The impact of the emotional disclosure intervention on physical and psychological health – a systematic review

A West Midlands Health Technology Assessment Collaboration report

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West Midlands Health Technology Assessment Collaboration (WMHTAC)

The WMHTAC produces rapid systematic reviews about the effectiveness of health care interventions and technologies, in response to requests from West Midlands Health Authorities. Reviews take approximately 6 months and aim to give a timely and accurate analysis of the available evidence, with an economic analysis (usually a cost-utility analysis) of the intervention accompanied by a statement of the quality of the evidence.

Conflicts of interest

This work has been undertaken by people funded by the NHS. The authors have received no funding from any sponsor in this work.

Contribution of Authors

Catherine Meads undertook the collection and collation of evidence for this review and wrote the report. Douglas Carroll gave some advice on a preliminary draft. Antonia Lyons read and commented on the draft report.

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West Midlands Regional Evaluation Panel Recommendation:

The recommendation for the impact of the emotional disclosure intervention on physical and psychological health was:

NOT PROVEN

There is insufficient evidence to recommend use of the intervention outside further good quality research to establish its effectiveness

Anticipated expiry date: 2005

- This report was completed in May 2003
- The searches were completed in February 2003
- Numerous small trials are currently underway or have recently been finished and not published yet, particularly in people with physical illnesses. This suggests that the evidence base of the intervention will gradually increase and uncertainties regarding the effectiveness will decrease correspondingly.

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1. EXECUTIVE SUMMARY

- Emotional disclosure is a technique whereby people are encouraged to write or talk in private about a traumatic, stressful or upsetting event, usually from their past. Typically they write for 15-20 minutes in 3-4 days and are encouraged to go into as much detail as possible about their feelings surrounding the event. This systematic review examines the effectiveness of emotional disclosure compared to neutral writing or non-intervention.

- One hundred and forty seven studies were found. Sixty-one trials were included, 72 studies were excluded and sufficient details were not available for a further 15 studies. Studies were excluded mainly because they were either not RCTs or because the emotional disclosure was indistinguishable from counselling. Of the excluded studies, five RCTs only published subgroup results and 2 had no follow-ups available. Of the included trials, 59 were RCTs and 2 were randomised crossover trials. Thirteen were on people with pre-existing morbidity such as fibromyalgia, rheumatoid arthritis and cancer, 17 had psychological inclusion criteria such as PTSD and the remaining RCTs and 2 crossover trials had physically healthy volunteers. Of the 61 included trials, many were small ($n<50$) and the reporting quality was generally poor. All trials reported physical health, psychological, performance, immunological or physiological outcomes.

- A wide variety of physical health outcomes were measured but many not reported. Objectively measured physical health in people with pre-existing morbidity either found no difference or an improvement for the intervention groups. Objectively measured health centre visits showed no significant differences between intervention and control (WMD –0.06, 95%CI –0.26 to +0.13, random effects). Self-report health centre visits showed a similar result. Self-assessed health behaviours, where reported, were found not to be different between the two groups. Other questionnaire measures showed conflicting results. In people with pre-existing morbidity, there were improvements in the intervention groups compared to controls for pain, sleep quality, physical dysfunction, physical symptoms, fibromyalgia impact, health interference with daily functioning and perceived somatic symptoms. None of the RCTs demonstrated worse physical health.

- For psychological outcomes there was more positive and negative mood for intervention compared to control but no differences in anxiety, depression or impact of events. Other psychological outcomes, where reported, either showed no difference or a mixture of results with no clear trend or conflicting results.

- There is no clear evidence to demonstrate the efficacy of the intervention reviewed. This finding is contrary to a previous meta-analysis and numerous recent editorials on the subject. It may be that the rather biased reporting of outcomes has resulted in a more positive impression of the intervention than is actually the case, but neither is there any evidence that it does any harm. Without solid evidence of effectiveness there is a danger of its proliferation in inappropriate circumstances in clinical practice. There is a need for a large, good quality RCT, adequately powered to detect a small effect size, to establish whether this type of emotional disclosure has any effect at all.

ABBREVIATIONS

AIMS-2	Arthritis Impact Measurement Scales. Outcome measure used in rheumatoid arthritis. Includes physical dysfunction, affective disturbance and pain scales.
ANOVA, ANCOVA	Analysis of variance, analysis of co-variance
ARA	American Rheumatism Association
B2M	Beta 2 microglobulin – marker of immune system activation
BDI	Beck depression inventory
BP	Blood pressure
BPS	Best possible self
BRFL	Brief reasons for living inventory
BSI	Brief symptom inventory
CABQ	College attitudes and behaviours questionnaire
CAT	College adjustment test
CD3, CD4, CD8, CD16, CD56	Specific subsets of T lymphocytes
CES-D	Center for Epidemiological Studies-Depression Scale
CHI^2	Chi squared test
COPE	Questionnaire measure of coping process
CSAQ	Cognitive and social anxiety questionnaire
DARE	Database of abstracts of reviews of effectiveness
EBV	Epstein Barr virus
ESR	Erythrocyte sedimentation rate
FACT	Functional assessment of cancer therapy scale
FEV1	Forced expiratory volume in one second
FIQ	Fibromyalgia impact questionnaire
FSS	Fatigue severity scale
GEQ	Grief experience questionnaire
GHQ	General health questionnaire (psychological health)
GPA	Grade point average
GRQ	Grief recovery questionnaire
Hb	Haemoglobin
HCV	Health centre visits
HDL	High density lipoproteins, blood lipid test
Hep B	Hepatitis B
HIV	Human immunodeficiency virus
IES, IES-R	Impact of events scale, impact of events scale – revised
IL-4, IL-10	Interleukins 4 and 10, cytokines
ISI, ISSI	Institute for Scientific Information databases
ITT	Intention to treat
LDL	Low density lipoproteins, blood lipid test
LFTs	Liver function tests
LOT	Life orientation test
MAACL-R	Multiple affect adjective checklist – revised
MANOVA, MANCOVA	Multivariate analysis of variance, multivariate analysis of covariance
MCSDS	Marlowe-Crowne social desirability scale
MMI	Mood measuring instrument – Combination of POMS and Amsterdam mood questionnaire
NAS	Negative affect schedule
ng	Not given (result not given in trial report)
NHRC mood	Naval health Research Centre mood questionnaire
NHSCRD	National Health Service Centre for Reviews and Dissemination
NICU	Neonatal intensive care unit
NK	Natural killer cell (lymphocyte)

NMCUES	National medical care utilization and expenditure survey
no	Number
NNT	Number needed to treat
PANAS	Positive and negative affect schedule
PBHQ	Pennebaker and Beall's health questionnaire
PHA	Phytohaemagglutinin, lymphocyte blastogenesis measure
PLSE	Pennebaker's LSE scale
PNA	Positive and negative affect
POMS	Profile of mood states questionnaire
(ps)	Present sample
PSA	Prostate specific antigen
PSQI	Pittsburgh sleep quality index
PSS	Perceived stress scale
PTGI	Post traumatic growth inventory
PTSD	Post traumatic stress disorder
RA	Rheumatoid arthritis
RBC	Red blood cells
RCT	Randomised controlled trial
RFL	Reasons for living inventory
SAT	Scholastic aptitude test
SBQ	Suicide behaviours questionnaire
SCAS	Spence children's anxiety scale
SCL	Symptom check list
SCL-90, SCL-90-R	Symptom checklist – 90, symptom checklist – 90 – revised
SCS	Social constraints scale
SD	Standard deviation
SDQ	Strengths and difficulties questionnaire
SDS	Zung self-rating depression scale
SE	Standard error
SF-36	Short form 36, quality of life measure
SGOT, SGPT	Specific liver function tests
SIP	Sickness impact profile
SIQ	Suicide ideation questionnaire
SIS	Suicide ideation scale
SMD	Standardised mean difference
SSF	Suicide status form
STAI	State, trait anxiety inventory
STNF-R11	Soluble receptor for TNF – marker of immune system activation
STNG	Statistical test result not given
SWLS	Satisfaction with life scale, combined with LOT
TBSQ	Transition search behaviour questionnaire
TNF	Tumour necrosis factor – a pro-inflammatory cytokine
U+E	Urea and electrolytes blood test
URTI	Upper respiratory tract infection
VCA	Viral capsid antigen (refers to EBV)
WAS	World assumption scale
WMD	Weighted mean difference

GLOSSARY

Consort diagram	The CONSORT statement is a series of recommendations for improving the quality of reports of parallel-group randomised trials. One of the key recommendations is a flow diagram of subject progress through the phases of the trial. This includes numbers assessed for eligibility and then randomised and numbers in each group to receive allocated intervention, numbers lost to follow up and numbers subsequently analysed or excluded from the analysis, together with reasons for the losses of subjects at each stage. The CONSORT recommendations have so far been implemented by numerous medical journals including Lancet, BMJ and JAMA. Full details of the statement can be seen at www.consort-statement.org
Forest plot	This is a graphical display of individual effects observed in studies included in a systematic review, along with a summary statistic if meta-analysis is used (the diamond shape at the bottom of the plot). The summary statistic can be odds ratio or relative risk for binary outcomes, or weighted mean difference or standardised mean difference (Cohen's d) for continuous outcomes. The vertical line is the line of no difference between the two comparators, confidence intervals overlapping the vertical line represent lack of statistically significant effect (set at 95% in this systematic review)
Funnel Plot	This is a plot of study size against effect size of each study in the systematic review measuring the outcome of interest. The vertical line is the line of 'no effect'. As smaller studies tend to have exaggerated effect sizes (both positive and negative) compared to larger studies, the shape of the plot tends to take the form of an inverted funnel. Where there is publication bias, the smaller negative studies will be missing so the funnel will be asymmetrical.
Jadad Score	The Jadad scale is a quality scoring system for randomised parallel group trials which has the intention of assessing the likelihood of bias. The scale includes three key factors – randomisation and allocation concealment, blinding, withdrawals and dropouts and the score ranges from 5 (excellent) to 0 (very poor). This scale is widely used in systematic reviewing to give a rough indication of the quality of reporting of included studies.
Meta-analysis	The use of statistical techniques to combine the results of studies addressing the same question into a summary measure[1]
Number needed to treat	The number of patients who would need to be treated with the intervention rather than control in order to reduce by one the number of patients experiencing the condition. For example a NNT of 4 means that 4 people would need to be treated for one to benefit.
Systematic review	A review of the evidence on a clearly formulated question that uses systematic and explicit methods to identify, select and critically appraise relevant primary research and to extract and analyse data from the studies that are included in the review. Statistical methods (meta-analysis) may or may not be used[1]

2. AIM OF THE REVIEW

The aim of this systematic review is to assess the effects of the emotional disclosure intervention on healthy volunteers and people with pre-existing morbidity. The focus of the review is particularly on:

- Longer term physiological, blood, immunological, physical health, performance and psychological outcomes.
- Immediate physiological, blood and immunological outcomes

3. BACKGROUND

3.1 Description of underlying health problem

The idea has been around for centuries that the mind and the body are linked regarding physical health. For example, in 1870 Sir James Paget wrote in a textbook of surgery 'The cases are so frequent in which deep anxiety, deferred hope and disappointment are quickly followed by the growth or increase in cancer that we can hardly doubt that mental depression is a weighty addition to the other influences that favour the development of the cancerous constitution'.[2] In 1884, Daniel Hack Tuke, one of the pioneers of British Psychiatry, published 'Illustrations of the influence of the mind upon the body in health and disease, designed to elucidate the action of the imagination'.[3] More recently there has been a large body of research investigating the links between psychological states and physical health.

One area of research has been to look at the links between inhibition or disclosure of emotionally laden secrets and its effects on psychological morbidity. Psychoanalysts from Freud onwards have long advanced the psychological value of revisiting painful experiences from the past. More recently, researchers have looked at the implications of emotional inhibition on physical health and morbidity. Research in this area has investigated links between emotional inhibition, repression or suppression and either self-reported or more objectively measured physical health. Assessment of emotional behaviour is usually carried out using self report questionnaires of clinic attenders before histologically confirmed diagnosis. Table 1 lists six cohort and case-control studies investigating the incidence of various types of cancer. Worse health was found for people who tended not to express emotions in five out of the six studies.

Table 1. Cohort and case control studies of cancer incidence related to emotional expression

Study	n	Morbidity	Findings
Bleiker 1997[4]	902	Breast cancer	Diagnosis unrelated to emotional expression or suppression
Cooper 1989[5]	1596	Breast cancer	Diagnosis less likely with ability to express anger
Dattore 1980[6]	200	Various cancer	Diagnosis more likely with emotional repression
Greer 1975[7]	160	Breast cancer	Diagnosis more likely with extreme suppression of anger and other feelings
Remie 1995[8]	262	Malignant melanoma	Pathology proven diagnosis highest with emotional control
Wirshing 1985[9]	56	Breast cancer	Diagnosis more likely with denying or suppressing feelings

A similar worsening of disease progression with emotional repression or suppression has been found in HIV infection[10], pulmonary rehabilitation[11], malignant melanoma[12,13], but not rheumatoid arthritis[14]. Mortality has been found to increase with emotional repression in cardiovascular disease[15,16] and lung cancer.[17]

Given this evidence from descriptive studies, there have been two main areas of experimentation. The first has been randomised controlled trials (RCTs) of the beneficial effects of counselling on mortality in malignant disease. The second has been RCTs of emotional disclosure.

Defining emotional expression, emotional disclosure and emotional inhibition are problematic because there is no one unifying definition of emotion. This review takes a cognitive approach and regards emotions as coming from within the person.[18] Emotional disclosure can be differentiated from worry or rumination in that worry is characterised by emotional inhibition, lack of emotional arousal and superficial processing of upsetting material whereas emotional disclosure is associated with overt emotional display with physiological changes and some deeper level cognitive reprocessing.[19] This review also takes the perspective that emotional discharge can also be differentiated from catharsis in that catharsis is associated with emotionally charged material from outside the person (such as watching an upsetting film), whereas emotional discharge uses material from inside the person (such as memories of traumatic life events).[20-22] Therefore, in order to discover whether emotional disclosure affects physical health, it is important to use the person's own memories of traumatic life events as a stimulus to disclosure.

3.2 Description of new intervention

Emotional disclosure is a technique whereby people are encouraged to write (or talk into a tape recorder) in private about a traumatic, stressful or upsetting event, usually from their recent or distant past. They write for 15-30 minutes typically for 3-4 days within a relatively short time period such as consecutive days or within 2 weeks. They are encouraged to go into as much detail about their feelings surrounding the event as they can. A typical example of the intervention instruction is as follows:

> *During each of the four writing days, I want you to write about the most traumatic and upsetting experiences of your entire life. You can write on different topics each day or on the same topic for all four days. The important thing is that you write about your deepest thoughts and feelings. Whatever you write about should deal with an event or experience that you have not talked with others about in detail.*[23]

All emotional disclosure trials include this type of intervention instruction. In addition, some have extra intervention groups with a variation of the instruction such as writing about a trauma that is imaginary or has previously been disclosed, writing about a positive event or the positive side of a difficult event or including efforts to come to terms with it (reappraisal). Some include another group that discloses in front of a listener which can be a confederate, a researcher or a doctor. Where a listener is present the behaviour of the volunteer is bound to change when compared to the volunteer being alone and it is often difficult to determine whether the intervention is in fact counselling rather than emotional disclosure.

In emotional disclosure RCTs the control group can be no treatment, waiting list or written control. Typical writing control instructions are:

> *During each of the four writing days, I want you to write about an assigned topic. You should describe the specific event or object in detail without discussing any of your thoughts and feelings related to the topic.*[23]

(In this RCT the specific writing topics that were assigned included descriptions of the following for days 1 to 4 respectively: subjects' activities for the day, the most recent social event that they attended, the shoes that they were wearing and their plans for the remainder of the day.)[23] A number of the RCTs use a time management control group.

3.2.1 Outcome measures

Following emotional disclosure the volunteers can be followed up for a variety of outcomes (dependent variables). These include physiological and immunological outcomes, objective and subjective measures of physical health, performance and psychological outcomes. Immediate and longer-term outcome measures from the RCTs included in the systematic review are listed and described in Appendix 1 (page 40).

One of the outcome measures used in many of the RCTs is the number of health centre/physician/GP visits (HCV) over a defined period before and after the intervention. This can be reported from medical notes (objective measurement) or from volunteer self-report (subjective measurement). Visits to the doctor are used as a proxy measure of health. However sickness related behaviour depends on psychological factors (anxiety, negative

affectivity etc.) as much as physical factors and can be misleading.[3] It should be noted that self-report is associated with significant under-reporting of primary care visits.[24]

If emotional disclosure affects physical health then there may be physical mechanisms which would become apparent around the time of the intervention. Because of this, immediate physiological, haematological and immunological parameters recorded in some of the RCTs have also been included in this review. Another possible mechanism is by change in health behavious such as different eating habits, drinking patterns and smoking behaviour. These outcomes have also been included in the systematic review.

The variety of longer-term psychological outcomes assessed in the systematic review include mood, affect, depression, anxiety, impact of events scale and numerous other measures. Immediate psychological measures have not been included in this systematic review for several reasons including space considerations and little dispute around the general trend of results. Emotional disclosure appears to heighten negative mood for the first few hours or days after the intervention and this effect quickly fades. It is also widely reported that volunteers find that emotional disclosure and taking part in RCTs of emotional disclosure has been beneficial to them and helped them try to understand or come to terms with emotional difficulties from the past.

4. EFFECTIVENESS

4.1 Methods for reviewing effectiveness

4.1.1 Search strategy

A scoping review of the published literature was made in order to determine the direction of the systematic review and to develop an effective search strategy. For the systematic review, the following sources were searched:

- Bibliographic databases: Cochrane Central Register of Controlled Trials and Database of Abstracts of Reviews of Effectiveness (2002, Issue 4), Medline (Ovid) (1966 – Feb 2003), Embase (1980 – Feb 2003) Cinahl (1982 – Feb 2003), Science Citation Index (Web of Science) (1981-Feb 2003) and ISSI (Mar 2003), FRANCIS (Mar 2003), Index to Theses (Mar 2003) and UMI Proquest digital dissertations (Mar 2003) databases
- A citation search on Pennebaker J.W. in BIDS ISI (Mar 2003)
- A general search of internet sites using Google (July 2002) and Scirus (Aug 2002) search engines using the search term emotional disclosure. The first 100 references on each were checked.
- The list of emotional disclosure trials on J.W. Pennebaker's website (July 2002)[25]
- Hand search of relevant journals (seeAppendix 2, page47)
- Contact with emotional disclosure RCT researchers and other interested academics
- Citations checked in reviews and RCTs identified by the searches

For Medline, Embase and Cinahl search strategies, see Appendix 2 (page 47). The search terms for Cochrane Central Register of Controlled Trials, Database of Abstracts of Reviews of Effectiveness, Science Citation Index and Social Science Citation Index were emotion* and disclosure. Search terms in Index to Theses and UMI Proquest digital dissertations were emotion and disclosure. Search terms for FRANCIS were emotion (keyword) and disclosure (textword in title or abstract).

4.1.2 Inclusion and exclusion criteria

One reviewer, using explicit predetermined criteria, made the inclusion and exclusion decisions. The inclusion and exclusion decisions were made prior to knowledge of the trial results.

The inclusion criteria were:

Study design:	a. RCTs only for longer-term outcomes (follow up 1 category below). b. RCTs or randomised crossover trials for immediate physiological or immunological outcomes (follow up 2 category below)
Population:	Any (ie healthy or with physical illness or psychological problem or both).
Intervention:	Emotional disclosure which can be written or verbal. Any element of written included. If verbal only must be done without a listener present ie into a tape recorder or similar. No time limit on the length of disclosure.
Control:	a. Either written or verbal non-emotional or fact based activity for the same time in same modality (written, verbal) as intervention. If verbal must be done without a listener present as above. b. Non-intervention control (do nothing) c. Waiting list control
Outcome measures:	Objective or subjectively measured health centre visits or other physical health outcomes, psychological health, performance, physiological or immune system outcomes.
Follow up A: (physical and psychological health, performance measures)	Minimum 1 week following the end of the intervention phase of the trial. No maximum time limit for follow up.
Follow up B: (physiological and immune measures)	During intervention or any follow up length.

Excluded were:

1. Study type:	Non-randomised studies. (Within subject or crossover trials allowed for physiological and immune outcomes only)
2. Population:	Actors
3. Intervention:	Verbal emotional disclosure in the presence of a listener (eg counsellor, psychotherapist, therapist or doctor). Counselling or psychotherapy, expressive dance, film, hypnosis.
4. Control:	RCTs where the intension or expectation is that the control group may have an effect, eg RCTs with one written and one verbal disclosure group only, control groups as expressive dance, positive event disclosure or relaxation therapy
5. Reporting	Trials reporting psychological outcomes only during the intervention period only.
6. Follow up 1.	Studies presenting baseline characteristics only, with no follow up reported. Studies presenting combined intervention and control group results only. Studies presenting no results comparing intervention and control groups. Follow up longer than 1 week for crossover trials
7. Follow up 2.	Studies presenting subgroup analyses only.

4.1.3 Data extraction and quality assessment strategies

One reviewer extracted effectiveness and quality assessment data from all included studies onto predefined data extraction forms. Study design and quality assessment data were extracted independently of assessment of results. The quality of RCTs was assessed qualitatively and by Jadad score.[26] The quality criteria assessed were whether the method of randomisation was given, the presence or absence of allocation concealment, whether blinding was mentioned, irrespective of whether it was blinding of investigators or outcome assessors, whether there was explicit intention to treat analysis, whether a power calculation was reported and the presence or absence of a Consort-style flow diagram.[27] Losses to follow up were examined and note was made if they were greater than 20% of the number randomised. Publication bias was assessed by funnel plot using the objective HCV outcome plotted against study size.

4.1.4 Handling of results, statistics and synthesis

Where RCTs were reported as abstracts only the @ symbol has been used next to the RCT first author. Where data for results was missing, this was noted in the results tables in the appendices. For some of the studies found early in the review process, missing data was sought from the trialists. If missing data was not obtainable, no attempt was made to impute it from statistics such as p values or Cohen's d.

A level of statistical significance of $p<0.05$ has been used throughout the results.

The main method of synthesis of results was qualitative, supplemented by further quantitative analysis and synthesis where appropriate using Review Manager software version 4.1. Meta-analysis was carried out if more than 2 RCTs reported the same outcome and had relatively homogeneous populations. For reasons of space in the report, Forest plots are only presented where 5 or more RCTs reported the same outcome. Weighted mean difference (WMD) was used where the same continuous outcome measure was used, such as numbers of HCV. Where there were different measures for the same outcome (eg depression), standardised mean difference (SMD) was used. Different outcomes have not been combined for four main reasons:

1. The level of heterogeneity between studies would markedly increase, suggesting that they should not have been combined in the first place as they were measuring different entities
2. If, as is likely, the different outcome measures are measuring different entities, a combined result would not tell us very much
3. Most of the RCTs measure multiple outcomes so combining results would mean double or triple counting for some trials unless there were specific rules as to which outcome to select by preference from each trial. This would have meant putting outcomes in a hierarchy but I was unable to determine, for example, whether depression would be a more important outcome to include than anxiety
4. Putting outcomes together would mean using SMD rather than WMD. SMD assumes that the differences in standard deviations between trials reflect differences in measurement scales rather than real differences in variability between trial populations. This assumption may not hold with widely differing populations. The overall treatment effect can be difficult to interpret as it is reported in standard deviation units rather than in the measurement scale used.[28] For a definable entity

such as depression, the result may give an indication of the effect of emotional disclosure on depression, however it was measured. If physical health outcomes were combined (such as health centre visits, health behaviours, rheumatic joint count etc) the result, if statistically significant at the 5% level, could suggest that emotional disclosure improves physical health. However, this is too wide a category for any meaningful result. There is also the presumption that if it improves the physical health category then it improves all outcomes contained within that category, which may not be true.

