in each study was 'standard aftercare' (except in Patsiokas & Clum, 1985, where it was non-directive counselling). However, it should be noted that this varied in content and intensity between the trials. The most extreme example was the trial of McLeavey *et al.* (1994) in which a basic form of problem solving was used as the control treatment as this was regarded at that stage as being 'standard aftercare'. Omitting this trial from the meta-analyses, however, only affected the odds ratio for hopelessness, which in fact became larger.

There was some variation between the trials in the characteristics of study participants. The main difference was in the proportion of those who were repeaters of DSH at the time of entry to the trial, this varying between nearly a third (Hawton *et al.* 1987) and all patients (Salkovskis *et al.* 1990; Evans *et al.* 1999), although this information was not provided in two trials. Repeaters are generally more difficult to treat effectively (Sakinofsky, 2000) so the main likely effect of this variation would have been to reduce treatment effects in those studies which included a greater proportion of individuals with previous DSH. In fact, there was no indication of this being so. Female patients made up half to nearly three-quarters of subjects. There was little variation in terms of age.

The content and context of problem-solving therapy varied somewhat between the trials. The more recent trials (Salkovskis *et al.* 1990; McLeavey *et al.* 1994; Evans *et al.* 1999) tended to place more overt emphasis on cognitive procedures than the earlier trials. Also, nearly all the trials included additional procedures, such as provision of information, open access at times of crisis, and, in the trial of Evans *et al.* (1999), a focus on management of emotions and negative thinking, together with a treatment

manual for patients. It could be argued that this variation diminishes the value of the meta-analysis. However, problem-solving was the primary therapeutic intervention in the experimental condition in all the trials.

Inadequate reporting of data from some of the trials made the analysis of the continuous outcome variables (depression and hopelessness) difficult. Incomplete reporting is quite common for trials with continuous outcomes. These difficulties were dealt with using various statistical methods in order to pool these data using meta-analytical procedures. The assumptions made in these calculations are likely to have had only a minimal effect on the numerical results. The statistical methods we used assume that the data have a normal distribution within each treatment group in each study. This condition is not met by the data for hopelessness and depression, which are positively skewed. The effect of skewness in meta-analysis not known, but in other circumstances it tends to reduce statistical power, although its effect is least when, as here, the groups are of similar size (Bland, 1995).

Problem-solving therapy is a pragmatic approach which may be suitable for a sizeable proportion of DSH patients. It has the advantages of being relatively easily taught, usable by a range of clinicians, brief and comparatively cheap. It has been demonstrated to be of value in the treatment of patients with emotional problems in general practice (Mynors-Wallis, 1996). If, as suggested by our findings, it is of benefit in many DSH patients this has important implications, particularly in view of the very considerable and growing problem of DSH (Hawton *et al.* 1997; Kapur *et al.* 1998).

The relatively small numbers of patients included in these trials limit the conclusions that can be based upon the results, either individually or when combined. The results of our analysis clearly indicate the need for a large single trial of problem-solving therapy, which, in addition to assessment of repetition of DSH, includes proper evaluation and reporting of mood, hopelessness and improvement in problems at follow-up. These latter factors are important in terms of reflecting patients' well-being and quality of life, as well as being relevant to risk of repetition. In the absence of a major trial the results of this

meta-analytical study are encouraging and should prompt those responsible for services for DSH patients to further investigate the provision and evaluation of this approach.

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