Mood, depression and anxiety have been reported as separate outcomes and not combined because depression and anxiety are listed separately in The International Classification of Diseases and Related Health Problems as affective disorders whereas mood or affect per se is not.[29]

Both fixed effects and random effects models were examined, but only random effects Forest plots given in the results section for reasons of space. If RCTs had more than one intervention group, the one that was most similar to the basic emotional disclosure intervention as in the single intervention group RCTs, was used in the meta-analysis. For example, if the two intervention groups were real trauma and imaginary trauma, results from the real trauma group were used. If there was a written and a non-written control group, the written control group results were used. The reason for this is because the systematic review was seeking to establish whether the standard emotional disclosure intervention had any effect rather than reviewing all the permutations and comparing their effects to the standard intervention.

4.1.5 Economic evaluation

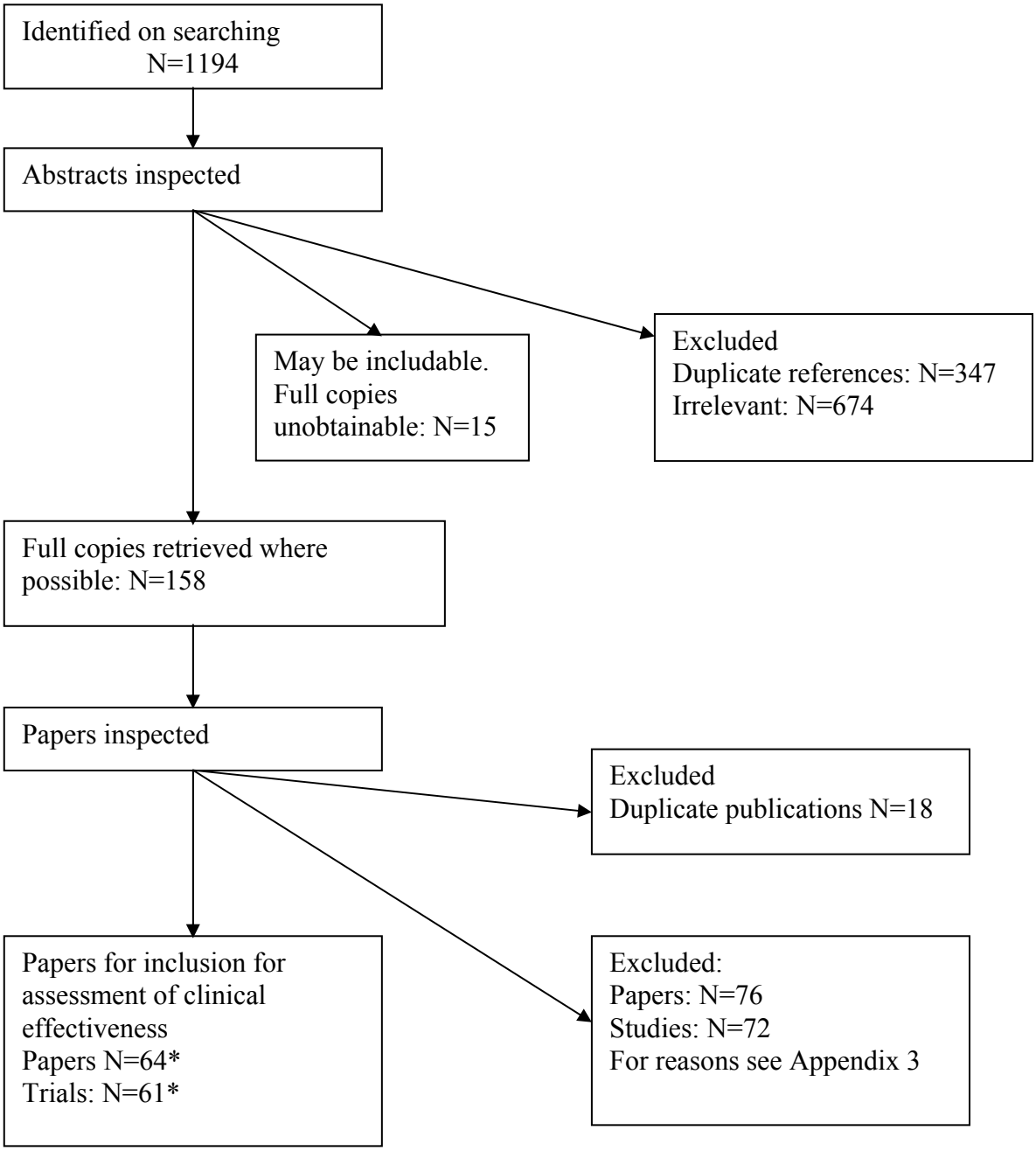
An economic evaluation was planned to have been carried out if there was evidence of clinical effectiveness of the emotional disclosure intervention in either healthy volunteers or in people with pre-existing morbidity. As there was no clear evidence of a beneficial effect, no economic evaluation was undertaken.

4.2 Results

4.2.1 Number of studies identified

Database searches found 1194 references of which 347 were duplicates. A total of 147 RCTs and other potentially relevant studies were found from the searches. For a flow diagram of the identification and inclusion of studies see Figure 1.

Figure 1. Flow diagram of identification and inclusion of effectiveness studies



*Some trials reported results of different outcomes in more than one paper

Sixty-one trials were included and 72 excluded. A list of excluded studies with reasons for exclusions are shown in Appendix 3 (page 49). The main reasons for exclusion were verbal emotional disclosure in front of a listener and being non-randomised studies. Brief details were obtained on a further 15 studies which may have been included if more details or the full trial report had been available (see Appendix 4, page 55)

Forty-seven of the included RCTs were reported mainly in one or more published journal articles (including internet journals), 4 were from unpublished manuscripts or PhD theses, 6 were published as conference abstracts only and 3 where the conference presentation was also obtained. Further unpublished information was obtained from the author in 4 RCTs. Two randomised crossover trials were included; one was a journal article and the other a master's degree thesis.

4.2.2 Number and type of studies included

The 61 randomised trials included in this systematic review are separated into three main categories:

- 13 randomised controlled parallel group trials carried out on people with pre-existing physical conditions [30-43]
- 18 randomised controlled parallel group trials carried out on people under psychological stress such as having a baby in an intensive care unit, losing a loved one to suicide or having PTSD[44-60]
- 28 randomised controlled parallel group trials carried out on physically healthy volunteers not under any specific psychological stress [23,61-86] (including one on children[83]) and 2 randomised crossover trials on physically healthy volunteers not under any specific psychological stress (for immediate physiological outcomes only) [87,88]

Data was extracted from these trials as per the methods section.

A full list of trials and their acronyms is given in Appendix 5 (page 56). In this and all the subsequent tables in the appendices, the trials are seprated in four categories. Listed first are RCTs with participants with pre-existing morbidity, next are RCTs with psychological inclusion criteria, then RCTs with healthy volunteers and finally the randomised crossover trials (where appropriate).

Of the 13 RCTs on people with pre-existing morbidity, all but one had written emotional disclosure intervention. This RCT was in people with rheumatoid arthritis and used verbal emotional disclosure into a tape recorder in private. Another combined written and verbal disclosure (into a tape recorder). Four RCTs had a second intervention group. Ten had written control groups, one verbal, one combined written and verbal and three had do nothing or waiting list controls.

Of the 46 RCTs on physically healthy volunteers, all included a written emotional disclosure intervention but 21 had more than one intervention group (see Table 4). Forty-three had a written control group and 3 had a non-intervention (waiting list or do nothing) control group only. Four had a second control group which was either written (1), or do nothing (3) control group.

Of the 2 crossover trials, one was written intervention and control with two groups in each. The other was single groups of verbal intervention and control in private.

Most of the trials were conducted in the USA (50) but other countries of origin were Great Britain (2), Israel (2), Netherlands (3) and New Zealand (4) (see Table 5, page 61)

There was a wide range of volunteers in the RCTs on people with pre-existing morbidity including students, sportspeople, men only and women only (see Table 5). The physical conditions included surgical (breast cancer, prostate cancer), medical (rheumatoid arthritis, asthma, chronic pelvic pain) and in rehabilitation (following anterior cruciate ligament surgery).

Sixteen of the RCTs specified psychological inclusion criteria such as recent bereavement or another stressful event. Of these, one RCT was in child sexual abuse survivors and two with people with PTSD. Other RCTs in the psychological stress group were carried out in subsections of society where a higher degree of stress would be expected such as prisoners or the recently unemployed. One was carried out in frequent clinic visitors where no organic cause had been found and it was assumed that the high rate of clinic use might have been partly psychological in origin.

The volunteers in the healthy volunteer trials were mainly students, particularly psychology students taking part in return for course credits. Two of the RCTs had immunological inclusion criteria – negative hepatitis B antibodies and positive Epstein Barr virus antibodies.

For all of the trials the time of the intervention varied from one episode of 20 minutes to 5 episodes of 45 minutes (see Table 6, page 63). The median was 60 minutes total writing time, usually split as 3 episodes of 20 minutes or 4 episodes of 15 minutes. Six RCTs had variable writing times, most frequently 60-80 minutes. Three RCTs did not specify writing times.

Follow up lengths varied from 1 week and 6 months for physiological, haematological or immunological outcomes, 1 to 15 months for physical health, 6 weeks to 8 months for performance and 1 to 7 months for psychological outcome measures.

4.2.3 Characteristics and quality of studies

The number of trial participants enrolled onto the trials is given by almost all of the trial reports but thereafter details of numbers were frequently difficult to ascertain (see Table 8, page 69). Only one RCT gave a Consort-style diagram. An attempt was made to construct a Consort-style diagram from the details given in the other 60 trials, with varying amounts of success. The number randomised to each group is given in 31 trials, the number in each group to receive allocated intervention in approximately 33 (some are a little vague, one could be calculated from percentages). The number of people followed up for any of the follow up measures reported was given in 34 of the 59 RCTs reporting follow up measures. The percentage lost to follow up could only be calculated in 33 RCTs. Of these, 15 had 20% or more lost to follow up and one had 59%. Six of the RCTs had considerable imbalance in losses to follow up, usually losing more of the intervention group than controls.

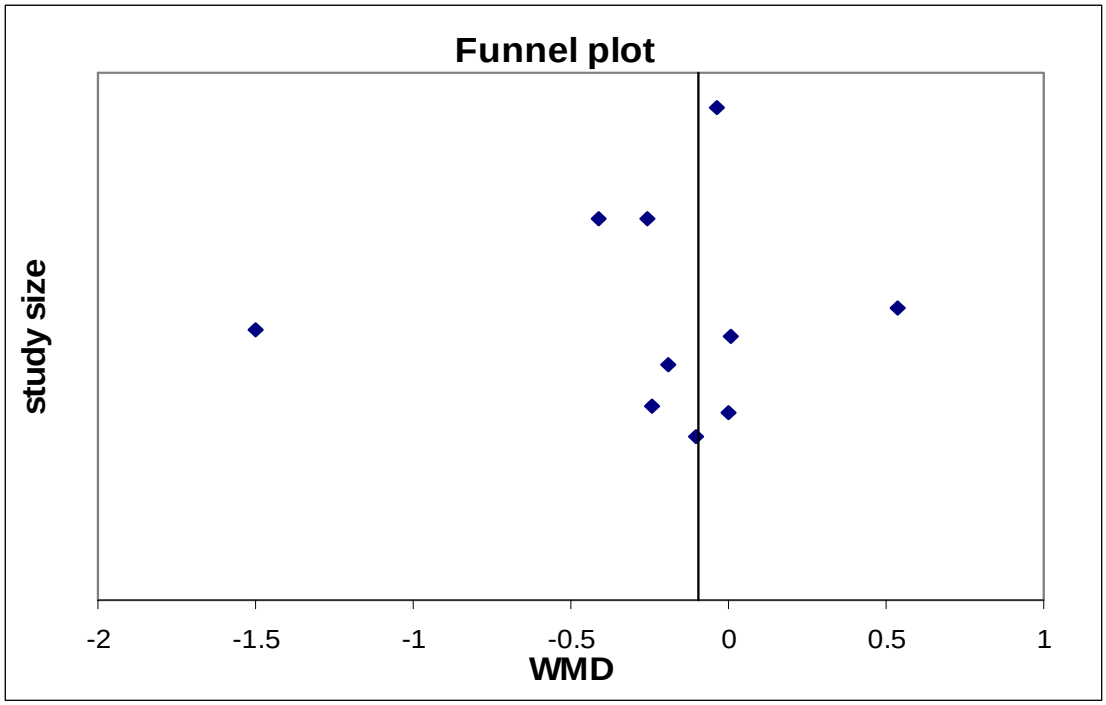
Many of the trials did not state whether the intervention and control group characteristics were balanced at the start of the trial (see Table 7, page 67). Of those that did mention it,

most reported where there was no differences between groups. Very few included basic details such as age, gender and ethnicity in each group. More reported psychological tests that were also used as outcome measures at follow up (ie administered the test twice). Some trials made statements such as 'pre-existing between group variation' but did not say on which factors this variation existed.

The quality rating of most of the RCTs was poor (see Table 9, page 71). The median Jadad score was 0 (from a scale of 0-5). One RCT achieved a Jadad score of 4 (this was published in the Journal of the American Medical Association), 5 RCTs scored 2 and 19 scored 1. The method of randomisation was given in 6 RCTs only, plus one used minimisation. Allocation concealment mentioned in 5 and some element of blinding in 17 RCTs. It was frequently unclear who was being blinded (investigators or outcome assessors – participants could not be blinded) and how successful the blinding was. There was a power calculation in 4 RCTs and explicit intention to treat analysis in only one.

There were sufficient trials for the possibility of publication bias to be considered in a funnel plot. The outcome chosen was objective HCV because this had the highest number of RCTs reporting sufficient data. The funnel plot does suggest some evidence of asymmetry which may suggest some publication bias but there are really too few data points to have any degree of certainty.

Figure 2. Funnel plot of RCTs, using objective HCV outcome measure



Footnote: vertical line is at –0.06, being the summary WMD for objective HCV, see Figure 3.

4.2.4 Tabulation of results

The results from the RCTs have been separated into 3 categories:

- Longer term follow up of physical health outcomes
- Longer term performance and psychological outcomes.
- Immediate or longer term follow up physiological and haematological/immunological outcomes

Numerical results from the trials are given in appendices 8-14. The first three appendices (8-10) (pages 73,75 and 77) are lists of outcomes measured and outcomes reported for physical health, performance and psychological and physiological/immunological outcomes. The last four appendices (11-14) (pages 79, 91, 93 and 105) are physical health results, performance results, psychological results and physiological/immunological results.

In the results tables, the numbers of people followed up for the various outcomes have been given rather than the number randomised or received allocated intervention for two main reasons – the number randomised to each group etc is not available for many of the trials and the number followed up is often different for different outcomes. Where absolute results have been available at follow up, these have been reported. Where these were not available, change scores from baseline have been reported instead. This is noted in the comments column. If there was more than one follow up, the longest follow up available was used. Where follow up results have been estimated visually from graphs, this has been noted in the comments column. If p values or statistical significance was mentioned in the RCT reports, these have been reported in the results tables. Where outcomes were described as being measured in the methods sections of the RCTs but there was no mention at all of any results in the results or discussion sections, these have been described in the systematic review as 'Not reported'. Physical health results have been separated into objective and subjective. In objective measures, the results were supplied by an external source such as examining physician (for physical state), health clinic (for health centre visits) or measuring equipment (for rehabilitation outcomes). Subjective outcomes were those where the participant filled in a questionnaire to report the outcome.

In the Forest plots, if RCTs did not give the number in each group at randomisation or follow up, an average per group of the total number followed up, or if this was not available, the number randomised or received allocated intervention was used instead.

The results presented below are for all trials then separated into results for the three categories, namely

- Volunteers with pre-existing physical conditions
- Volunteers under psychological stress
- Physically healthy volunteers with no obvious psychological stress

4.2.4.1 Physical health results

Objective physical health outcomes (Table 13**)**

Volunteers with pre-existing physical conditions
These RCTs measured a variety of relevant physical health outcomes, several using standard outcome measures. In three RCTs with participants with rheumatoid arthritis, two found no significant differences and the other found a significant improvement in disease state for the intervention group compared to control. This RCT also found a significant improvement in disease state in participants with asthma.

The surgical RCT measuring disease stage of participants who had had prostate cancer did not report the results.

The RCT with participants in rehabilitation following anterior cruciate ligament injury found a significant improvement for the intervention group compared to controls for one physical outcome – the number of step ups the person could manage, but not for the three other outcomes which were range of motion (extension and flexion) and biofeedback (a measure of how much the participant used a particularly relevant muscle for knee stability).

Physically healthy volunteers with no obvious psychological stress
One RCT on healthy volunteers measured illness related absences but they were not reported separately from total absences including annual leave.

Objectively measured health clinic visits (Table 14**)**
Sixteen RCTs reported this outcome although it was only fully reported in 11 (ie gave means and standard deviations or medians and ranges). The Forest plot is shown in Figure 3. The summary WMD for all of the 10 RCTs giving results (means and SDs) was -0.09 (95%CI –0.19 to +0.02) fixed effects and –0.06 (-0.26 to +0.13) random effects. The results suggest that there is no difference in objective HCVs overall for the intervention group compared to control at follow up. However, there is significant heterogeneity which may be partly explained by the analysis below.

Volunteers with pre-existing physical conditions
Only one trial measured objective HCV but found significantly more visits for the intervention group compared to control.

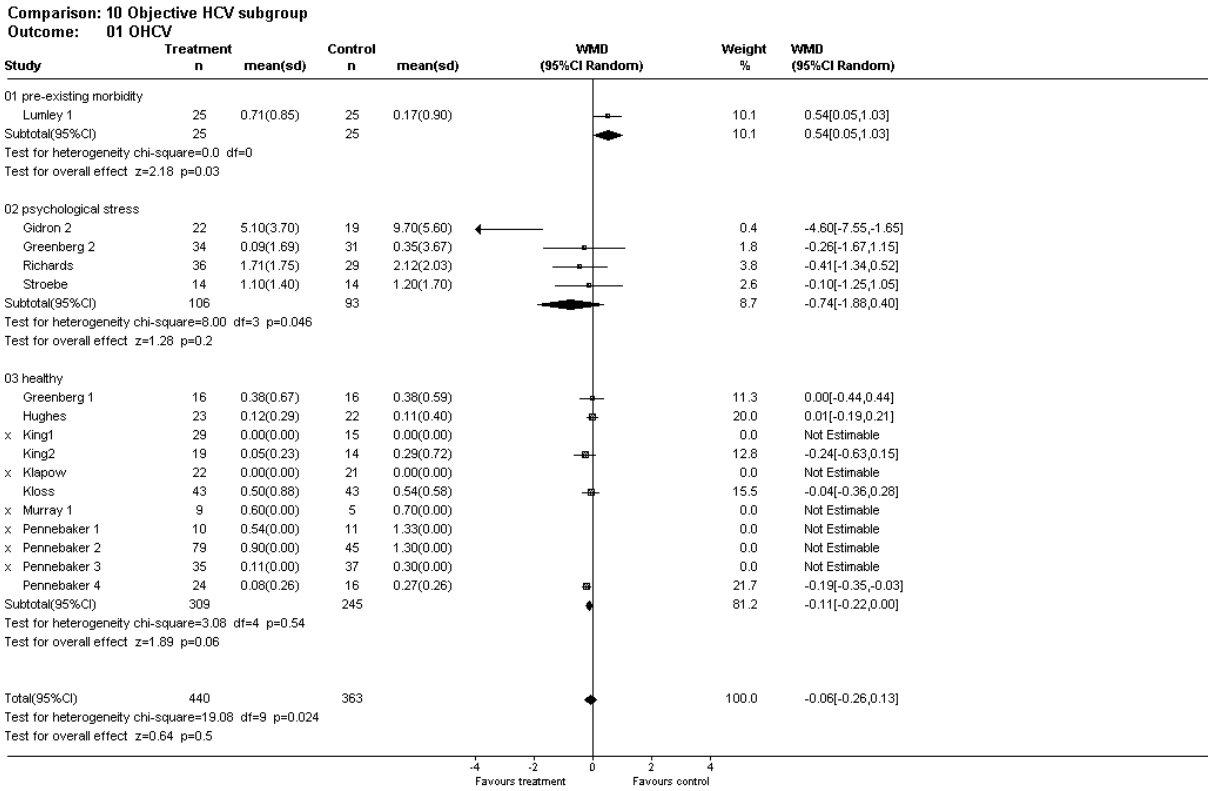
Volunteers under psychological stress
Four RCTs measured this outcome and all reported. The summary WMD was -0.48 (95%CI –1.11 to +0.15) fixed effects and -0.74 (95%CI -1.88 to +0.40) random effects, suggesting that there is no difference in objective HCVs for the intervention group compared to control at follow up. The heterogeneity was partly reduced in that there was a single RCT which showed a statistically significant result in favour of the intervention whereas the other three RCTs had very similar non-significant results.

Physically healthy volunteers with no obvious psychological stress

Eleven RCTs measured this but only 5 could be included in the Forest plot. The summary WMD was -0.11 (95%CI –0.22 to 0.00) fixed and random effects with very little heterogeneity, suggesting that there may be a decrease in HCV for the intervention groups.

Of the 6 RCTs not giving sufficient details to be included in the Forest plot, 3 showed significantly fewer HCV, 1 showed more use and 2 showed no significant differences. The one showing more service use at follow up reported medians and ranges rather than means and SDs and had a considerable baseline imbalance, with the intervention group using twice as many services as the control group. This was not apparent in the other non-reporting RCTs. For the 4 RCTs which reported means but no SDs, an average of all the reported SDs (of SD=0.5) were inserted for intervention and control groups. The effect of this was to change the summary WMD to -0.2 (95%CI –0.29 to –0.12) fixed effects and -0.21 (95%CI -0.35 to -0.07) random effects, suggesting that if results for these trials had been available, the meta-analysis would have shown a clearer statistically significant difference in HCV for healthy volunteers.

Figure 3. Forest plot of objective health centre visits



Subjectively measured health centre visits (Table 15**)**
Sixteen RCTs measured this outcome but only ten gave sufficient results to be included in a Forest plot (see Figure 4). The summary WMD was –0.95 (95%CI –1.11 to –0.78) fixed effects and –0.55 (-1.13 to +0.03) random effects. The results are suggestive but not conclusive of fewer HCV with this intervention but there was also considerable heterogeneity. Also, examining the RCTs that gave insufficient detail to be included in the Forest plot, five showed no significant difference between intervention and control groups and one was not reported. This suggests that the ones that did give summary statistics may have been a biased sample.

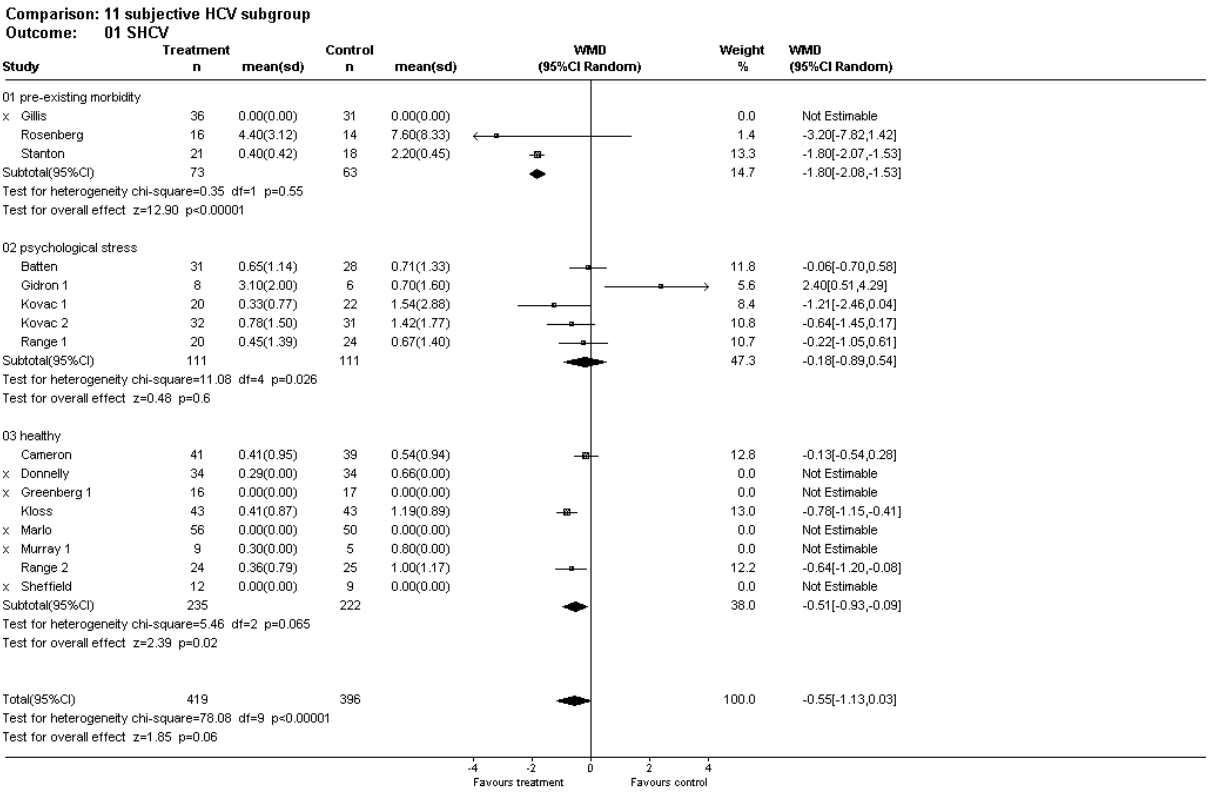
Volunteers with pre-existing physical conditions
One of the two RCTs reported cancer related and all other HCV separately (including regular dental and eye examinations). Only the cancer related results have been included in the Forest plot because most of the other RCTs reporting this outcome that were explicit did not include routine check-ups in HCV results. The meta-analysis demonstrated significantly fewer cancer related HCV for the intervention group compared to control (-1.8 (95%CI -2.08 to –1.53) fixed and random effects).

The trend of these results is in the opposite direction to the objective HCV results for volunteers with pre-existing physical conditions. However, there was only one RCT in that category so the result may have been a ‘statistical blip’.

Volunteers under psychological stress
Five RCTs reported and the combined result showed no significant difference for both fixed and random effects models (WMD –0.24 (95%CI –0.64 to +0.15) fixed and –0.18 (95%CI -0.89 to +0.08) random effects. There was significant heterogeneity, mainly because of one RCT which found a significant increase in HCV in the intervention group compared to control, rather than a decrease. This trial was the smallest of all the trials (n=14) and was in people with PTSD. For two of the trials, two numerical values of mean and SD were difficult to establish precisely. However, substituting the alternative values changed the WMD very little and do not alter the conclusions.

Physically healthy volunteers with no obvious psychological stress
Three RCTs reported and the combined result showed significantly fewer subjective HCV for the intervention groups compared to controls. WMD was –0.52 (95%CI –0.77 to –0.27) fixed and -0.51 (95%CI –0.51(-0.93 to –0.09) random effects models. Five of the non-reporting RCTs were in this group so lack of reporting may well have affected the result.

Figure 4. Forest plot of subjective health centre visits



Subjective physical health outcomes

The subjective physical health outcomes have been separated into four categories, compliance and health behaviours, results of the PILL and SMU health questionnaires and various other physical health outcomes.

1. One RCT looked at compliance (adherence) with drug regimens for people with HIV but demonstrated no difference between the two groups at follow up (Table 16). Seven RCTs looked at health behaviours in volunteers with pre-existing physical conditions, psychological stress and healthy students but the results were only reported in five. All showed no significant differences between intervention and control groups.

2. Six RCTs measured the PILL questionnaire (Table 17) but one did not report their results. Three either showed no significant differences or a relevant statistical comparison was not given. Two RCTs had statistically significant results – one showed fewer illnesses in the intervention group compared to control (lower PILL score) whilst the other showed the opposite. Meta-analysis of the 4 RCTs with sufficient information, using WMD gave 4.97 (2.16 to 7.78) fixed effects and 3.27 (-3.43 to 9.96) random effects. This suggestive but not conclusive that overall at follow up there is more reported illness for the intervention group than control. Three of the RCTs had volunteers with psychological stress and their results mirrored the overall result whereas the one RCT in healthy volunteers had a trend towards fewer reported illnesses in the intervention group.

3. Regarding SMU-HQ (Table 18), two RCTs measured this and the one that reported showed no difference between intervention and control.

4. A wide variety of other subjective physical health outcomes were measured by 10 RCTs on participants with pre-existing morbidity, 4 RCTs on people with psychological stress and 13 RCTs on physically healthy volunteers (Table 19 and Table 20). Many RCTs measured more than one outcome.

Volunteers with pre-existing physical conditions

In these RCTs (Table 19), 27 outcomes were measured and 21 reported. Of the reported outcomes, 12 showed no difference between intervention and control groups or no relevant statistical test was given. Regarding pain, of the 5 RCTs to measure this, 2 reported less pain for the intervention group compared to control and 3 showed no significant difference. There were improvements for the intervention groups compared to controls for sleep quality, fibromyalgia impact, rheumatoid arthritis physical dysfunction, generalised physical symptoms, health interference with daily functioning and perceived somatic symptoms. None of the RCTs demonstrated worse subjective physical health.

Volunteers under psychological stress

For the 4 RCTs on people with psychological stress, 6 outcomes were both measured and reported. One RCT split physical symptom scales and reported results and statistical tests on each subscale separately. The remaining five outcomes showed no significant differences.

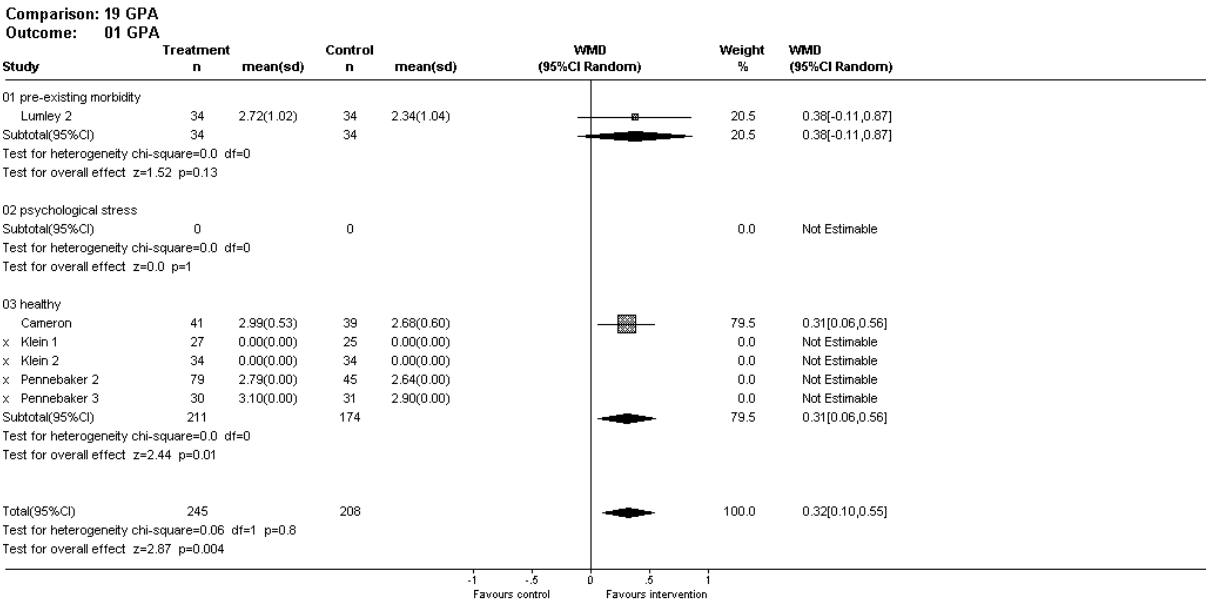
Physically healthy volunteers with no obvious psychological stress

For the RCTs on physically healthy volunteers, out of 22 outcomes measured, 4 were not reported and 13 showed either no difference between intervention and control groups or no relevant statistical test was reported. The remaining five outcomes provided conflicting results. One RCT showed fewer physical symptoms for the intervention group compared to controls whereas another showed more symptoms and a third showed more symptom severity. The fourth RCT showed less activity restriction from illness for the intervention groups compared to control but this RCT also showed more days off due to illness.

4.2.4.2 Performance results (Table 21)

Performance outcomes were mostly measured only in the RCTs on healthy volunteers and the types of outcome used reflect the fact that most of the volunteers in these RCTs were students. Six RCTs reported grade point average (GPA). Two of these showed higher scores for the intervention group compared to controls and four showed no significant differences. Full results were only available for two of the RCTs and the Forest plot (see Figure 5) demonstrates that with the results from these two RCTs the WMD showed a significant improvement in GPA for the intervention groups. Two of the other RCTs gave means but not SDs. For these RCTs, an average of the reported SDs (of SD=0.8) was inserted for intervention and control groups. This had very little effect on the overall result, suggesting that if results for these trials had been available, the meta-analysis would still have shown a clear difference in GPA.

Figure 5. Forest plot of grade point average



The two RCTs to record SATs did not report the results. Absences from school or work were no different in both RCTs to measure this. The one RCT to measure subsequent employment in a group of unemployed volunteers found that more obtained a job in the intervention group than in the control group. The RCT was stopped when this was found to have occurred. Job seeking behaviours in this RCT were no different between the two groups. In three other RCTs working memory and thought generation were found to be no different between intervention and control groups at follow up. One RCT measured total charges paid for medical treatment (in US$), but found a very wide range in both intervention and control groups.

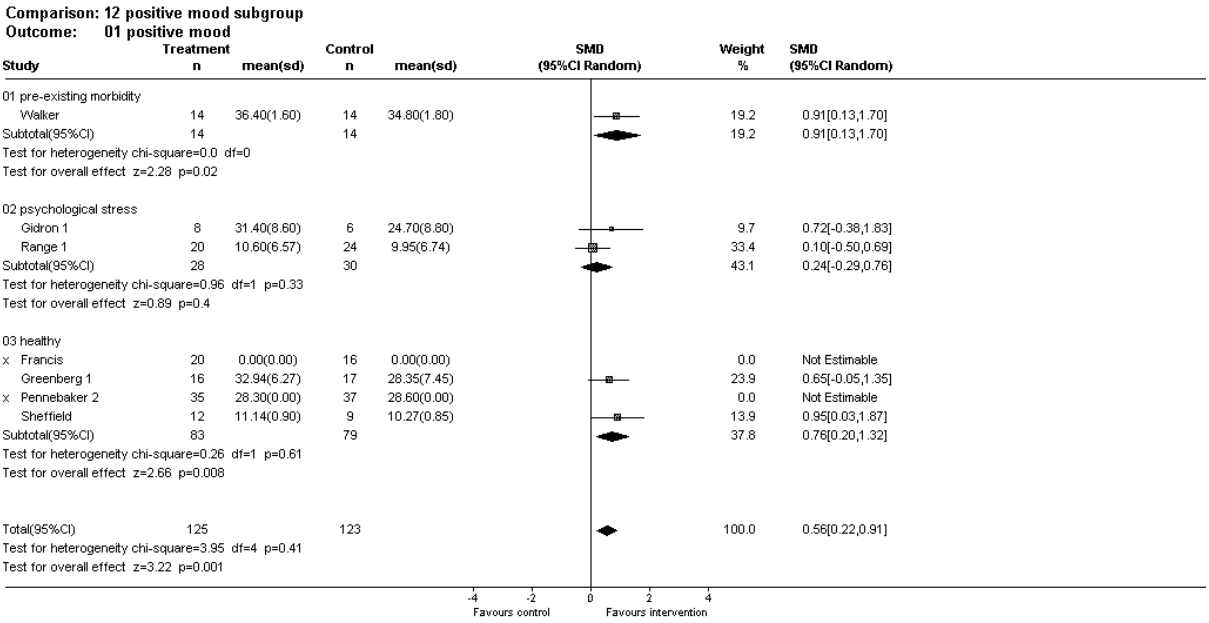
4.2.4.3 Psychological results

Psychological outcomes have been listed in several categories – mood or affect, anxiety, depression or emotional distress, impact of events as measured by the impact of events scale, results of the college adjustment test and the SCL-90 and SCL-90-R and various other psychological outcomes measured. Where SCL-90 and SCL-90-R results were given separately for anxiety and depression from the other subscales in the measure, these have been reported in the anxiety and depression table results. The remaining SCL-90 and SCL-90-R results are in the SCL-90 and SCL-90-R table, along with results that were not split by subscale. This also applies to CAT positive and negative affect.

Mood or affect (Table 22**)**
Twenty three RCTs measured mood or affect using a variety of different measures, many reporting positive and negative affect separately, giving 31 outcomes. Four RCTs did not report the results and 21 RCTs either showed no difference or did not report a relevant statistical test. Where RCTs measured total mood or affect, seven showed no significant differences and one 'a better disease state'.

Five RCTs reported positive mood in sufficient detail for the results to be used in a Forest plot (see Figure 6). The SMD was 0.56 (0.22 to 0.91) for both the fixed effects and random effects models, with no heterogeneity between the RCTs. This result shows an increase in positive mood at follow up overall for intervention groups compared to controls. The Forest plot also suggests an increase inpositive mood for volunteers with pre-existing physical conditions and healthy students but not for those under psychological stress

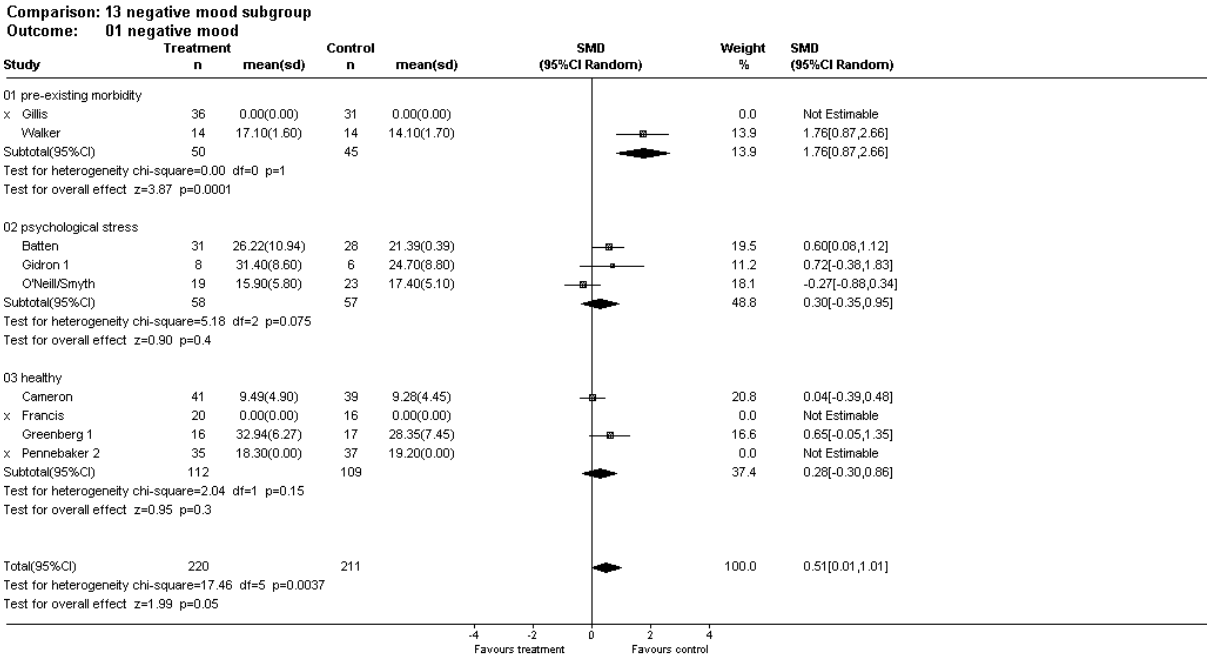
Figure 6. Forest plot of positive mood



Six RCTs reported negative mood in sufficient detail for a Forest plot (Figure 7). The SMD was 0.37 (0.12 to 0.62) fixed effects and 0.51 (0.01 to 1.01) random effects with considerably more heterogeneity between the RCTs. This result is suggests that there is an increase in negative mood overall at follow up for the intervention group compared to controls. The only

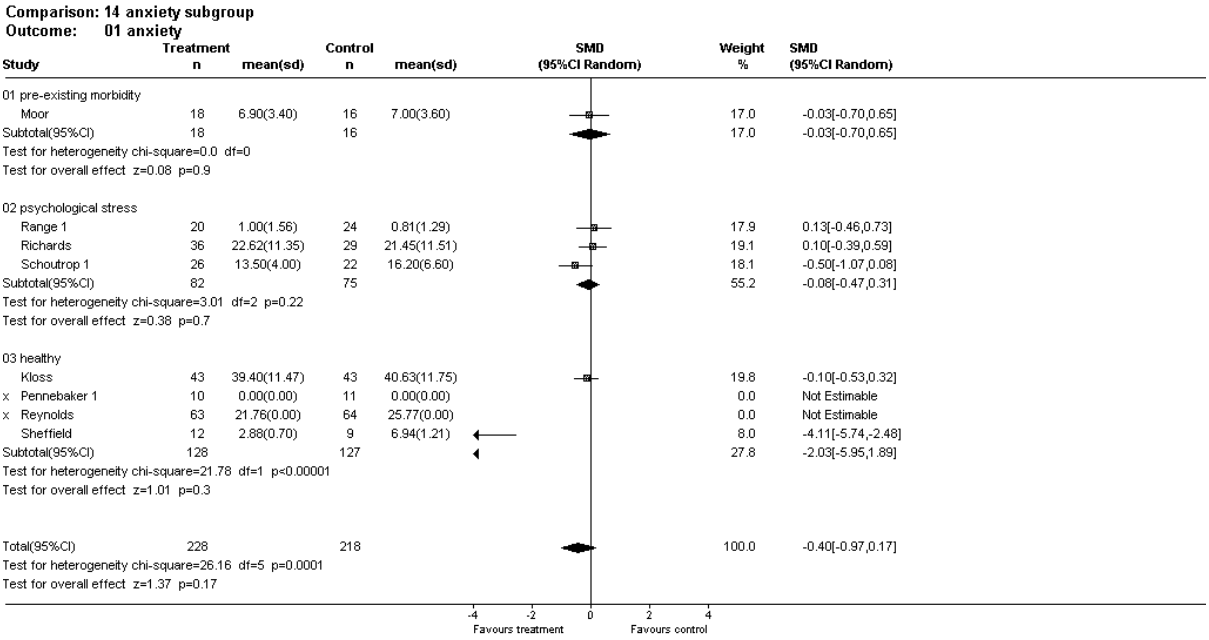
RCT with volunteers with pre-existing physical morbidity that reported mood had significantly more positive and more negative mood at follow up. For RCTs with volunteers under psychological stress and with healthy participants, the meta-analysis showed no significant difference in negative mood.

Figure 7. Forest plot of negative mood



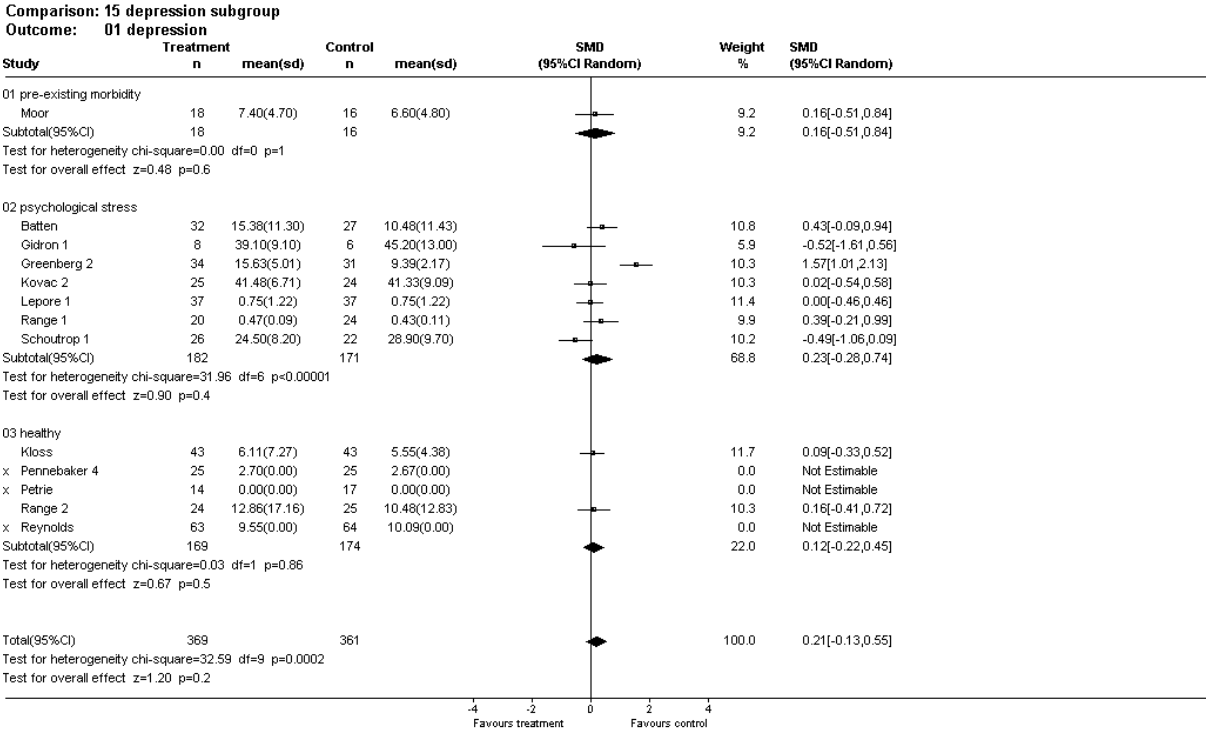
Anxiety (Table 23**)**
Eight RCTs measured anxiety and 6 reported sufficient detail for a Forest plot (see Figure 8). The SMD was 0.16 (-0.39 to +0.18) fixed effects and –0.40 (-0.97 to +0.17) random effects showing that there was no difference in anxiety at follow up for intervention compared to control groups. Only one RCT with volunteers with pre-existing physical morbidity reported anxiety at follow up and this showed no difference between the two groups as did the combined result for RCTs with volunteers under psychological stress. The only RCT to show a significant decrease in anxiety for the intervention group was carried out on healthy volunteers and had a 59% dropout rate at follow up.

Figure 8. Forest plot of anxiety



Depression (Table 24**)**
Twenty-one RCTs measured depression or emotional distress in various ways. Results from ten of the RCTs that reported depression could be used for a Forest plot (see Figure 9). The SMD was 0.22 (+0.05 to +0.40) for the fixed effects model and 0.21 (-0.13 to +0.55) for the random effects models with very little heterogeneity between the RCTs. The results suggest that there is no significant difference in depression for the intervention group compared to controls. In the subgroups of pre-existing morbidity, psychological stress or healthy volunteers there was no difference in depression in the fixed and random effects models. One RCT measured depression in two ways, MAACL-R and SDS, one showing less depression and one showing more. The SMD changed very little if one or the other was used and did not alter the conclusions.

Figure 9. Forest plot of depression



Impact of events scale (Table 25**)**

Fifteen RCTs measured this outcome and 9 gave results separately for the two subscales of avoidance and intrusion in sufficient detail for Forest plots (Figure 10 and Figure 11). For the overall results, the IES avoidance WMD was –0.06 (-1.13 to +1.00) fixed effects and 0.08 (-1.54 to +1.70) random effects. For IES intrusion the WMD was 0.17 (-0.76 to +1.10) fixed and –0.04 (-2.31 to +2.22) random effects model. This is suggests that the intervention overall has no effect on avoidance or intrusion. Both Forest plots show some heterogeneity, particularly IES intrusion where one RCT demonstrated statistically significantly more intrusion whereas one demonstrated the opposite.

For the 2 RCTs with volunteers with pre-existing physical morbidity, IES avoidance was not significantly different but there was more IES intrusion at follow up. For the RCTs with volunteers under psychological stress both IES avoidance and IES intrusion show considerable heterogeneity, with RCTs demonstating significantly more and significantly less of the outcome. The single RCT in healthy volunteers did not give sufficient details (ie no SDs) to impact on the WMD.

Figure 10. Forest plot of IES avoidance

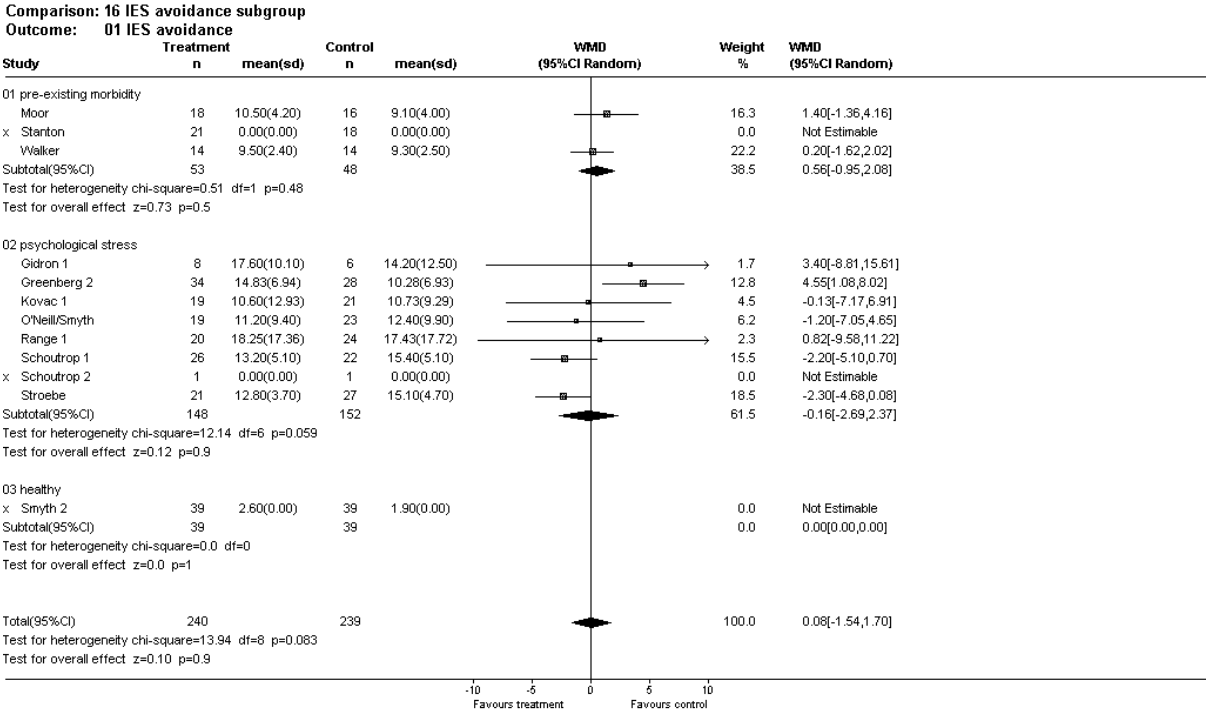
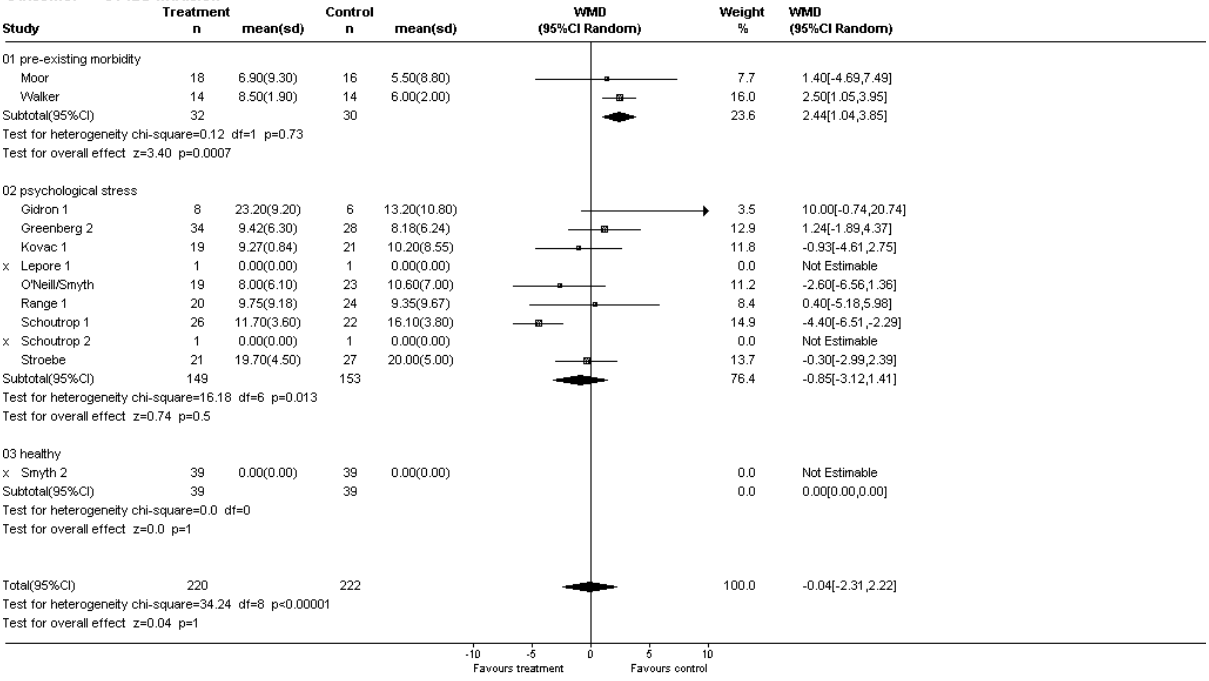


Figure 11. Forest plot of IES intrusion



College adjustment test (Table 26**)**
Of the 4 RCTs in healthy volunteers to report this outcome, one found better adjustment for the intervention (self regulation) group compared to controls and three found no significant differences between the two groups

SCL-90 and SCL-90-R (Table 27**)**
Eight RCTs measured this outcome. Two with volunteers with pre-existing physical conditions did not report the results. Only 5 RCTs in people with psychological stress reported gave any results. These varied between 0.82 and 77.4, so it is likely that the same marking scheme was not used in each. Two found fewer symptoms for the intervention group compared to control for the total questionnaire score and one a significant difference between intervention and control groups but did not say which way. The others found no significant differences or did not report a relevant statistical test.

Other psychological outcome measures (Table 28 and Table 29**)**

Volunteers with pre-existing physical conditions
A wide variety of psychological outcomes were measured in 6 RCTs, including health related quality of life (SF-36). Fewer were reported. There was no difference in low support, LOT, PSS, psychological symptoms, COPE, FACT, rumination and barriers efficacy. The statistically significant results were less sleep disturbance and better rehabilitation efficacy for the intervention groups compared to control.

Volunteers under psychological stress
Six RCTs measured other psychological outcomes. The significant results were less grief, more grief recovery and less grief recovery. All other outcomes measured were either not reported or showed no differences.

Physically healthy volunteers with no obvious psychological stress
Ten RCTs measured a wide variety of psychological outcomes in healthy volunteers. The significant results were better psychological wellbeing and a group by time interaction on posttraumatic growth. All the other 10 outcomes were either not reported, there was no difference between the two groups or a relevant statistical test was not given.

4.2.4.4 Physiological and haematological/immunological results

Due to the small numbers of trials reporting these outcomes, no trends were seen distinguishing trials in volunteers with pre-existing morbidity, psychological stress or healthy people. Results for all trials have been presented separately in the results tables but have been combined in the text for each group of outcomes.

Immediate physiological outcomes (Table 30 to Table 33**)**
Six RCTs and 2 crossover trials measured immediate physiological outcomes of blood pressure, heart rate and skin conductance.

Two RCTs measured blood pressure but did not report and 3 RCTs reported no significant differences between intervention and control arms. One of the RCTs reported diastolic blood pressure only, where there was a within session decrease. One RCT reported in a conference abstract indicated that the intervention group blood pressure was elevated but it is unclear whether this was in comparison to the other intervention group, the control group or the baseline intervention group results. The two crossover trials reported both systolic and diastolic blood pressure during intervention and control, with a general trend for the intervention group to have slightly higher blood pressure.

Two RCTs measured heart rate but did not report and two reported no significant differences between intervention and control groups. One RCT reported as a conference abstract, again indicated that the intervention group heart rate was elevated but again it was unclear whether this was in comparison to the other intervention group, the control group or the baseline intervention group results. Another RCT described their heart rate results as 'uninterpretable'. One of the crossover trials showed no discernable trend in heart rate. The other reported higher immediate change from baseline heart rate for the intervention condition compared to control.

Regarding skin conductance, 2 RCTs showed a decrease for the intervention group, one showed no significant difference and the other did not report. One of the crossover trials showed higher change from baseline for the intervention condition compared to control. The other showed no particular trend.

Immediate haematological/immunological outcomes (Table 34**)**
Many of these measures showed no significant differences between intervention and control groups, including haemoglobin, red blood cells, B2M, cortisol, lymphocyte reaction to Concavalin A, monocytes and subgroups of lymphocytes including CD8, CD16, CD56 and NK cells. There was an increase in the intervention group for sTNF-R11 and decrease in basophils. Regarding total lymphocytes, one RCT showed a significant increase for the intervention groups whereas two others showed significantly fewer. With the CD4 subset, one RCT showed a significant increase whereas another showed a significant decrease for the intervention groups compared to controls. Lymphocyte reaction to PHA stimulation was found to be increased for the intervention group compared to control. However the relevance of this finding has been disputed.[89,90]. One RCT found salivary cortisol reactivity in the intervention group but did not specify whether cortisol levels increased or decreased.

Follow up physiological outcomes (Table 35**)**

Reaction time, blood pressure, heart rate and skin conductance were measured at 1 month or 6 weeks in 2 RCTs. No differences between intervention and control groups were found.

Follow up haematological/immunological outcomes (Table 36**)**
There were no differences between intervention and control groups for uric acid, globulin, albumin, triglycerides, cholesterol, HDL, LDL, TNFα, IL4, IL10, basophils, and lymphocyte subsets CD4, CD8, CD56 and NK cells. There was a significant increase in Hepatitis B antibodies for the intervention group compared to controls and a significant decrease in EBV-VCA antibodies and liver function tests SGOT and SGPT. Lymphocyte reaction to Concavalin A again was not reported in the only RCT to measure this. Lymphocyte reaction to PHA stimulation was found to be increased in the intervention group compared to control. Correspondence on this has suggested that the effect may have been artefactual but this has been disputed.[89,90] One trial measured ESR at follow up in people with rheumatoid arthritis but there was no significant difference between the intervention and control groups.

4.2.5 Critical appraisal of other systematic reviews

One other systematic review on the emotional disclosure intervention was found during the searches.[91] This is described as a meta-analysis and was published in 1998. It combined the results of 13 emotional disclosure RCTs and looked at the categories of reported health, psychological well-being, physiological functioning, general functioning and health behaviours. Its findings were that health was enhanced in the first four categories but that health behaviours were not influenced. The meta-analysis reports an overall effect size of 'd=0.47, representing a 23% improvement in the experimental group over the control group. For example, illness rates decreasing from 61% in the control group to 38% in the experimental group'.[91] This is a very large drop in illness rates, representing a NNT of 4.

An attempt to replicate the meta-analysis was considered but was not possible because two of the trials were unpublished doctoral dissertations and we were unable to obtain one of them (See O'Heeron in Appendix 4 - unobtainable studies).

There are a few aspects of the way this meta-analysis was undertaken that may cause problems with the interpretation of the results.

- They searched 3 databases only (Psychological Literature, PsychInfo and Citation Index) but did not describe the search terms used. They also found unpublished studies by citation checking and contacts with authors. However, although inclusion and exclusion criteria were discussed, it was unclear why they did not include 4 RCTs that were available at the time, three that were cited in the reference list and one other that was published before 1997 [46,64,74,75]. The study by Gidron et al[46] was very small but it had worse outcomes for the intervention group compared to control. It is not clear what impact the other 3 RCTs would have had on the meta-analysis had they been included.
- In common with many meta-analyses conducted in the psychological literature, results were aggregated across wide ranging categories. For example in this meta-analysis, psychological well-being included positive and negative affect, intrusions, general temperament and adjustment to college and high school. General functioning included re-employment, GPA, absenteeism, thought generation, reaction time and school behaviour. The effect of aggregating across wide ranging categories is that heterogeneity is markedly increased. By this we mean that there is marked differences in patient groups, baseline measurements and duration of follow up. There were also methodological differences in the different outcomes and the way that they were measured. This suggests that the results in these trials and their outcome measures would be largely incompatible. [92] The implication of this heterogeneity is that the overall effect size is not easy to interpret quantitatively in relation to the benefits that might result from emotional disclosure. Use of SMD, which assumes that the differences in standard deviations between RCTs reflects differences in measurement scales and not real differences in variability between trial populations[28], means that this extra variability is not taken into account by the numerical result of the SMD. The meta-analysis did find considerable heterogeneity and significant within group variance for the overall effect. They also investigated the significant within group effect size variation that existed in the psychological wellbeing and physiological functioning outcome types. As a consequence of the heterogeneity that they found, it could be seen as misleading to consider that emotional disclosure results in an enhancement overall, in psychological wellbeing or in physiological functioning.

- The meta-analysis mentions the problem of allowing more than one effect size per study and non-independence. 'the primary analysis used a single effect size from each study'. Also 'the magnitude and significance of the overall mean weighted effect size was computed for all outcomes (averaged within study) and all studies'. If they used a single effect size from each RCT, the rules by which the outcome measure was chosen for each RCT were not made explicit. Several RCTs reported multiple outcomes and the primary outcome of interest planned before the start of the RCTs was not clearly stated. This means that one of several results could have been chosen for the meta-analysis. As RCTs tend to highlight their most positive findings, one of the more positive results may have been used, which would not mirror the true spread of results. This may give a more optimistic overall effect size. Alternatively, if all of the outcomes were averaged within each RCT and that figure used to derive the overall effect size then some RCTs would have contributed a single outcome whereas others an averaged outcome. Therefore, the more fully reported RCTs with a spread of outcomes would contribute a lower effect size than the RCTs that presented their most positive results only.
- It is not immediately apparent whether the method used for deriving the summary estimates of effect sizes was the inverse variance method (fixed effects) or DerSimonian and Laird (random effects). This would be useful to know as random effects meta-analysis is usually used when there is more heterogeneity, tends to be more conservative but also gives relatively more weight to smaller studies.[28]

Therefore, given these uncertainties, results of the meta-analysis should be viewed with some caution.

5. DISCUSSION AND CONCLUSIONS

5.1 Summary of results and assessment of effectiveness

A wide variety of outcomes have been measured in the 61 emotional disclosure trials included in this review but considerably fewer reported and even fewer with full details available. Reporting bias may have influenced the results available.

Several objective measures of physical health showed improvements for people with pre-existing physical morbidity and none showed worse health outcomes but this was offset by the larger number showing no difference between intervention and control groups or that did not report the results. There was no difference for objectively measured HCV and results for subjectively measured HCV were equivocal. Looking at the trials with volunteers with pre-existing morbidity, the one to measure objective health centre visits demonstrated significantly more visits for the intervention group whereas the combined result of the two RCTs to provide full results for subjective HCV demonstrated significantly fewer HCV. There seemed to be no difference in health behaviours or SMU-HQ results. The PILL questionnaire results suggested that more illnesses were reported in the intervention groups. Other subjective physical health outcomes in healthy volunteers mostly either showed conflicting results or no difference between intervention and control groups. More outcomes showed significant improvement for the intervention group compared to control for RCTs of volunteers with pre-existing physical morbidity, but again this was offset by the number of outcomes that showed no difference or were not reported.

The performance outcomes showed equivocal results with most either showing no difference or were not reported. For GPA, there did seem to be an improvement for the intervention group, but if more RCTs had reported, the evidence would have been stronger.

Regarding psychological outcomes, there seems to be an increase in positive and negative mood, equivocal results for depression and no differences in anxiety, IES avoidance and intrusion at follow up for intervention compared to control. The SCL-90 and SCL-90-R results suggest that there may be an improvement in symptoms but this finding is offset by the larger number of RCTs where there was no difference found, a statistical test not given or where the outcome was not reported. With other psychological outcomes, 5 showed better results, 1 worse, 20 no difference or no significance test was given and 7 were not reported at all. When results were split by participant characteristics, there seemed to be a slight trend for worse results in RCTs with volunteers with pre-existing morbidity. The RCTs with healthy volunteers tended to have fewer results reported in sufficient details to be included in the meta-analyses.

Regarding physiological outcomes at the time of the trial and at follow up there may be an immediate decrease in skin conductance, increase in heart rate but little change in any of the other parameters. For immediate haematological/immunological measures, there was an increase in sTNF-R11 and decrease in basophils. The result for total lymphocytes was equivocal and the CD4 subset gave conflicting results. In the longer term there were increases in Hepatitis B antibodies and lymphocyte reaction to PHA stimulation (which has been disputed) and decreases in Epstein-Barr virus antibodies. All the other outcomes

measured showed no differences. Although the one RCT (abstract) to measure salivary cortisol demonstrated increased reactivity, it was unclear how this was defined.

There was no discernable visual trend on whether results were more likely to be positive in RCTs with larger sample sizes, better quality or longer follow up time or if the RCT was conducted in the USA compared to other countries.

5.2 Potential methodological strengths and weaknesses this systematic review

We identify the following features as being methodologically robust:

- A clearly defined question
- A comprehensive search strategy incorporating published, partially published and unpublished material
- Rigorous application of inclusion and exclusion criteria. Details of excluded studies with reasons for exclusions
- Detailed assessment of included study quality
- Recording of all outcomes measured irrespective of whether results were reported
- Use of meta-analysis to amplify the assessment of patterns of results across several trials measuring the same outcomes

All of these features are undertaken with the explicit intension of minimising bias, both for and against the intervention reviewed.

5.2.1 Potential weaknesses

Firstly, abstracting data from 61 trials means that there is a large amount of information in this systematic review. Although considerable efforts have been made to prevent errors, it will be inevitable that some have occurred. However, this is likely to generate random error rather than systematic bias.

This systematic review has been undertaken as part of a PhD and no one was available to conduct duplicate inclusion and exclusion decisions or duplicate data extraction. However, detailed inclusion and exclusion criteria were developed to help reduce any inconsistency taken in the inclusion/exclusion decisions. Data extraction was conducted twice on approximately one third of the RCTs, with an interval of greater than 6 months and then checked prior to publication on all RCTs. Some discrepancies were found. The internal consistency of the systematic review would have been improved if duplicate inclusion/exclusion and data extraction had been performed.

In systematic reviews, publication bias is always a potential problem. Although the comprehensive search strategy helps minimise this and the funnel plot showed little evidence of asymmetry, the fact that 15 study references were found that were potentially includable suggests that some publication bias may be occurring. These 15 studies could represent the tip of an iceberg of a considerable volume of unpublished research. Also, where researchers have conducted small trials on physically healthy students and where the results have shown no significant differences in the primary outcome measure(s), it seems likely that there will be no great imperative to publish.

Related to the above is the major constraint of lack of complete information on published trials. With the outcome measures, it is noticeable that a third of these were measured but not reported. It may be safe to assume that if they had had statistically significant results then many would have been reported. Therefore this suggests that some reporting bias is operating. Of the outcomes that are reported, many are just by the statistical tests done on the summary results and no summary measures such as means and standard deviations are given. This means that the statistics and conclusions arising cannot be checked. It also means that many results cannot be entered into meta-analysis. As a result it is difficult to gain a true picture of the trend of results. This is particularly apparent when a variety of outcome measures have been used to explore the effects of the intervention. In the absence of adequate information for meta-analysis for some of the outcomes, a vote counting approach has been used instead. We acknowledge that this is not ideal because it ignores sample size, effect size and the variance of results. However, all the data available from the RCTs has been clearly tabulated in the appendices to enable the reader to make their own judgement about the strength of the evidence.

Collecting missing outcome data could be important for two reasons:
- It would allow more definitive conclusions on effectiveness of emotional disclosure
- It would provide reassurance that there is no selective reporting bias is occurring

Ideally it would have been useful to explore completely the influence of different variables on the pattern of effectiveness results using meta-regression. However, although available time was a limiting factor, so, too, was the availability of complete data.

Quality assessment of the randomised crossover trials was limited to the same criteria as the randomised parallel studies. It may have been useful to include additional criteria such as; was a period effect test carried out, was there a washout period and were measurements taken at the start and end of both crossover periods? The washout period from a psychological intervention may be particularly long or very short, depending on the impact of the intervention on the volunteer. It is unclear whether washout period effects may have had an impact on the immediate outcomes measured in these trials.

In the results table and in the meta-analyses, the number in each group at follow up has been used, rather the number randomised and allocated to each group. This is because the follow up numbers are more consistently reported but it does ignore the intention to treat principle. The result of this would be to accentuate any treatment effects found.

Both WMD and SMD assume that the outcome measurements in each trial have an approximately normal distribution. For the outcomes of objective and self-report HCV the results will almost certainly be heavily skewed to the right. Therefore the results of the meta-analyses of these outcomes may be misleading.

The quality of the RCTs was assessed using CONSORT criteria and the Jadad scale. This could be seen as a weakness in that most of the included RCTs were published in psychology journals not in the medical press. Standards of reporting are different in each discipline, the psychology journals generally adhering to the Publication Manual of the American Psychological Association.[93] However, this manual includes the following guidance:

'The sample should be adequately described'
'Give the total number of subjects and the number assigned to each experimental condition'
'If any did not complete the experiment, state how many and explain why they did not continue'
'Describe randomisation'
'Mention all relevant results'
'Be sure to include descriptive statistics (eg means or medians)'
'Where means are reported, always include an associated measure of variability, such as standard deviations, variances or mean square errors'
If this guidance had been followed by authors of RCTs and editors of the relevant journals then far more information would have been available for this systematic review and the effectiveness of the emotional disclosure intervention would have been clearer.

5.2.2 Important issues not addressed by this systematic review

This systematic review addresses the question of the effectiveness of the emotional disclosure intervention as described in the background section of this systematic review. It does not review the additional instructions such as development of coping plans, insight or 'best possible self'. Many of the RCTs had these second groups and although they have been included in the results tables in the appendices for completeness, considerable further work would be required to determine the impact of these additional aspects to emotional disclosure.

Every effort has been made to try to include a relatively homogeneous intervention, described as emotional disclosure. However, instructions for emotional disclosure do vary between RCTs to some extent, as do the time of the interventions and the length of follow up. The impact of these factors has not been explored.

5.3 Conclusions

The emotional disclosure intervention has become established in the research literature and a relatively standard form has been developed. Fifty-nine RCTs and two crossover trials were included in the systematic review. Considerable effort was made to find unpublished trials and 72 studies were excluded for a variety of reasons. Of the excluded studies, five emotional disclosure RCTs were excluded solely because they only published results for subgroup analyses and 2 because no follow up results were available.

Of the included RCTs, most were small (half are of n=50 or less) and mostly poorly reported. The quality of the trial reports was also mostly very poor. Very little is known about the conduct of many of these trials such as the method of randomisation or whether any allocation concealment or blinding was attempted. It has been suggested that lack of allocation concealment in particular, can result in exaggerated effect sizes, perhaps by up to 30%.[94] The emotional disclosure intervention will probably have a small effect size if any, so lack of allocation concealment could have resulted in exaggerated effects being found. Most RCTs do not use intention to treat analysis, yet volunteers who drop out after randomisation or undergoing the intervention are not likely to be representative of all remaining in the study and the differences are likely to lead to systematic changes (selection bias) rather than random changes in outcome measures.

At the moment, it remains unclear as to whether the equivocal results are due to small sample sizes and lack of power in the RCTs, poor quality of reporting or because the emotional disclosure intervention actually has little effect. Accordingly, the trend of results provides a mixed picture. There is no clear balance in favour of the emotional disclosure intervention for many of the outcomes measured. This is not what one would expect from reading the reviews and editorials on emotional disclosure.[95-97] It may that the way the RCTs have been reported has resulted in a more positive picture of the effects of this intervention than is actually the case. This is all the more worrying as this intervention has been recommended in a therapeutic setting[98-100], when the benefits have not been clearly established, and has been evaluated for use in this setting.[101,102] On the other hand there is little evidence from the RCTs reviewed that this intervention does any harm. This systematic review is not suggesting that all emotional disclosure has no or very little effect. It is suggesting that the current evidence available has not demonstrated the effectiveness of this brief emotional disclosure intervention.

There is also little evidence of a clear mechanism by which beneficial physical effects could be achieved. If emotional disclosure does affect physical health then the mechanism may be by alterations in physiological, haematological or immunological parameters. However, it is not clear at the moment which way these parameters would vary.

If this emotional disclosure intervention were found to be effective in improving physical health then it would probably prove quite cost effective when compared to short courses of psychotherapy or other psychological treatments that required time from trained personnel. However, on the basis of this systematic review, the effectiveness of this brief intervention should not be taken as read.

5.4 Implications for future research

There is a pressing need for further research in several areas:

- A properly conducted, good quality emotional disclosure RCT which is adequately powered to detect a small effect size on physical health and which clearly reports all outcomes measured. This will determine whether the emotional disclosure intervention does have any effects on physical health or whether the current findings are mainly chance effects. The difficulty is how to establish physical health in physically healthy people. If health-seeking behaviour is used as a proxy, then this can lead to considerable bias, as with sickness absences etc. Self reported health is well known not to correlate well with physical health measures and also can lead to considerable bias. It may be that this type of intervention can only be tested properly on people with pre-existing morbidity that is amenable to regular health checks.
- If the emotional disclosure intervention does have beneficial effects on physical health, research would be needed to determine whether it was because of a physical mechanism arising from the intervention, such as changes in hormone or immune system levels, or changes in health behaviours which eventually resulted in changes in physical health. What psychological mechanisms are the precursors to these physical changes?
- Regarding health-seeking behaviour, if emotional disclosure has a beneficial effect, it would be useful to know whether this was by affecting psychological health or physical health. The currently available RCTs do not adequately answer this issue.

- If emotional disclosure does have any effects how long do they last? Follow up over several time periods would be required. However, the cost of an adequately powered trial to establish this could be prohibitively expensive.

6. APPENDICES

Appendix 1. Outcome measures

Table 2. Alphabetical list of outcome measure definitions

Measure	Study its from	Number of questions	Marking scale (number of responses)	Possible total score	Lower score means…	Cronbach's alpha/test retest reliability
Activity restricted from illness	Greenberg 2, Smyth 2	3	Y/N	-	?	?
AIMS-2 (3 subscales normalised)	Kelly	5	0-10	-	Better symptoms	Physical dysfunction α=0.93, affective disturbance α=0.87, pain α=0.88,
Alcohol consumtion	Spera	Not defined	-	-	-	-
ARA joint condition-joint count	Kelly	Total joint count = no joints affected (out of 17) + severity in 12 joints (scored 0-24)			Less swelling	-
ARA grip strength	Kelly	Pressure attained (in mmHg) by squeezing a sphygmomanometer cuff			Poorer strength	-
ARA walking time	Kelly	Time taken to walk a 50 foot long corridor			Faster walking, better joints	-
ATQ-R	Kovac 2	40	(5)		Lower frequency of negative automatic thoughts	α=0.96
B2M	Dickerson[@]	Method not specified			-	-
Barriers efficacy	Strough	11	Y/N + 0-100 (11)		?	r=0.93
BDI	Batten, Kloss	21	0-3 (4)		? Fewer symptoms	r=0.48-0.74
BDI	Gidron 1	Not defined	-	-	-	-
Biofeedback	Strough	Surface EMG using three electrode placement, active on vastus medialis oblique and 6 in proximal to patella, inactive on patella, sensitivity in microvolts			-	-
Birleston depression inventory	Reynolds	18	-	-	?	-
Blood pressure	Pennebaker 4, Schoutrop 2[@], Klein 3[@]	Methods not specified	-	-	-	-
Blood pressure	Czajka, Pennebaker 5	Marshall 88 sphygmomanometer with digital readout			-	-
BRFL	Kovac 2	12	1-6 (6)		Less endorsement	α=0.92

Measure	Study its from	Number of questions	Marking scale (number of responses)	Possible total score	Lower score means…	Cronbach's alpha/test retest reliability
					of reasons not to commit suicide	
CAT	Klein 1 Pennebaker 2,	19	-	-	-	α=0.79 r=0.65
CAT	Hughes	19	1-7 (7)		More negative feelings about being at college	-
CAT	Cameron,		1-7 (7)	6-42	worse adjustment	α=0.79
CES-D	Moor	Not defined	-	-	-	-
Change in restricted days	Hughes	Not defined	-	-	-	-
Children's somatisation inventory	Reynolds	35	-	-	Fewer physical symptoms	-
Compliance	Mann	5 + 3	1-6 (6)		Less compliance	α=0.87 (ps)
COPE	Stanton	(3 subscales, denial, mental engagement, behavioural disengagement)	4 (?4)	-	-	-
Cortisol (salivary)	Sloan[@]	Taken before and 15 minutes after writing			Lower stress	-
Cortisol	Dickerson[@]	Method not specified			Lower stress	-
CSAQ	Pennebaker 1, Richards	-	-	-	-	α=0.81 (cognitive) α=0.76 (somatic)
Days absent	Francis	Directly from personnel records			-	-
Days off due to illness	Sheffield	Not defined	-	-	-	-
Depressive symptoms	Lepore 1	13	0-4 (5)	-	Less depression	α=0.87-0.93 (ps)
Difficulty falling asleep	Spera	Not defined	-	-	-	-
Distress	Klapow	-	-	0-74	Fewer symptoms	-
EBV-VCA	Esterling	Primary infection presents 40% as infectious mononucleosis (glandular fever) 60% asymptomatic. Have latent infection in B lymphocytes. Reactivation causes antigens in blood stream to trigger antibodies –level shows efficiency of cellular immune response			High psychosocial stress.	-
Emotional health	Donelly	Not defined (? From PBHQ)	-	-	-	-
Employment	Spera	From outplacement centre records			-	-
Exercise taken	Spera	Not defined	-	-	-	-
FACT	Stanton	28	5 (0-4)		--	-
FEV1	Smyth 1	Forced expiratory volume in one second – spirometry guidelines by American Thoracic Society			Worse breathing	-

Measure	Study its from	Number of questions	Marking scale (number of responses)	Possible total score	Lower score means…	Cronbach's alpha/test retest reliability
FSS	Gillis	Not defined	-	-	-	-
GEQ	Kovac 1, Range 1	55 (11 subscales)	1-5 (5)	55-180	Less severe grief	α=0.76-0.97
GHQ-28	Stroebe	28 (4 scales – depression, social dysfunction, anxiety and sleep problems, somatic complaints)	-	-	-	α=0.91-0.93
GHQ	Sheffield	21 (3 scales – somatic symptoms, anxiety/insomnia, social dysfunction)	-	-	-	-
GPA	Cameron, Klein 1, 2, Pennebaker 2, 3, Lumley 2	Directly from university records / registrars office			-	-
GRQ	Kovac 1, Range 1	8 – 3 5	Y/N 1-9 (9)	-	More grief recovery	α=0.83 (?ps)
HCV	Numerous RCTs	Various definitions including visits to student health centre, doctor, GP, health care use			Better perceived health	-
'health'	Lumley 1[@], Range 1	Not defined	-	-	-	-
Health behaviours/ measures	Murray 1, Pennebaker 1, 2, Petrie,	Includes aspirin use, vitamin use, alcohol, cigarettes, caffeine, exercise, hours of sleep (?PBHQ)			-	-
Healthcare use (NMCUES)	Rosenberg	Includes medical services use, use of medicines and health behaviours			Less use	-
Health interference with daily functioning	Lumley 1[@]	Not defined	-	-	-	-
Health self report	Spera	70	?Y/N	-	-	-
Heart rate	Pennebaker 4 Klein 3[@]	Measurement method not reported			-	-
Heart rate	Czajka, Pennebaker 5	Marshall 88 sphygmomanometer with digital readout			-	-
Hepatitis B antibodies	Booth 1	Antibodies HbsAg (subtypes ad and ay) measured with an Imx AUSAB kit in a standard microparticle enzyme immunoassay (EIA) system			Worse immunity	-
IES – R	O'Neill/Smyth	22 (3 subscales – avoidance, intrusion, hyperarousal)	-	-	Lower avoidance, intrusion, hyperarousal	r=0.94 (ps)
IES-R	Barry [@]	Not defined	-	-	-	-
IES	Greenberg 2, Klein 2, Kovac 1, Range 1, Smyth 2, Walker	15 (2 subscales – avoidance, intrusion)	0-5 (4 ie 0,1,3,5) (or not at all, rarely, sometimes, often	-	Lower avoidance, intrusion, not affected by event	Avoidance α=0.82-0.91 intrusion α=0.79-0.92
IES	Moor, Schoutrop 1	15 (2 subscales – avoidance, intrusion)	1-5 (5)	-	-	Avoidance α=0.60

Measure	Study its from	Number of questions	Marking scale (number of responses)	Possible total score	Lower score means…	Cronbach's alpha/test retest reliability
						intrusion α=0.72 total α=0.71
IES	Gidron 1, Schoutrop 1, 2	Not defined	-	-	-	-
IES avoidance	Stanton	8	-	-	-	-
IES intrusive thoughts	Lepore 1	10 (7 from intrusion subscale + 3 other)	0-4 (5)	-	Fewer intrusive thoughts	α=0.92-0.95 (ps)
Illness reports	Kloss	Not defined	-	-	-	-
IL4, IL10	Rosenberg	Used ELISA sandwich assay			-	-
Interview log	Spera	From outplacement centre records			-	-
LFT's, lipids	Frances	23 routine tests used by the University Wellness program to indicate changes in cardiovascular fitness and general health			-	-
LOT	King 2	8	Disagree – agree (5)		Low optimism	-
LOT	Mann	8 (+4 filler items)	1 (strongly agree) – 5 (strongly disagree)	8-40	Less optimism	α=0.73 (ps)
Lymphocyte reaction to PHA and Concavalin A stimulation	Pennebaker 4	PHA stimulates T helper lymphocytes, measured at 5,10,20 μg/ml. Concavalin A measures T helper and suppressor lymphocytes, measured at 2,5,10 μg/ml. Used radioactive marker.			Smaller lymphocyte response	-
Lymphocytes	Booth 1, 2	Used Bayer Technicon H1 haematology analyser and flow cytometry in a Coulter EPICS Profile 11 analyser with fluorescein-anti CD4 and rhodamine-anti CD 8 monoclonal antibodies			-	-
Lymphocytes, RBCs, Monocytes, Haemoglobin	Petrie	Used Bayer Technicon H1 haematology analyser. CD3, CD4, CD8, CD16/56 – used flow cytometry using a Becton Dickinson FACScan cell analyser with Becton Dickson Simultest fluorescent antibody reagents			-	-
MAACL – R	Range 1, 2	132 (5 subscales)	-	-	-	α=0.74 – 0.94
Marlowe Crowne SDS	Pennebaker 1	Not defined	-	-	-	-
Medical visits	Stanton	Included dental and eye exams (subset of ?n confirmed through medical records, 92% 'agreement'			-	-
MMI	Schoutrop 1	?n	1-5 (5)	-	-	α=0.73-0.91
Mood (+ve and –ve)	Sheffield	30	(5)	-	-	α=0.99
Negative mood	Cameron	7	0-4 (5)	0-28	Less –ve mood	α=0.60
Negative mood (NAS)	O'Neill/Smyth	10	0-4 (5)	-	Less –ve mood	r=0.89 (ps)
NHRC mood	Greenberg 2	40	1-5 (5)	-	Low mood	-
No days ill (PBHQ)	Donnelly	Not defined	-	-	-	-
No days restricted from illness (PBHQ)	Murray 1	Not defined	-	-	-	-

Measure	Study its from	Number of questions	Marking scale (number of responses)	Possible total score	Lower score means…	Cronbach's alpha/test retest reliability
No illnesses, no sick days	Kloss, Pennebaker 1	Not defined	-	-	-	-
No letters generated	Spera	From outplacement centre records			-	-
No pain relievers used	Spera	Not defined	-	-	-	-
No phone calls received	Spera	From outplacement centre records			-	-
Pain (Brief pain inventory)	Rosenberg	11	0-10	-	-	-
Pain intensity (?McGill)	D'Souza	Not defined				
PANAS	Gidron 1	Not defined	-	-	-	-
PANAS positive and negative mood	Batten, Walker, Frances, Greenberg 1	20 (10 +ve, 10 –ve)	(5)	20-100	Low feelings	+ve α=0.87 r=0.86-90 –ve α=0.87 r=0.84-87
PANAS-X	Gillis	Not defined	-	-	-	-
Patient satisfaction	Klapow	9	1-5 (5)	-	Poor satisfaction	-
PCPTC	Klapow	Coding used for bill charging (USA) for outpatient services			Fewer services used	-
Pennebaker's physical symptom scale	Greenberg 1	8	1-7 (7)	-	Fewer symptoms	r=0.75
Perceived somatic symptoms	Stanton	9	-	-	-	-
Physical health	Murray 2	Not defined	-	-	-	-
Physical symptom scales (from SMUHQ)	Greenberg 2	24 (3 subscales – upper respiratory, musculoskeletal, miscellaneous)	Y/N (2)	-	-	-
Physical symptoms index	O'Neill/Smyth	12	1-4 (4)	-	Fewer symptoms	r=0.88 (ps)
Physical symptoms	Sheffield	17	?Y/N	-	?fewer symptoms	-
Physical symptoms	Lumley 1[@]	Not defined	-	-	-	-
Physician's global assessment of RA	Smyth 1	Structured interview rating diagnostic symptoms, global assessment of disease activity, symptom severity, distribution of pain, tenderness and swelling of joints, presence and severity of deformity, assessment of daily living capacity, general psychosocial functioning			Fewer symptoms	-
PILL	Batten, Kloss, Richards	54	?Y/N, ?5	-	Fewer symptoms	α=0.88 r=0.79
PILL	Gidron 1, Pennebaker 1	Not defined	-	-	-	
POMS	Petrie	65	0-4 (5)	-	Less mood	-
POMS	Strough	40 (7 subscales)	0-4 (5)	-	Less mood	α=0.66-0.95
POMS	Stanton	? (6 subscales)	-	-	-	-
POMS	Moor	65 (6 subscales)	-	-	-	-
POMS-SF	Lepore 2	5	1-5(5)	-	Less mood	α=0.90

Measure	Study its from	Number of questions	Marking scale (number of responses)	Possible total score	Lower score means…	Cronbach's alpha/test retest reliability
PSA specific CD4, CD8	Rosenberg	Used hybritech method			-	-
PSQI	Moor	? (7 subscales)	-	-	Better sleep quality	-
PSS	Moor	14	-	-	-	-
Psychological health	Murray 2	Not defined	-	-	-	-
Psychological symptoms (combination of SCL-90-R and Brief POMS)	Rosenberg	Not defined	-	-	-	-
PTGI	Ullrich	21			?	α=0.91
Pulse	Pennebaker 1	Manually by experimenter			-	-
Range of motion	Strough	Measured with a joint goniometer, recorded extension and flexion			-	-
Reaction time	Pennebaker 3	Time taken to associate words seen to master phrases			Faster reaction time	-
Rehabilitation efficacy	Strough	11	Y/N + 0-100 (11)	-	?	-
Restricted activity from illness	Pennebaker 1	Not defined	-	-	-	-
RFL	Range 2	48 (6 subscales)	1-6 (6)	Score = total/ over no of items	Less reason for living	α=0.72-0.92 for each subscale
Rumination	Strough	11 (10 + 1)	Stongly agree (1)- strongly disagree (5) (5), no.	-	Less rumination	-
SCAS	Reynolds	38 + 7 (6 subscales)	-	-	Less anxious	-
School absences	Reynolds	From school records			-	-
SCL-90	Lumley 1[@]	Not defined	-	-	-	-
SCL-90	Greenberg 2	90	0-4 (5)	-	Less discomfort	α=0.82-0.93
SCL-90	Gidron 2	6	0-3 (4)	0-18	Less symptoms	-
SCL-90 – R	Batten, Schoutrop 1	90 (6 subscales)	1-5 (5)	-	-	α=0.73-0.91, r=0.78-0.90
SCL-90-R	Barry[@]	Not defined	-	-	-	-
SDQ	Reynolds	25	-	0-40	Fewer difficulties	-
SDS	Range 1, Kovac 2	20	1-4 (4)	-	Less depression	α=0.88-0.93
SIQ	Range 2	30 (3 subscales)	0-7 (7)	0-180	Less ideation	α=0.96
SIQ	Kovac 2	25	0-6	0-150	Lower frequency of suicidal thoughts	α=0.96, r=0.86
SIS	Range 2	10	A1-A5 (5)	1-50	Less suicide ideation	α=0.86
Skin	Booth 1,	Method not	-	-	-	-

Measure	Study its from	Number of questions	Marking scale (number of responses)	Possible total score	Lower score means…	Cronbach's alpha/test retest reliability
conductance	Pennebaker 4, Schoutrop 2[@]	specified				
Skin conductance	Czajka, Pennebaker 5	Used J&J IG-3 GSR preamp attached to a J&J model T-68 meter at 300 mV constant voltage and two 1cm diameter Ag/AgCl finger electrodes			-	-
Sleep quality	Gillis	4	-	-	?	-
SMU-HQ	Greenberg 1	63	?Y/N	-	-	-
Somatic symptom scores	Klapow	13	0-2	-	Fewer symptoms	-
Somatisation – Hopkins SCL	Gidron 2	6	0-3	-	Few symptoms	-
SSF	Kovac 2	6	(5)		?	r=0.35-0.69
sTNF-R11	Dickerson[@]	Method not specified			-	-
Strength	Strough	Number of step ups to failure (4in step)			-	-
Subjective knee rating	Strough	11	Various likert type	-	Better function?	-
SWLS	King 2	5	(?5)	-	?low life satisfaction	-
Symptom report	Smyth 2	See physical symptom scales	-	-	-	-
Symptom severity	Ullrich	13	1-3		Less severe symptoms	α=0.76
T cells	Rosenberg	Used cell census proliferation assay method with PSA specific and tetanus toxoid specific assays			-	-
TNFα	Rosenberg	Used ELISA sandwich assay			-	-
Thought generation	Pennebaker 3	Writing as many words in 2 minutes as they could think of in response to having a birthday and to coming to college			-	-
Trait anxiety (from STAI)	Kloss	40	(4)	-	-	α=0.90 r=0.73-0.86
TBSQ	Spera	12	-	-	-	α=0.87 r=0.62 (ps)
Treatment side effects	Mann	39	0-5 (6)	-	Fewer side effects	-
Working memory (OSPAN)	Klein 1	81	-	-	Worse memory	α=0.75 r=0.88
Working memory (OSPAN)	Klein 2	75	-	-	Worse memory	-
ps=present sample						

Appendix 2. Search strategies

```
Medline <1966 to February Week 2 2003
   1. randomized controlled trial.pt./ (169507)
   2. controlled clinical trial.pt./ (62276)
   3. randomized controlled trials.sh./ (26602)
   4. random allocation.sh./ (47169)
   5. double blind method.sh./ (71710)
   6. single blind method.sh./ (6962)
   7. 0r/1-6/ (287316)
   8. (animal not human).sh./ (2636290)
   9. 7 not 8 / (273573)
   10.emotion$.mp. or exp EMOTION/ (104252)
   11.catharsis.mp. or exp CATHARSIS/ (278)
   12.10 or 11/ (104425)
   13.exp Health Status/ (35412)
   14.emotional disclosure.mp./ (21)
   15.emotional expression.mp./ (361)
   16.9 and 12/ (6741)
   17.13 and 16/ (130)
   18.14 or 15 or 17/ (507)


EMBASE <1980 to 2003 Week 8>
1. randomized controlled trial/ (72062)
2. exp clinical trial/ (262934)
3. exp controlled study/ (1527898)
4. double blind procedure/ (46739)
5. placebo/ (61804)
6. single blind procedure/ (4040)
7. (control$ adj (trial$ or stud$ or evaluation$ or experiment$)).mp.
   (91528)
8. ((singl$ or doubl$ or trebl$ or tripl$) adj5 (blind$ or mask$)).mp.
   (66380)
9. (placebo$ or matched communities or matched schools or matched
   populations).mp. (101738)
10.(comparison group$ or control group$).mp. (97809)
11.(clinical trial$ or random$).mp. (440249)
12.(quasiexperimental or quasi experimental or pseudo experimental).mp.
   (852)
13.matched pairs.mp. (1392)
14.randomization/ (5611)
15.or/1-14 (1847774)
16.emotion$.mp. or exp EMOTION/ (91041)
17.catharsis.mp. (108)
18.rehearsal.mp. or rehearsal/ (499)
19.exp Self Disclosure/ (397)
20.emotional disclosure.mp. (16)
21.16 or 17 or 18 or 19 or 20 (91789)
22.15 and 21 (27637)
23.writing.mp. or exp WRITING/ (6258)
24.journal.mp. (24890)
25.23 or 24 (30906)
26.22 and 25 (107)
27.from 26 keep 1-107 (107)


Database: CINAHL <1982 to February Week 3 2003>
   1. emotion$.mp. (8332)
   2. exp Emotions/ (11299)
   3. rehearsal.mp. (74)
   4. catharsis.mp. or exp “Catharsis (Psychology)”/ (30)
   5. disclosure.mp. (726)
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6. writing.mp. or exp WRITING/ (4727)
7. journal.mp. (5390)
8. expression.mp. (1659)
9. random$.mp. (24745)
10.exp Clinical Trials/ (16707)
11.trial$.mp. (14632)
12.1 or 2 or 3 or 4 or 5 or 8 (19696)
13.6 or 7 (9793)
14.9 or 10 or 11 (37579)
15.12 and 13 and 14 (24)
16.from 15 keep 1-24 (24)
17.from 16 keep 1-24 (24)
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Journals hand searched

Behavior Therapy 2002;33:1-4
Behaviour Research and Therapy 2002;40:1-12, 2003:41:1,2
Health Psychology 2002;21:1-6, 2003;22:1
Psychology and Health 2002;17:1-6, 2003;18:1
Psychology, Health and Medicine 2002;7:1-4
Psychosomatic Medicine 2002;64:1-6, 2003;65:1 including Abstracts from the 61st Annual Scientific Meeting, American Psychosomatic Society. Phoenix, USA, 5-8th March 2003

Appendix 3. Excluded studies

Table 3. Excluded studies and reasons for exclusion

Study name	Exclusion category	Specific reason
Averill 1969	3	Film intervention
Baker 1993	5	Psychological outcomes during intervention period only
Berger 1978	3,5	Very early trial of feeling disclosure. Disclosure in front of a listener, no follow up planned
Berk 1991	3	Film intervention
Beutler 1988	3	Verbal emotional disclosure in front of an experimenter
Brewin 1999	5	Psychological outcomes during intervention period only
Brown 2001	3,6	One of the two intervention (and control) groups involved disclosure in front of a listener. No results presented for the other intervention and control groups
Christensen 1 1993	3,4	No proper control group, Verbal emotional disclosure in front of an experimenter
Christiansen 2 1996	3	Verbal emotional disclosure in front of an experimenter
Costello 1995	1	Not RCT
Davis 2003	3	Not emotional disclosure intervention
Dominguez 1995	1	Not RCT
Donati 2002	1	Probably not RCT
Eddins 1999	3	Probably disclosure to a listener
Efran 1979	3	Film intervention
Ekman 1983	2	Actors
Esterling 1990	1	Case series
Fontanilla 2000	6	No follow up available
Futterman 1994	2	Actors
Gallagher 2002	6	Combined experimental and control group results
Gillis 2003	7	Subgroup of Gillis 2002 (5 patients' results missing)
Graybeal 2002	1	Crossover trial
Gross 1993	3	Film intervention
Guinther 2003	1	Probably case series
Hannay 1999	1	Not RCT
Hernandez 2003	4	No control group (2 intervention groups – emotional writing about anger provoking or pleasant event)
Hess (study 3) 2000	1	Not RCT
Hughes 1994	7	Only subgroup analysis results presented
Kelly 2001	5	Psychological outcomes during intervention period only
Knapp 1992	3	Verbal emotional disclosure in front of an experimenter
Koriat 1972	3	Film intervention
Kraft C 2003	2	Subgroup results from D'Souza 2003

Kranz 1995	3, 4,	Written emotional disclosure and expressive dance v. expressive dance. No non-emotional control group.
Kurylo 2000	3	Probably disclosure in front of a listener
Lee 1999	3	Not emotional disclosure intervention
Luminet 2000	1,3	Not RCT of emotional disclosure
Lumley 2001	7	Alexithymia subgroup results only
Lutgendorf 1994 and 1999	3	Verbal emotional disclosure in front of an experimenter
Malatesta 1987	1	Not RCT
Masley 2002	1	Not RCT of emotional disclosure
McCord 1999	2	Actors
Mueller 2002	1,3	Not RCT, film intervention
Nichols 1974	3	Verbal emotional disclosure in front of an experimenter
Njus 1996	3	Film intervention written about
Norman 2001	4	No non-emotional control (2 intervention groups, most distressing and positive aspects of their lives)
O'Cleirigh 2002	1	Not RCT of emotional disclosure
Paez 1999 (Exp 1 and 2), 1995	4	Control group instructions included feelings about a recent social event
Park 1, 2002	1	'Random' allocation was by signing up for time slots, every 4th one was the control slot.
Park 2, 2002	3	Not emotional disclosure intervention
Pennebaker 1989	1	Case series
Pennebaker 1987 (Exp 2)	4	Two intervention groups, (talking alone or to a listener), no neutral control group
Pham 2000	3	Film intervention
Philippot 1993	3	Film intervention
Pyszczynski 1993	5	Psychological outcomes during intervention period only
Quas 2000	1,3	Not RCT of emotional disclosure
Rime 1990	4	Two intervention groups (real event/stereotype)
Ritz 1995	1,3	?not RCT, not emotional disclosure (pictures)
Rusalova 1975	2	Actors
Schilte 2001	3	Verbal emotional disclosure in front of a doctor
Scholle 1992	5	Psychological outcomes during intervention period only
Schoutrop 1997	1	Not RCT
Schut 1997	3	Verbal emotional disclosure in front of an experimenter
Schwartz 1981	2	Actors
Segal 1994	4	Control group – verbal emotional disclosure in front of an experimenter (cognitive therapy)
Segal 1999 and 2001	4	Delayed treatment control group intervention carried out before reported outcomes measured
Springer 1995	7	Only subgroup results available for follow up measure of illness related absences
Struthers 1991	3	Disclosure to a listener
Sullivan 1999	7	Results for subgroups only
Tojek 2003	4,7	Two intervention groups, no control (stressful

		experiences or positive events), Substudy of Meyer
Zachariae 1991	3	Hypnosis intervention
Zakowski 2002	7	Subgroup results of social constraints scale only

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Appendix 4. Unobtainable studies that may be includable RCTs of emotional disclosure

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Appendix 5. Acronyms and references of included trials

Acronym	References
RCTs with volunteers with pre-existing physical conditions	
D'Souza	D'Souza P, Lumley MA, Kraft C, Dooley J, Roberson T, Stanislawski B, *et al.* Emotional disclosure and relaxation training for migraine and tension headaches: A randomised trial. Phoenix, USA: Presentation to 61st Annual Scientific Meeting of the American Psychosomatic Society; Phoenix, Arizona, 5-8th March 2003
Gillis	Gillis ME, Lumley MA, Koch H, Roehrs TA, Mosley-Williams AD, Leisen JC. Written emotional disclosure in fibromyalgia: Effects on sleep quality and fatigue. *Sleep* 2002; **25**:538. and Gillis M, Lumley M, Koch H, Mosley-Williams A, Leisen J, Roehrs T Written Emotional Disclosure in Fibromyalgia Syndrome. Presentation to 61st Annual Scientific Meeting of the American Psychosomatic Society; Phoenix, Arizona, 5-8th March 2003
Kelley	Kelley JE, Lumley MA, Leisen JC. Health effects of emotional disclosure in rheumatoid arthritis patients. *Health Psychology* 1997; **16**(4):331-340.
Lumley 1@	Lumley M, Leegstra S, Provenzano K, Warren V. The health effects of writing about emotional stress on physically symptomatic young adults. *Psychosomatic Medicine* 1999; **61:84-130**:89.
Lumley 2	Lumley MA.; Provenzano,K. Stress management through written emotional disclosure improves academic performance among college students with physical symptoms. Journal of Educational Psychology (in press) 2003.
Mann	Mann T. Effects of future writing and optimism on health behaviors in HIV-infected women. *Annals of Behavioral Medicine* 2001; **23**(1):26-33.
Meyer	Meyer T; Lumley MA; Markowitz A; Macklern D; Leisen J; Lubetsky M; Lasichak L; Mosley-Williams A; Granda J. Written and verbal emotional disclosure about stress in patients with rheumatoid arthritis. Presentation to 61st Annual Scientific Meeting of the American Psychosomatic Society; Phoenix, Arizona, 5-8th March 2003
Moor	de Moor C; Sterner J; Hall ML; Warneke C; Gilani Z; Amato RJ. A pilot study of the effects of expressive writing on psychological and behavioural adjustment in patients enrolled in a Phase II trial of vaccine therapy for metastatic renal cell carcinoma. Health Psychology 2002;21(6):615-9 and de Moor C; Warneke C; Sterner J; Gilani Z; Amato RJ; Cohen L. Emotional expression writing program for cancer patients. Psychosomatic Medicine 2001;63(91-190):1143
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Greenberg 1	Greenberg MA, Stone AA. Emotional disclosure about traumas and its relation to health: effects of previous disclosure and trauma severity. *Journal of Personality & Social Psychology* 1992;

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King 2	King LA. The health benefits of writing about life goals. *Personality and Social Psychology Bulletin* 2001; **27**(7):798-807
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Marlo	Marlo H, Wagner MK. Expression of negative and positive events through writing: Implications for psychotherapy and health. *Psychology and Health* 1999; **14**:193-215.
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Appendix 6. Included trials – study design

Table 4. Study design of included trials

First author		Intervention			Control				
	RCT	written	verbal	no	written	verbal	no	non-intervention	no
RCTs with volunteers with pre-existing physical conditions									
D'Souza	Y	Y	N*	1	Y	N	1	N	1
Gillis	Y	Y	N	1	Y	N	1	N	-
Kelley	Y	N	Y	1	N	Y	1	N	-
Lumley 1[@]	Y	Y	N	1	Y	N	1	N	-
Lumley 2	Y	Y	N	1	Y	N	1	N	-
Mann	Y	Y	N	1	N	N	0	Y	1
Meyer	Y	Y	Y	2	Y	Y	1	N	-
Moor	Y	Y	N	1	Y	N	1	N	-
Rosenberg	Y	Y	N	1	N	N	-	Y	1
Smyth 1	Y	Y	N	1	Y	N	1	N	-
Stanton	Y	Y	N	2	Y	N	1	N	-
Strough	Y	Y	N	2	Y	N	1	N	-
Walker	Y	Y	N	2	N	N	-	Y	1
RCTs with psychological inclusion criteria									
Barry[@]	Y	Y	N	1	?N	?N	0	?Y	1
Batten	Y	Y	N	1	Y	N	1	N	-
Gidron 1	Y	Y	(Y)	1	Y	(Y)	1	N	-
Gidron 2	Y	Y	N	1	Y	N	1	N	-
Greenberg 2	Y	Y	N	2	Y	N	1	N	-
Klein 3[@]	Y	Y	N	2	Y	N	1	N	-
Kovac 1	Y	Y	N	1	Y	N	1	N	-
Kovac 2	Y	Y	N	2	Y	N	1	N	-
Lepore 1	Y	Y	N	1	Y	N	1	N	-
Lepore 2	Y	Y	N	1	Y	N	1	N	-
O'Neill/Smyth	Y	Y	N	1	Y	N	1	N	-
Range 1	Y	Y	N	1	Y	N	1	N	-
Richards	Y	Y	N	1	Y	N	1	Y	1
Schoutrop 1	Y	Y	N	1	N	N	-	Y	1
Schoutrop 2[@]	Y	Y	N	3	Y	N	1	Y	1
Sloan[@]	Y	Y	N	1	Y	N	1	N	-
Spera	Y	Y	N	1	Y	N	1	N	-
Stroebe	Y	Y	N	3	N	N	-	Y	1
RCTs with physically healthy volunteers									
Booth 1	Y	Y	N	1	Y	N	1	N	-
Booth 2	Y	Y	N	1	Y	N	1	N	-
Cameron	Y	Y	N	2	Y	N	1	N	-
Dickerson[@]	Y	Y	N	1	Y	N	1	N	-
Donnelly	Y	Y	N	2	Y	N	1	N	-
Esterling	Y	Y	Y	2	Y	N	1	N	-
Francis	Y	Y	N	1	Y	N	1	N	-
Greenberg 1	Y	Y	N	2	Y	N	1	N	-
Hughes	Y	Y	N	4	Y	N	1	N	-
King 1	Y	Y	N	3	Y	N	1	N	-
King 2	Y	Y	N	3	Y	N	1	N	-
Klapow	Y	Y	N	1	Y	N	1	N	-

First author		Intervention			Control				
	RCT	written	verbal	no	written	verbal	no	non-intervention	no
Klein 1	Y	Y	N	1	Y	N	1	N	-
Klein 2	Y	Y	N	2	Y	N	1	N	-
Kloss	Y	Y	N	2	Y	N	1	N	-
Marlo	Y	Y	N	2	Y	N	1	N	-
Murray 1	Y	Y	N	2	Y	N	1	N	-
Murray 2	Y	Y	Y	2	Y	Y	2	N	-
Pennebaker 1	Y	Y	N	3	Y	N	1	N	-
Pennebaker 2	Y	Y	N	1	Y	N	1	N	-
Pennebaker 3	Y	Y	N	1	Y	N	1	N	-
Pennebaker 4	Y	Y	N	1	Y	N	1	N	-
Petrie	Y	Y	N	2	Y	N	2	N	-
Range 2	Y	Y	N	1	Y	N	1	N	-
Reynolds	Y	Y	N	1	Y	N	1	Y	1
Sheffield	Y	Y	N	1	Y	N	1	Y	1
Smyth 2	Y	Y	N	2	Y	N	1	N	-
Ullrich	Y	Y	N	2	Y	N	1	N	-
Randomised crossover trials									
Czajka	N	N	Y	1	N	Y	1	N	-
Pennebaker 5	N	Y	N	2	Y	N	2	N	-

No is the number of groups. Non-intervention includes waiting list controls
Brackets mean intervention was both written and verbal to some extent * 2nd intervention guided imagery group

Table 5. Included trials – country of origin and inclusion criteria

First author	Country	Physically well	Volunteers	Physical inclusion criteria	Psychological inclusion criteria
RCTs with volunteers with pre-existing physical conditions					
D'Souza	USA	N	Students	Migraine or tension headaches	
Gillis	USA	N	Volunteers	Fibromyalgia	-
Kelley	USA	N	Volunteers	Rheumatoid arthritis	-
Lumley 1[@]	USA	N	Students	'Symptomatic'	-
Lumley 2	USA	N	Psychology students	>80th%ile on somatic symptoms of SCL-90-R	-
Mann	USA	N	Women	With HIV	-
Meyer	USA	N	Volunteers	Rheumatoid arthritis	
Moor	USA	N	Volunteers	Metastatic renal cell carcinoma	-
Rosenberg	USA	N	Men	Previous prostate cancer	-
Smyth 1	USA	N	Volunteers	Rheumatoid arthritis, asthma	-
Stanton	USA	N	Women	Breast cancer	-
Strough	USA	N	Sportspeople	Anterior cruciate ligament recon-struction surgery	-
Walker	USA	N	Volunteers	Breast cancer	-
RCTs with psychological inclusion criteria					
Barry[@]	USA	Y	Women	Mothers whose babies were in NICU	
Batten	USA	Y	Women	-	Child sexual abuse survivors
Gidron 1	Israel	Y	Trauma survivors	-	PTSD
Gidron 2	Israel	Y	Frequent clinic visitors	-	-
Greenberg 2	USA	Y	Students	-	Severe trauma
Klein 3[@]	USA	Y	Women	-	Traumatic event history
Kovac 1	USA	Y	Students	-	Lost loved one to suicide
Kovac 2	USA	Y	Undergraduate students	-	Scored 6 or more on SBQ
Lepore 1	USA	Y	Students/examinees	-	Taking professional examination
Lepore 2	USA	Y	Psychology students	-	Relationship break up in previous year
O'Neill/Smyth	USA	Y	Psychology students	-	High distress on flooding from hurricane Floyd
Range 1	USA	Y	Students	-	Lost loved within 2 ½ years
Richards	USA	Y	Prisoners	-	-
Schoutrop 1	NL	Y	Psychology students	-	Trauma or stress

First author	Country	Physically well	Volunteers	Physical inclusion criteria	Psychological inclusion criteria
					within 6 months
Schoutrop 2[@]	NL	Y	Volunteers	-	Suffered a traumatic event
Sloan[@]	USA	Y	Volunteers	-	PTSD
Spera	USA	Y	Volunteers	-	Recently unemployed
Stroebe	NL	Y	Volunteers	Age < 70	Recently bereaved
RCTs with physically healthy volunteers					
Booth 1	NZ	Y	Medical students	-ve Hep B	-
Booth 2	NZ	Y	Medical students	-	-
Cameron	NZ	Y	Psychology students	-	-
Dickerson[@]	USA	Y	Students	-	-
Donnelly	USA	Y	Psychology students	-	-
Esterling	USA	Y	Psychology students	EBV+ve	-
Francis	USA	Y	Employees	-	-
Greenberg 1	USA	Y	Psychology students	-	-
Hughes	USA	Y	Psychology students	-	-
King 1	USA	Y	Psychology students	-	-
King 2	USA	Y	Psychology students	-	-
Klapow	USA	Y	Elderly clinic visitors	-	-
Klein 1	USA	Y	Students	-	-
Klein 2	USA	Y	Students	-	-
Kloss	USA	Y	Psychology students	-	-
Marlo	USA	Y	Psychology students	-	-
Murray 1	USA	Y	Psychology students	-	-
Murray 2	USA	Y	Psychology students	-	-
Pennebaker 1	USA	Y	Psychology students	-	-
Pennebaker 2	USA	Y	Psychology students	-	-
Pennebaker 3	USA	Y	Psychology students	-	-
Pennebaker 4	USA	Y	Psychology students	-	-
Petrie	NZ	Y	Medical students	-	-
Range 2	USA	Y	Psychology students	-	-
Reynolds	GB	Y	Children	-	-
Sheffield	GB	Y	Psychology students	-	-
Smyth 2	USA	Y	Psychology students	-	-
Ullrich	USA	Y	Psychology students	-	-
Randomised crossover trials					
Czajka	USA	Y	Psychology students	-	-
Pennebaker 5	USA	Y	Psychology students	-	-

Table 6. Timing and nature of intervention

First author	Time of intervention	Intervention		Control
RCTs with volunteers with pre-existing physical conditions				
D'Souza	4x20mins	A trauma, upheaval or stressful experience, facts and deepest feelings and how the experience has affected their lives		Time management in past week, past 24hrs, next 24hrs and next week (also second control group of relaxation training)
Gillis	4x15-20mins	Written disclosure about stressful life events, write about deepest feelings		How they manage their time
Kelley	4x15mins	A trauma or upheaval experienced now or in the past (verbal into tape recorder)		Neutral pictures (verbal into tape recorder)
Lumley 1[@]	4x15-20mins	Life stress		Plans
Lumley 2	4x15-20	Most traumatic and upsetting experience of whole life		Plans for next day, week, year, 10 years
Mann	8x10mins	A positive future with only one HIV pill/day		(no write)
Meyer	4x20	Deepest thoughts and feelings about a stressful event	A positive event	Time management last week, today, tomorrow, next week
Moor	4x?mins	About their cancer		Health behaviours of diet, physical activity, substance use, sleep
Rosenberg	4x20-30mins	Experience with prostate cancer or other traumatic and upsetting experience		(no write)
Smyth 1	3x20mins	Most stressful experience ever undergone		Plans for the day
Stanton	4x20mins	Deepest thoughts and feelings about their breast cancer	Positive thoughts and feelings about their breast cancer	Facts about breast cancer experience
Strough	4x15mins	Deepest thoughts and feelings about their knee and the rehabilitation protocol		All food and drink in the previous 3 days
Walker	3 (or 1) x30mins	Deepest thoughts and feelings about their cancer experience		(usual care)
RCTs with psychological inclusion criteria				
Barry[@]	4x30mins	About NICO experience		(?no write)
Batten	3x20mins	Child sexual abuse		Time management
Gidron 1	3x20mins	Most traumatic experience		Casual daily agenda
Gidron 2	3x15mins	Event in chronological order then thoughts and feelings at time then thoughts and feelings now		Daily activities, their house, current or last job
Greenberg 2	1x30mins	Most traumatic (real) event that ever happened to them	An imagined traumatic event	Factual details about the campus
Klein 3[@]	?1x30mins	Their most traumatic experience	An imaginary traumatic event	Physical layout of campus
Kovac 1	4x15mins	Events and emotions surrounding loss of loved one		Describe previous meal/ bedroom, activities for day, plans after writing
Kovac 2	4x20mins	Thoughts and feelings about when they felt most suicidal, depressed or upset	Thoughts and feelings about when they felt most suicidal, depressed or upset, with reinterpretation	Bedroom or dorm room
Lepore 1	1x25mins	Deepest thoughts and feelings about exam		Activities in last 24 hrs

First author	Time of intervention	Intervention			Control	
Lepore 2	3x20mins	Deepest thoughts and feelings about the relationship break-up			Impersonal non-specific relationship topics	
O'Neill/Smyth	1x20mins	Stressful or traumatic experiences with the hurricane (Floyd) or flooding			Time management – plans for the week	
Range 1	4x15mins	Events and emotions surrounding loss of loved one			Bedroom	
Richards	2x30mins	Most traumatic and upsetting experiences of entire life			Time management	(no write)
Schoutrop 1	5x45mins	Deepest feelings and thoughts about traumatic event			(waiting list)	
Schoutrop 2[@]	4x30mins	Actualisation of painful feelings	Coping style	both	Plans for the day	(waiting list)
Sloan[@]	3x20mins	Trauma writing			Trivial writing	
Spera	5x20mins	Deepest thoughts and feelings about the layoff			Plans for the day, activities in jobsearch	
Stroebe	7x10-30mins	Feelings and emotions about death of spouse	Problems caused by death of spouse	Both feelings and problems about spouse death	(no write)	
RCTs with physically healthy volunteers						
Booth 1	4x20mins	Most traumatic and upsetting experiences of entire life			Activities in previous 24 hrs, plans for next day, week, year	
Booth 2	4x20mins	Most traumatic and upsetting experiences of entire life			Activities in previous 24 hrs, plans for next day, week, year	
Cameron	3x20mins	Deepest thoughts and feelings about going to college	Same plus development of coping plans		Activities that morning, plans for the day, previous social event	
Dickerson[@]	3x20mins	Traumatic, emotional experiences where they blamed themselves			Neutral experiences	
Donnelly	4x30mins	Most traumatic and upsetting experience of entire life	(psychotherapy)		Contents of closet, bedroom, wardrobe, psychology classroom	
Esterling	3x20mins	A stressful event that had happened to them, traumatic or where they felt guilty			Contents of closet, bedroom, car	
Francis	4x20mins	A trauma or personal upheaval now or in past			Activities since waking, for rest of day, characteristics of room, work related projects in next 2 months	
Greenberg 1	4x20mins	Most traumatic and upsetting experiences of entire life, undisclosed	Same but discussed with others in past		Activities for day, most recent social event, their shoes, plans for day	
Hughes	3x15mins	Deepest thoughts and –ve feelings about going to college	Deepest thoughts and +ve feelings about going to college	Deepest thoughts and –ve feelings plus insight	Deepest thoughts and +ve feelings plus insight	Factually about college
King 1	3x20mins	Some traumatic event	Trauma and benefits	Perceived benefits	Plans for the next day, their shoes	

First author	Time of intervention	Intervention			Control	
King 2	4x20mins	Some traumatic event or loss	Best possible self	Trauma and best possible self	Plans for the day	
Klapow	3x20mins	Thoughts and feelings about the most distressing event in their lives			What they did to stay healthy	
Klein 1	3x20mins	Their deepest thoughts and feelings about coming to college			Time management	
Klein 2	3x20mins	Deepest thoughts and feelings about a negative event	Deepest thoughts and feelings about a positive event		How they spend their time	
Kloss	3x20mins	Most traumatic and upsetting experiences of entire life	Most positive experiences of entire life		Activities that morning/ previous or following day	
Marlo	4x20mins	A negative, traumatic, stressful time in their life	A positive, special, beautiful or happy time or event		Their classes, schedule for day, future plans for week, shoes, clothes, parts of a car	
Murray 1	2x30mins	A traumatic or disturbing event, current or past	(Psychotherapy)		Contents of room or clothes closet	
Murray 2	4x20mins	One of the most traumatic and stressful experiences of their life			Contents of closet, bedroom, psychology classroom, wardrobe	
Pennebaker 1	4x15mins	Any upsetting personal experience and the facts and feelings about it	Any upsetting personal experience and the facts about it	Any upsetting personal experience and their feelings about it	Living room, their shoes, a tree, their room	
Pennebaker 2	2x30mins	Deepest thoughts and feelings about coming to college			Activities that morning, plans for the day, last social event attended	
Pennebaker 3	2x30mins	Deepest thoughts and feelings about coming to college			Any object or event of their choice	
Pennebaker 4	4x20mins	Most traumatic and upsetting experience of entire life			Activities for day, most recent social event, their shoes, plans for the day	
Petrie	3x15mins	A difficult or traumatic emotional event, without suppression for last 5 mins	A difficult or traumatic emotional event,with suppression for last 5 mins		Use of time in previous 24 hrs, without suppression for last 5 mins	Use of time in previous 24 hrs,with suppression for last 5 mins
Range 2	4x15mins	An event experienced that was highly stressful, traumatic or where you felt guilty			Bedroom/ dormitory room, ate for lunch/ dinner, activities since waking, plans for day	
Reynolds	4x15-20mins	Deepest thoughts and feelings about things you have found stressful or sad or made you feel angry or upset			How you spend your time	(no write)

First author	Time of intervention	Intervention		Control	
Sheffield	3x10mins	Deepest thoughts and feelings about a traumatic or upsetting experience that has happened to you		Activities of day, a recent social event, plans for rest of day	(no write)
Smyth 2	1x20mins	The most traumatic or stressful event in your life		?	
Ullrich	>8x10mins	Deepest feelings of a stressful or traumatic topic	Deepest feelings of a stressful or traumatic topic with understanding	Facts about events from the media involving loss and trauma	
Randomised crossover trials					
Czajka	1x4 mins	A personally traumatic event		Their shoes, a chair	
Pennebaker 5	1x6 mins	A highly stressful or traumatic event		Plans for the day	
Control instructions in brackets are non writing controls ? = probably written control but subject not specified					

Table 7. Included trials – trial characteristics

First author	Total no followed up	No differences between groups	Some differences between groups
RCTs with volunteers with pre-existing physical conditions			
D'Souza	112#	Not reported	
Gillis	72	Not reported	-
Kelley	65	Age, education, gender, ethnicity, marital status, employment, diagnosis duration, RA stage, medications, no stressful events, mean stress rating	-
Lumley 1[@]	75	Not reported	-
Lumley 2	64	Age, gender, ethnicity, ACT score, high scool GPA, credit hours attempted or earned, GPA in baseline semester	
Mann	40	Age, ethnicity, marital status, number of children, having AIDS, number of pills taken per day	-
Meyer	149#	Health status measures	
Moor	34	Medical or demographic characteristics, CES-D, IES, POMS, PSQI, PSS	-
Rosenberg	30	Age, ethnicity, occupation, education, income, marital status, cancer stage, type of cancer treatment	-
Smyth 1	106	Age, gender, ethnicity, no children, education, employment, income, medication, exercise, smoking, alexithymia, IES, coping strategy, anxiety, disease severity (at $p<0.2$)	-
Stanton	60	Not reported	-
Strough	30	Age, years of sport activity, degree of support	-
Walker	39	Not reported	-
RCTs with psychological inclusion criteria			
Barry[@]	30	Not reported	-
Batten	59	Age, ethnicity, marital status, income, results of PILL, BDI, SCL-90-R GSI, previous therapy	-
Gidron 1	14	Education, medication, health scores	Less time since trauma in control group
Gidron 2	46	Age, education, health status, number of life events, gender, clinic visits in previous 3 months	More somatisation in control group
Greenberg 2	97	HCV	'pre-existing between group variation'
Klein 3[@]	91	Not reported	-
Kovac 1	42	Not reported	-
Kovac 2	94	Not reported	
Lepore 1	74#	Depressive symptoms	-
Lepore 2	145	Not reported	-
O'Neill/Smyth	42	Not reported	-
Range 1	44	-	Death event less recent in control group
Richards	94	Age, education, prison sentence length, HCV, sex offender status, ethnicity, type	-

First author	Total no followed up	No differences between groups	Some differences between groups
		of disorder, CSAQ, PILL	
Schoutrop 1	48	Biographical variables	-
Schoutrop 2[@]	133#	Not reported	-
Sloan[@]	?n	Not reported	-
Spera	40	TSBQ, energy, motivation, frustration, anxiety, personal behaviours	-
Stroebe	87	Not reported	-
RCTs with physically healthy volunteers			
Booth 1	40	Mood, physical symptoms	-
Booth 2	38	Not reported	-
Cameron	122	CAT, LOT, openness to experience, HCV	-
Dickerson[@]	49	Not reported	-
Donnelly	102	HCV, physical illness, emotional health	Negative mood ?
Esterling	57	Health behaviours, EBV-VCA	-
Francis	36	Blood measurements, PANAS	More absentees in control group
Greenberg 1	50	-	SMU-HQ lower in control group
Hughes	111	PANAS, +ve & -ve emotion, health behaviours	-
King 1	85	HCV	-
King 2	70	HCV	-
Klapow	43	Charges	PCPTC codes, somatic and distress symptoms less in control group
Klein 1	71	Working memory	-
Klein 2	101	Working memory, IES	-
Kloss	129	Trait anxiety, BDI, PILL, PANAS, HCV, gender, age, exercise, alcohol, smoking	-
Marlo	156	Not reported	-
Murray 1	24	Time since event, sadness	Heart rate
Murray 2	120	Not reported	-
Pennebaker 1	42	Not reported	-
Pennebaker 2	124	Not reported	-
Pennebaker 3	72	HCV	-
Pennebaker 4	40	Not reported	-
Petrie	65	Not reported	-
Range 2	49	Not reported	-
Reynolds	191	Gender, age, SAT level	More life events in written control
Sheffield	30	-	HCV, days off due to illness, somatic symptoms, positive affect
Smyth 2	116#	Not reported	-
Ullrich	122	Rate of dropout, mean age, proportion of men to women, number of illness episodes, severity of illness symptoms, positive growth from trauma	-
Randomised crossover trials			
Czajka	32	Not reported	-
Pennebaker 5	40	Not reported	-
# = number randomised			

Appendix 7. Included trials – study quality

Table 8. Quality of included trials – numbers in each group and losses to follow up

First author	Consort flow diagram (or information to draw one)	No random-ised to each group	No in each group received intervention	No in each group at follow up	Losses to follow up nos in each group stated	%age lost to follow up	Similar in each group (≤ 2x)
RCTs with volunteers with pre-existing physical conditions							
D'Souza	N	Y	N	N	Y	~26%	?
Gillis	N	N	N	N	Y	22.1%	?
Kelley	N	Y	Y	Y	Y	17.7	N
Lumley 1[@]	N	N	N	N	N	-	?
Lumley 2	N	Y	N	Y	Y	8.1%	Y
Mann	N	Y	N	Y	Y	16.7	N
Meyer	N	Y	N	N	N	-	?
Moor	Y	Y	Y	Y	Y	19.0[=]	Y
Rosenberg	N	Y	?Y	Y[#]	Y[#]	33.3	Y
Smyth 1	Y	Y	Y	Y	Y	15.1	Y
Stanton	Y	Y	Y	Y	Y	4.8	Y
Strough	N	Y	?Y	?Y	N	?0	?Y
Walker	N	Y	Y	Y	Y	22.0	N
RCTs with psychological inclusion criteria							
Barry[@]	N	N	N	N	N	-	?
Batten	N	Y	N	Y	N	19.2	?
Gidron 1	N	N	Y	N	N	-	?
Gidron 2	N	N	Y	Y	N	-	?
Greenberg 2	N	N	Y	N	N	-	?
Klein 3[@]	N	N	N	N	N	-	?
Kovac 1	N	Y	Y	N	N	28.9	?
Kovac 2	N	N	N	Y	N	19.0	?
Lepore 1	N	N	N	N	N	-	?
Lepore 2	N	N	N	N	Y	9.2	?
O'Neill/Smyth	N	Y	N	Y	Y	20.6	N
Range 1	N	Y	N	Y	Y	31.2	Y
Richards	N	Y	N	Y	Y	4.1	Y
Schoutrop 1	N	Y	?Y	N	N	-	?
Schoutrop 2[@]	N	Y	N	N	Y	21.8	?
Sloan[@]	N	N	N	N	N	-	?
Spera	N	Y	Y	Y	Y	2.4	Y
Stroebe	N	Y	Y	Y	Y	42.3	N
RCTs with physically healthy volunteers							
Booth 1	N	N	Y	N	N	-	?
Booth 2	N	N	Y	N	N	-	?
Cameron	N	N	N	Y	Y	9.0	Y
Dickerson[@]	N	Y	N	N	N	-	?
Donnelly	N	N	Y	N	Y	27.3	?
Esterling	N	N	N	Y	N	-	?
Francis	N	N	N	Y	Y	12.2	Y
Greenberg 1	N	Y	Y	Y	Y	18.3	Y
Hughes	N	N	Y	Y	N	-	?
King 1	N	N	Y	Y	N	-	?

First author	Consort flow diagram (or information to draw one)	No random-ised to each group	No in each group received intervention	No in each group at follow up	Losses to follow up nos in each group stated	%age lost to follow up	Similar in each group (≤ 2x)
King 2	N	N	Y	Y	N	-	?
Klapow	N	N	N	Y	N	4.4	?
Klein 1	N	Y	Y	Y	Y	7.8	Y
Klein 2	N	Y	Y	N	N	17.0	?
Kloss	N	N	N	N	N	-	?
Marlo	N	N	Y	N	N	-	?
Murray 1	N	N	Y*	Y*	N	-	?
Murray 2	N	Y	N	N	N	-	?
Pennebaker 1	N	N	Y	Y	N	-	?
Pennebaker 2	N	Y	Y	Y	Y	4.6	Y
Pennebaker 3	N	N	N	Y	N	20.0	?
Pennebaker 4	N	N	Y	N	N	-	?
Petrie	N	N	Y	N	N	-	?
Range 2	N	N	N	Y	N	21.0	?
Reynolds	N	Y	Y	Y	Y	0.5	Y
Sheffield	Y	Y	Y	Y	Y	58.9	N
Smyth 2	N	N	N	N	N	-	?
Ullrich	N	Y	N	Y	Y	30.2	Y
Randomised crossover trials							
Czajka	N	Y	Y	N/A	Y	(42.9)	?
Pennebaker 5	N	Y	Y	N/A	N	(23.1)	?

Losses to follow up in each group are the total losses between randomisation and follow up in each group. The %age lost to follow up is the difference between the total number randomised and the total number followed up. * Numbers in each group calculated from percentages. # Losses to follow up stated for one outcome only. = number includes patients who died during the follow up. Percentage lost to follow up in brackets are differences between number randomised and number received interventions.

Table 9. Quality of included trials – randomisation, blinding, Jadad score

First author	Random method given	Allocation concealment mentioned	Blinding mentioned	Explicit intention to treat	Power calculation	Jadad Score
RCTs with volunteers with pre-existing physical conditions						
D'Souza	N	N	N	N	N	0
Gillis	N	N	N	N	N	0
Kelley	Y	N	N	N	N	2
Lumley 1[@]	N	N	N	N	N	0
Lumley 2	N	N	Y	N	N	0
Mann	N	N	N	N	N	0
Meyer	N	N	N	N	N	0
Moor	Y*	N	N	N	N	1
Rosenberg	N	Y	Y	N	N	1
Smyth 1	Y	Y	Y	Y	Y	4
Stanton	Y	Y	Y	N	Y	2
Strough	Y	N	N	N	N	0
Walker	N	N	N	N	N	1
RCTs with psychological inclusion criteria						
Barry[@]	N	N	N	N	N	0
Batten	N	Y	Y	N	N	1
Gidron 1	N	N	Y	N	N	0
Gidron 2	N	N	Y	N	N	1
Greenberg 2	N	N	Y	N	Y	0
Klein 3[@]	N	N	N	N	N	0
Kovac 1	N	N	Y	N	N	0
Kovac 2	N	N	N	N	N	0
Lepore 1	N	N	N	N	N	0
Lepore 2	N	N	N	N	N	0
O'Neill/Smyth	N	N	N	N	N	0
Range 1	N	N	N	N	N	1
Richards	N	N	N	N	N	1
Schoutrop 1	N	N	N	N	N	0
Schoutrop 2[@]	N	N	N	N	N	0
Sloan[@]	N	N	N	N	N	0
Spera	N	N	N	N	N	1
Stroebe	N	N	N	N	N	0
RCTs with physically healthy volunteers						
Booth 1	N	N	N	N	N	0
Booth 2	N	N	N	N	N	0
Cameron	N	N	N	N	N	0
Dickerson[@]	N	N	N	N	N	0
Donnelly	N	N	N	N	N	0
Esterling	N	N	N	N	N	0
Francis	Y[+]	N	N	N	N	2
Greenberg 1	N	N	N	N	Y	1
Hughes	N	N	N	N	N	1
King 1	N	N	Y	N	N	1
King 2	N	N	Y	N	N	1
Klapow	N	N	N	N	N	1
Klein 1	N	N	Y	N	N	1
Klein 2	N	N	Y	N	N	1
Kloss	N	N	N	N	N	0

First author	Random method given	Allocation concealment mentioned	Blinding mentioned	Explicit intention to treat	Power calculation	Jadad Score
Marlo	N	N	N	N	N	0
Murray 1	N	N	N	N	N	0
Murray 2	N	N	N	N	N	0
Pennebaker 1	N	N	Y	N	N	1
Pennebaker 2	N	N	Y	N	N	1
Pennebaker 3	Y[+]	N	N	N	N	2
Pennebaker 4	N	N	Y	N	N	0
Petrie	N	N	N	N	N	0
Range 2	N	N	N	N	N	0
Reynolds	N	N	N	N	N	1
Sheffield	N	Y	Y	N	N	2
Smyth 2	N	N	N	N	N	0
Ullrich	N	N	N	N	N	1
Randomised crossover trials						
Czajka	N	N	N	N	N	N/A
Pennebaker 5	N	N	N	N	N	N/A
[*] minimisation on prognostic factors. [+] randomisation by social security number						

Appendix 8. Physical health outcomes

Table 10. Physical health outcomes measured. (Outcomes in brackets not reported)

First author	Objective health	Objective HCV	Subjective HCV	Subjective health	What measured
RCTs with volunteers with pre-existing physical conditions					
D'Souza	-	-	-	Y	Headache pain, headache frequency, McGill pain inventory (short form), Migraine Disability Assessment Scale, days using pain medications in previous month
Gillis	-	-	Y	Y	FIQ, FSS, medication, sleep quality
Kelley	Y	-	-	Y	ARA Joint condition including joint count, grip strength and walking time. AIMS-2 including physical dysfunction, pain
Lumley 1[@]	-	Y	-	Y	'Health,' physical symptoms, health interference with daily functioning
Lumley 2	-	-	-	-	
Mann	-	-	-	Y	Compliance, Treatment side effects
Meyer	Y	-	-	Y	Joint status, walking speed, grip strength, over the counter medications, AIMS-2 physical functioning, pain, fatigue
Moor	-	-	-	(Y)	(Brief symptom inventory)
Rosenberg	(Y)	-	Y	Y	Health care use, use of medicines, pain, (disease stage, health behaviours, physical symptoms)
Smyth 1	Y	-	-	-	FEV1, physician's global assessment of RA
Stanton	-	-	Y	Y	Perceived somatic symptoms
Strough	Y	-	-	Y	Range of motion, strength, biofeedback, subjective knee rating
Walker	-	-	-	Y	(Side effect severity)
RCTs with psychological inclusion criteria					
Barry[@]	-	-	-	-	
Batten	-	-	Y	Y	PILL
Gidron 1	-	-	Y	Y	PILL
Gidron 2	-	Y	-	-	
Greenberg 2	-	Y	-	(Y)	Physical symptom scales, activity restricted from illness
Klein 3[@]	-	-	-	-	
Kovac 1	-	-	Y	-	
Kovac 2	-	-	Y	-	
Lepore 1	-	-	-	-	
Lepore 2	-	-	-	Y	Upper respiratory symptoms
O'Neill/Smyth	-	-	-	Y	Physical symptoms index
Range 1	-	-	Y	-	
Richards	-	Y	-	Y	PILL
Schoutrop 1	-	-	-	-	
Schoutrop 2[@]	-	-	-	-	
Sloan[@]	-	-	-	-	
Spera	-	-	-	Y	Health behaviours
Stroebe	-	Y	-	-	
RCTs with physically healthy volunteers					
Booth 1	-	-	-	-	
Booth 2	-	-	-	-	
Cameron	-	-	Y	-	
Dickerson[@]	-	-	-	-	

First author	Objective health	Objective HCV	Subjective HCV	Subjective health	What measured
Donnelly	-	-	Y	Y	No. days ill-PBHQ. (Whether felt physically ill)
Esterling	-	-	-	-	
Francis	(Y)	-	-	-	(Illness related absences)
Greenberg 1	-	Y	(Y)	Y	SMU-HQ (?Pennebaker's physical symptoms scale)
Hughes	-	Y	-	Y	Change in restricted days, health behaviours, no days restricted from illness
King 1	-	Y	-	-	
King 2	-	Y	-	-	
Klapow	-	Y*	-	Y	*Health centre visits recorded as Physicians' Current Procedural Terminology Codes – outpatient only. Somatic symptom scores
Klein 1	-	-	-	-	
Klein 2	-	-	-	-	
Kloss	-	Y	Y	Y	PILL, no illnesses, no sick days, illness reports.
Marlo	-	-	Y	-	
Murray 1	-	Y	Y	Y	'health measures' (PBHQ), no days restricted from illness
Murray 2	-	-	-	Y	'physical health' (change in health state)
Pennebaker 1	-	Y	-	Y	No. of illnesses, restricted activity from illness. PILL, health behaviours
Pennebaker 2	-	Y	-	Y	Health behaviours
Pennebaker 3	-	Y	-	-	
Pennebaker 4	-	Y	-	Y	Health behaviours
Petrie	-	-	-	(Y)	(Health behaviours)
Range 2	-	-	Y	-	
Reynolds	-	-	-	Y	Children's Somatisation Inventory
Sheffield	-	-	Y	Y	Physical symptoms, days off due to illness
Smyth 2	-	-	-	Y	Symptom report, activity restricted from illness
Ullrich	-	-	-	Y	Infectious illness episodes, symptom severity

Appendix 9. Performance and psychological outcomes

Table 11. Performance, psychological outcome measured. (Outcomes in brackets not reported)

First author	Perform-ance	Psycho-logical	What measured
RCTs with volunteers with pre-existing physical conditions			
D'Souza	-	(Y)	(SCL-90-R somatisation scale)
Gillis	-	Y	PANAS-X, support
Kelley	-	Y	AIMS-2 affective disturbance
Lumley 1[@]	-	-	
Lumley 2	Y	-	Credit hours attempted and earned, GPA
Mann	-	Y	LOT
Meyer	-	Y	Emotional functioning
Moor	-	Y	CES-D, IES, POMS, PSQI, PSS
Rosenberg	-	Y	Psychological symptoms, (FACT, POMS, SF-36, SCL-90-R)
Smyth 1	-	-	
Stanton	-	Y	COPE, FACT, IES, POMS
Strough	-	Y	POMS, rumination, self-efficacy
Walker	-	Y	IES, PANAS
RCTs with psychological inclusion criteria			
Barry[@]	-	Y	IES-R, SCL-90-R (WAS)
Batten	-	Y	BDI, negative mood-PANAS, SCL-90-R
Gidron 1	-	Y	BDI, IES, PANAS
Gidron 2	-	Y	Somatisation-Hopkins SCL
Greenberg 2	-	Y	IES, NHRC Mood, SCL-90
Klein 3[@]	-	-	
Kovac 1	-	Y	GEQ, GRQ, IES, (Counselling or therapy sought)
Kovac 2	-	Y	ATQ-R, BRFL, SDS, SIQ, SSF
Lepore 1	-	Y	Depressive symptoms-SCL-90-R, intrusive thoughts-IES
Lepore 2	-	Y	POMS-SF, relationship status, (IES)
O'Neill/Smyth	-	Y	IES-R, negative mood-NAS
Range 1	-	Y	IES, GRQ, MAACL-R, SDS, (GEQ)
Richards	-	Y	CSAQ
Schoutrop 1	-	Y	IES, MMI, SCL-90-R
Schoutrop 2[@]	-	Y	IES (MMI, SCL-90-R)
Sloan[@]	-	(Y)	(Overall level of improvement in ?PTSD)
Spera	Y	-	Employment, interview log, no phone calls received, no letters generated, (TSBQ)
Stroebe	-	Y	GHQ, IES
RCTs with physically healthy volunteers			
Booth 1	-	-	
Booth 2	-	-	
Cameron	Y	Y	GPA, CAT, negative mood
Dickerson[@]	-	-	
Donnelly	-	Y	'Emotional health', (consulted a mental health professional, felt down or emotionally distressed)
Esterling	-	-	
Francis	Y	Y	Days absent, PANAS
Greenberg 1	-	Y	PANAS
Hughes	-	Y	CAT, (CABQ)
King 1	-	-	
King 2	-	Y	LOT and SWLS combined
Klapow	Y	Y	Total charges paid, distress, symptom score, patient satisfaction

First author	Perform-ance	Psycho-logical	What measured
Klein 1	Y	Y	Working memory, CAT, GPA, (perceived stress)
Klein 2	Y	Y	Working memory, GPA, IES
Kloss	-	Y	BDI, trait anxiety
Marlo	-	(Y)	(No times consulted a mental health professional)
Murray 1	-	-	
Murray 2	-	Y	Psychological health, (change in psychological health state)
Pennebaker 1	-	(Y)	CSAQ, Marlowe-Crowne SDS
Pennebaker 2	Y	Y	GPA, CAT, (SAT)
Pennebaker 3	Y	Y	GPA, thought generation, (adjustment to college, SAT)
Pennebaker 4	-	(Y)	Happiness, depression, (Subjective distress)
Petrie	-	(Y)	Depression, sadness, (affect)
Range 2	-	Y	RFL, SIQ, SIS (MAACL-R)
Reynolds	-	Y	School absences, Birleston depression inventory, SCAS, SDQ, (LEQ)
Sheffield	-	Y	Anxiety/insomnia-GHQ, mood
Smyth 2	-	Y	IES
Ullrich	-	Y	PTGI

Appendix 10. Physiological and blood/immunological outcomes

Table 12. Immediate and follow up physiological and blood/immunological outcomes measured. (Outcomes in brackets not reported)

First author	Immediate physiological	Immediate blood/immune measures	Follow up physiological	Follow up blood/immune measures	What measured
RCTs with volunteers with pre-existing physical conditions					
D'Souza	-	-	-	-	
Gillis	-	-	-	-	
Kelley	-	-	-	-	
Lumley 1[@]	-	-	-	-	
Lumley 2	-	-	-	-	
Mann	-	-	-	-	
Meyer	-	-	-	Y	ESR
Moor	-	-	-	-	
Rosenberg	-	-	-	Y	IL-4, IL-10, TNFα, PSA specific CD4, CD8
Smyth 1	-	-	-	-	
Stanton	-	-	-	-	(heart rate, skin conductance)
Strough	-	-	-	-	
Walker	-	-	-	-	
RCTs with psychological inclusion criteria					
Barry[@]	-	-	-	-	
Batten	-	-	-	-	
Gidron 1	-	-	-	-	
Gidron 2	-	-	-	-	
Greenberg 2	-	-	-	-	
Klein 3[@]	Y	-	-	-	BP, heart rate
Kovac 1	-	-	-	-	
Kovac 2	-	-	-	-	
Lepore 1	-	-	-	-	
Lepore 2	-	-	-	-	
O'Neill/Smyth	-	-	-	-	
Range 1	-	-	-	-	
Richards	-	-	-	-	
Schoutrop 1	-	-	-	-	
Schoutrop 2[@]	Y	-	-	-	Diastolic BP, skin conductance, (BP)
Sloan[@]	-	Y	-	-	Salivary cortisol
Spera	(Y)	-	-	-	(BP, heart rate, weight)
Stroebe	-	-	-	-	
RCTs with physically healthy volunteers					
Booth 1	Y	Y	-	Y	Skin conductance, lymphocytes, hepatitis B antibodies
Booth 2	-	Y	-	(Y)	CD4, CD8, total lymphocytes
Cameron	-	-	-	-	
Dickerson[@]	-	Y	-	-	B2M, cortisol, sTNF-R11
Donnelly	-	-	-	-	
Esterling	-	-	-	Y	Epstein-Barr virus VCA antibodies
Francis	-	-	-	Y	Various inc. LFTs, lipids (U+E)
Greenberg 1	-	-	-	-	

First author	Immediate physiological	Immediate blood/immune measures	Follow up physiological	Follow up blood/immune measures	What measured
Hughes	-	-	-	-	
King 1	-	-	-	-	
King 2	-	-	-	-	
Klapow	-	-	-	-	
Klein 1	-	-	-	-	
Klein 2	-	-	-	-	
Kloss	-	-	-	-	
Marlo	-	-	-	-	
Murray 1	(Y)	-	-	-	BP, heart rate
Murray 2	-	-	-	-	
Pennebaker 1	(Y)	-	-	-	BP, heart rate
Pennebaker 2	-	-	-	-	
Pennebaker 3	-	-	Y	-	Reaction time
Pennebaker 4	Y	-	-	Y	BP, heart rate, skin conductance, lymphocyte reaction to Concavalin A and PHA stimulation
Petrie	-	Y	-	-	Lymphocytes, RBCs, monocytes, Hb.
Range 2	-	-	-	-	
Reynolds	-	-	-	-	
Sheffield	-	-	-	-	
Smyth 2	-	-	-	-	
Ullrich	-	-	-	-	
Randomised crossover trials					
Czajka	Y	-			BP, HR, skin conductance
Pennebaker 5	Y	-			BP, HR, skin conductance (EMG)

Appendix 11. Physical health results

Table 13. Physical health outcomes – Objectively measured health outcomes results

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
RCTs with volunteers with pre-existing physical conditions						
Kelley	ARA joint count, mean number	34	6.57 (ng)	31	6.19 (ng)	At 3 months, baseline adjusted means, p=ns
	ARA grip strength – mean pressure in mmHg	34	131.85 (ng)	31	135.43 (ng)	
	ARA walking time – mean time in seconds	34	16.01 (ng)	31	15.50 (ng)	
Meyer	Joint status	74	ng (ng) (stressful)	39	ng (ng)	At 6 months, p=ns
		36	ng (ng) (positive)			
	Walking speed (time)	74	ng (ng) (stressful)	39	ng (ng)	At 6 months, p=ns
		36	ng (ng) (positive)			
	Grip strength	74	29.9 (80.5) (stressful)	39	22.8 (104.8)	At 6 months, change scores 'significant differences'
		36	5.0 (77.9) (positive)			
Rosen-berg	(disease stage)					Not reported
Smyth 1	FEV1, mean	39	76.3 (3.2)	19	65.3 (3.2)	At 16 weeks, SE, both outcomes significant improvement (Wilcoxon)
	Physician's global assessment of RA	31	1.19 (0.09)	17	1.71 (0.17)	
Strough	Range of motion – mean flexion in degrees	15	132.6 (8.18)	15	132.3 (10.51	At 8 weeks step ups – significant improvement, other three measures – p=ns
	Range of motion – mean extension in degrees	15	-2.36 (2.02)	15	-2.4 (2.2)	
	Strength – mean number of step ups	15	79.47 (33.73)	15	58.27 (46.59)	
	Biofeedback – mean muscle strength in microvolts	15	131.67 (35.79)	15	113.67 (40.55)	
RCTs with physically healthy volunteers						
Francis	(Illness related absences)					Not reported

Outcome in brackets means outcome measured but not reported. * n at follow up used where available,, ng = result not given

Table 14. Physical health outcomes – Objectively measured HCV results

Trial first author	N inter-vention group*	Mean (SD) intervention group	N control group*	Mean (SD) control group	Significant result – fewer HCV for intervention group (test used)	Follow up time Comments
RCTs with volunteers with pre-existing physical conditions						
Lumley 1[@]	~25[#]	0.71 (0.85) (trauma)	~25[#]	0.17 (0.90)	Yes (ANOVA)	3 months results from author email
	~25[#]	0.37 (0.85) (guided)				
RCTs with psychological inclusion criteria						
Gidron 2	22	5.1 (3.7)	19	9.7 (5.6)	Yes (ANOVA)	15 months
Greenberg 2	34[#]	0.09 (0.29) (real trauma)	31[#]	0.35 (0.66)	Yes (ANCOVA)	1 month, SE, included free and paid-for clinic visits, extreme outliers reduced
	32[#]	0.12 (0.33) (imaginary trauma)				
Richards	36	1.71 (1.75)	29	2.12 (2.03) (trivial writing)	Yes (ANOVA)	6 weeks, Results average from non-sex and sex offender results
			29	2.61 (2.14) (non-writing)		
Stroebe	14	1.1 (1.4) (emotions)	14	1.2 (1.7)	No (ANOVA)	6 months, nos from author email
	14	1.3 (1.4) (problems)				
	10	1.0 (1.2) (emotions + problems)				
RCTs with physically healthy volunteers						
Greenberg 1	16	0.38 (0.67) (previously undisclosed)	16	0.38 (0.59)	No (ANOVA)	2 months, included free and paid-for clinic visits (some data subjective)
	17	0.38 (0.57) (previously disclosed)				
Hughes	23[#]	0.12 (0.29) (negative emotion)	22[#]	0.11 (0.40)	No (ANOVA)	6 months,
	22[#]	0.11 (0.23) (positive emotion)				
	22[#]	0.06 (0.18) (negative + insight)				
	22[#]	0.14 (0.24) (positive + insight)				

Trial first author	N inter-vention group*	Mean (SD) intervention group	N control group*	Mean (SD) control group	Significant result – fewer HCV for intervention group (test used)	Follow up time Comments
King 1	29	-0.217 (0.55) (trauma only)	15	0.553 (0.51)	Yes (ANOVA)	5 months, mean change in HCV
	17	0.129 (0.71) (trauma + benefits)				
	24	-0.258 (0.73) (benefits only)				
King 2	19	0.05 (0.23) (trauma)	14	0.29 (0.72)	Yes (protected t test)	5 months, controlled for previous HCV
	18	0.00 (0.01) (BPS)				
	19	0.10 (0.22) (trauma + BPS)				
Klapow	22	66.0 (0-312.0)	21	44.5 (0-414.0)	ng	3 months medians and ranges only
Kloss	ng ?43	0.50 (0.88) (trauma)	ng ?43	0.54 (0.58)	No (ANOVA)	2 months ?participant numbers
	ng ?43	0.28 (0.45) (positive)				
Murray 1	9	0.6 (ng) (trauma)	5	0.7 (ng)	No (ANCOVA)	6 months follow up nos calculated from percentages
	10	1.0 (ng) (psychotherapy)				
Pennebaker 1	10	0.54 (ng) (facts+ feelings)	11	1.33 (ng)	No (ANOVA)	6 months
	10	1.45 (ng) (facts only)				
	11	1.58 (ng) (feelings only)				
Pennebaker 2	79	0.9 (ng)	45	1.3 (ng)	Yes (ANOVA)	5 months Variable follow up lengths, HCV estimated from graph
Pennebaker 3	35	0.1 (ng)	37	0.3 (ng)	Yes (t test)	2 months HCV estimated from graph
Pennebaker 4	24	0.08 (0.26)	16	0.27 (0.26)	Yes (ANOVA)	6 weeks HCV estimated from graph, average SD given
*numbers at follow up used where available, #numbers who received allocated intervention – ie follow up numbers not available. ng = result not given. BPS – best possible self						

Table 15. Physical health outcomes – Subjective (self report) HCV results

Trial first author	N inter-vention group*	Mean (SD) intervention group	N control group*	Mean (SD) control group	Significant result – fewer HCV for intervention group (test used)	Follow up time Comments
RCTs with volunteers with pre-existing physical conditions						
Gillis	36	-0.5 (1.8)	31	+0.3 (1.3)	No (?ANOVA)	At 3 months, change scores, p=ns
Rosenberg	16	4.4 (3.12)	14	7.6 (8.33)	No (MANOVA)	At 6 months, p=ns
Stanton (cancer related)	21	0.40 (0.42) (emotions)	18	2.2 (0.45)	Yes (ANOVA)	At 3 months, SE, p=0.0069
	21	0.90 (0.40) (positive)				
Stanton (all other medical)	21	3.45 (0.73) (emotions)	18	4.08 (0.79)	No (ANOVA)	At 3 months, SE, p=0.678
	21	3.57 (0.70) (positive)				
RCTs with psychological inclusion criteria						
Batten	31	0.65 (1.14)	28	0.71 (1.33)	No (CHI^2)	At 12 weeks
Gidron 1	8#	3.1 (2.0)	6#	0.7 (1.6)	Yes but fewer for control group (ANOVA)	At 5 weeks
Kovac 1	20#	0.33 (0.77) (SD may be 0.72)	22#	1.54 (2.88)	No (ANOVA)	At 6 weeks intervention group SD – discrepancy between text and table
Kovac 2	32	0.78 (1.50) (exposure)	31	1.42 (1.77)	No (ANOVA)	At ?6 weeks
	31	1.48 (2.14) (reinterpret)				
Range 1	20	0.45 (1.39)	24	0.67 (1.4) (mean may be 1.54)	No (ANOVA)	At 6 weeks, control group mean – discrepancy between text and table, p=ns
RCTs with physically healthy volunteers						
Cameron	41	0.41 (0.95) (disclosure)	39	0.54 (0.94)	Yes (ANOVA)	At 4 weeks results from author email
	42	0.38 (0.58) (self-regulation)				
Donnelly	34#	0.29 (ng) (trauma)	34#	0.66 (ng)	No (probably ANOVA)	At 3 months
	34#	0.16 (ng) (psychotherapy)				
Greenberg 1	16	ng (ng) (undisclosed)	17	ng (ng)	Not given	At 2 months ? results combined

Trial first author	N inter-vention group*	Mean (SD) intervention group	N control group*	Mean (SD) control group	Significant result – fewer HCV for intervention group (test used)	Follow up time Comments
	17	ng (ng) (disclosed)				with objective HCV
Kloss	ng ?43	0.41 (0.87) (trauma)	ng ?43	1.19 (0.89)	No (ANOVA)	At 9 weeks ?participant numbers
	ng ?43	0.67 (0.93) (positive)				
Marlo	56#	ng (ng) (negative)	50#	ng (ng)	No (probably ANOVA)	At 1 month
	50#	ng (ng) (positive)				
Murray 1	9	0.3 (ng) (trauma)	5	0.8 (ng)	No (ANOVA)	At 6 months follow up nos calculated from percentages
	10	0.6 (ng) (psychotherapy)				
Range 2	24	0.36 (0.79)	25	1.0 (1.17)	Yes (ANOVA)	At 6 weeks
Sheffield	12	ng (ng)	9	ng (ng)	No (ANOVA)	At 30 weeks
			9	ng (ng) (non writing)		
*numbers at follow up used where available, #numbers who received allocated intervention – ie follow up numbers not available. ng = result not given.						

Table 16. Physical health outcomes – Subjective health outcomes – health behaviours

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
RCTs with volunteers with pre-existing physical conditions						
Mann	Compliance	20	4.12 (0.31)	20	4.82 (0.16)	At 4 weeks, SE, p=ns
Rosen-berg	(Health behaviours)					Not reported
	Use of medicines	16	4.94 (2.66)	14	6.05 (4.70)	p=ns (MANOVA)
RCTs with psychological inclusion criteria						
Spera	Alcohol consumption	16	ng (ng)	18	ng (ng)	At 6 weeks less alcohol p=ns (ANOVA)
	Exercise taken	16	ng (ng)	18	ng (ng)	At ?3 months p=ns (ANOVA)
	No pain relievers used	16	ng (ng)	18	ng (ng)	
RCTs with physically healthy volunteers						
Hughes	Health behaviours					Reported (see below)[++]
Penne-baker 1	Health behaviours	10	ng (ng) (facts+ feelings)	11	ng (ng)	At 4 months p=ns (ANOVA)
		10	ng (ng) (facts only)			
		11	ng (ng) (feelings only)			
Penne-baker 2	Health behaviours	ng	ng (ng)	ng	ng (ng)	At 5 months p=ns (ANOVA)
Penne-baker 4	Health behaviours	25[#]	ng	25[#]	ng	At 6 weeks, p=ns
	(daily habits)					Not reported
Petrie	(Health behaviours)					Not reported

* numbers at follow up used where available, ng = result not given, [++] results given separately for cigarettes, caffeine, alcohol, sleep, aerobic activity, aspirin, traffic tickets.

Table 17. Physical health outcomes – Subjective health outcomes – PILL

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
RCTs with psychological inclusion criteria						
Batten	PILL	32	22.19 (10.04)	27	15.11 (7.65)	At 12 weeks STNG
Gidron 1	PILL	8	138.5 (34.7)	6	116.0 (28.9)	At 5 weeks STNG
Richards	PILL	36	17.29 (7.85)	29	11.92 (7.96) (trivial writing)	At 6 weeks More illnesses $p < 0.05$ (ANOVA)
				29	14.77 (7.6) (non-writing)	
Spera	(PILL)					Not reported
RCTs with physically healthy volunteers						
Kloss	PILL	ng ?43	73.86 (21.98) (trauma)	ng ?43	83.86 (25.78)	At 2-3 months p = ns (ANOVA)
		ng ?43	75.0 (19.49) (positive)			
Pennebaker 1	PILL	10	ng (ng) (facts+ feelings)	11	ng (ng)	At 4 months, p=ns
		10	ng (ng) (facts only)			
		11	ng (ng) (feelings only)			
* numbers at follow up used where available, ng = result not given						

Table 18. Physical health outcomes – Subjective health outcomes – SMU – HQ

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
RCTs with psychological inclusion criteria						
Spera	(SMU –HQ)					Not reported
RCTs with physically healthy volunteers						
Greenberg 1	SMU – HQ	16	4.49 (2.83) (previously undisclosed)	16	3.09 (2.43)	At 2 months, p=ns
		17	4.65 (3.19) (previously disclosed)			
* numbers at follow up used where available,						

Table 19. Physical health outcomes – Subjective health outcomes – various results in people with pre-existing physical conditions

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
RCTs with volunteers with pre-existing physical conditions						
D'Souza	Pain intensity (?McGill)	47	ng (ng)	43	ng (ng)	At 3 months, reduced pain intensity, p=0.03
	(Headache frequency)					Not reported
	(Migraine assessment disability scale)					Not reported
	(days using pain medications in previous month)					Not reported
Gillis	FSS	36#	0.0 (0.6)	31#	+0.1 (0.7)	At 3 months, change scores, p=ns
	Sleep quality		ng (ng)		ng (ng)	Improvement p=0.008
	Poor sleep		-0.3 (1.0)		+0.3 (0.9)	?less poor sleep, p=0.01
	Pain		-0.1 (0.6)		+0.1 (0.7)	p=ns
	Treatment medications		+4.8 (11.9)		+2.8 (11.1)	p=ns
	Fibromyalgia impact		-0.6 (1.4)		+0.1 (1.2)	less fibromyalgia impact, p=0.04
Kelley	AIMS-2 physical dysfunction	33	2.46 (ng)	35	2.91 (ng)	At 1-6 months, less dysfunction 'adjusted means' p=0.05
	AIMS-2 pain scales	33	5.1 (ng)	35	5.8 (ng)	At 1-6 months, estimated from graph, 'adjusted means' p=ns
Lumley 1@	'Health,',	?25#	ng (ng) (standard)	?25#	ng (ng)	At 3 months p=ns
		?25#	ng (ng) (guided)			
	Physical symptoms	?25#	ng (ng) (standard)	?25#	ng (ng)	p=0.03 'improvement'
		?25#	ng (ng) (guided)			
	Health interference with daily functioning	?25#	ng (ng) (standard)	?25#	ng (ng)	p=0.006 'improvement'
		?25#	ng (ng) (guided)			
Mann	Treatment side effects	20	37.7 (5.71)	20	35.85 (4.76)	At 4 weeks, SE, ?p=ns
Meyer	Over the counter medications	74	-4.3 (11.5) (stressful)	39	-2.7 (8.8)	At 6 months, change scores, STNG
		36	-1.0 (15.4) (positive)			
	Sensory pain	74	-0.2 (0.7) (stressful)	39	-0.08 (0.61)	At 6 months, change scores, STNG
		36	+0.15 (0.77) (positive)			

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
Meyer (cont)	Affective pain	74	-0.11 (0.67) (stressful)	39	+0.05 (0.68)	At 6 months, change scores, STNG
		36	+0.21 (0.83) (positive)			
	Fatigue	74	ng (ng) (stressful)	39	ng (ng)	At 6 months, p=ns
		36	ng (ng) (positive)			
	Physical functioning	74	ng (ng) (stressful)	39	ng (ng)	At 6 months, p=ns
		36	ng (ng) (positive)			
Moor	(Brief symptom inventory)					Not reported
Rosen-berg	Pain	16	3.19 (3.95)	14	9.43 (8.08)	At 6 months less pain, p=0.03
	(physical symptoms)					Not reported
Stanton	Perceived somatic symptoms	21	16.99 (3.24) (emotion)	18	30.16 (3.47)	At 3 months, SE, fewer symptoms p<0.0183
		21	22.3 (3.04) (positive)			
Strough	Subjective knee rating	?15[#]	79.0 (11.82)	?15[#]	69.64 (20.6)	At 8 weeks p=ns (?ANOVA)
Walker	(Side effect severity)					Not reported

* numbers at follow up used where available, ng = result not given

Table 20. Physical health outcomes – Subjective health outcomes – various results in physically healthy volunteers

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
RCTs with psychological inclusion criteria						
Greenberg 2	Physical symptom scales	34[#]	See footnote (real trauma)	31[#]	See footnote	At 4 weeks
		32[#]	See footnote (imaginary trauma)			
	Activity restricted from illness	34[#]	0.51 (0.16) (real trauma)	31[#]	0.60 (0.17)	At 4 weeks (SE) p=ns (MANCOVA)
		32[#]	0.42 (0.16) (imaginary trauma)			
Lepore 2	Upper respiratory symptoms	ng ?69	1.6 (0.2)	ng ?69	1.6 (0.2)	SE, at 15 wks, estimated from graph, p=ns
O'Neill/ Smyth	Physical symptoms index	19	21.9 (4.3)	23	21.3 (6.2)	At 2-3 months p=ns
Spera	Difficulty falling asleep	16	ng (ng)	18	ng (ng)	At ?3 months p=ns (ANOVA)
	Health self report	16	ng (ng)	18	ng (ng)	
RCTs with physically healthy volunteers						
Donnelly	No. days ill	34[#]	4.67 (ng) (written)	34[#]	3.86 (ng)	At 3 months p=ns (?MANOVA)
		34[#]	4.94 (ng) (psychotherapy)			
	(Whether felt physically ill)					Not reported
Greenberg 1	(Pennebaker's physical symptom scale)					Not reported
Hughes	Change in restricted days	19	1.06 (ng) (negative emotion)	14	-0.46 (ng)	At 5 months STNG
		15	1.0 (ng) (positive emotion)			
		13	0.54 (ng) (negative + insight)			
		12	0.26 (ng) (positive + insight)			
	(no days restricted from illness)					Not reported
Klapow	Somatic symptom scores	22	4.17 (0-18.2)	21	5.21 (1.0-19.5)	At 3 months (median and range) STNG
Kloss	No illness	ng ?43	1.88 (2.84) (trauma)	ng ?43	2.02 (1.52)	At 2-3 months STNG
		ng ?43	1.47 (1.6) (positive)			
	no sick days	ng ?43	ng (ng) (trauma)	ng ?43	ng (ng)	At 2-3 months,

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
		ng ?43	ng (ng) (positive)			p=ns
Kloss (cont)	illness reports	ng ?43	ng (ng) (trauma)	ng ?43	ng (ng)	At 2-3 months, p=ns
		ng ?43	ng (ng) (positive)			
Murray 1	'health measures' (PBHQ)	9	ng (ng) (trauma)	5	ng (ng)	At 6 months p=ns
		10	ng (ng) (psychotherapy)			
	no days restricted from illness	9	1.5 (ng) (trauma)	5	7.0	At 6 months p=ns
		10	3.9 (ng) (psychotherapy)			
Murray 2	'physical health'	30[#]	ng (ng) (written)	30[#]	ng (ng) (written)	At 3 months p=ns
		30[#]	ng (ng) (vocal)	30[#]	ng (ng) (vocal)	
	(change in health state)					Not reported
Pennebaker 1	Number of illnesses	10	-0.6 (ng) (facts+ feelings)	11	0.18 (ng)	At 4 months change scores, fewer illnesses p=0.04 (ANOVA)
		10	4.65(ng) (facts only)			
		11	-0.73 (ng) (feelings only)			
	Restricted activity from illness	10	0.7 (ng) (facts+ feelings)	11	4.0 (ng)	At 4 months, change scores, p=ns (ANOVA)
		10	1.9 (ng) (facts only)			
		11	1.18 (ng) (feelings only)			
Reynolds	Children's Somatisation Inventory	63	14.58 (ng)	64	22.17 (ng) (written)	At 2 months fewer symptoms p<0.001 (ANOVA)
				64	14.37 (ng) (non-written)	
Sheffield	Physical symptoms	19	5.15 (0.45)	11	3.22 (0.76) (written)	At 3 weeks, ?SE, ?more symptoms p=0.02 (ANCOVA)
				16	3.99 (0.44) (non-written)	
	Days off due to illness	19	1.58 (0.46)	11	0.33 (0.24) (written)	At 3 weeks, ?SE, more days off, p=0.02 (ANCOVA)
				16	0.36 (0.17) (non-written)	
Smyth 2	Symptom report	ng	ng (ng) (narrative)	ng	ng (ng)	At 5 weeks p=ns
		ng	ng (ng) (fragmented)			

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
Smyth 2 (cont)	Activity restriction	ng	0.7 (ng) (narrative)	ng	1.7 (ng)	At 5 weeks, estimated from graph, less restriction, p<0.01 (ANOVA)
		ng	1.3 (ng) (fragmented)			
Ullrich	Symptom severity	41	5 (ng) (emotions)	34	2.5	After 1 month Estimated from graph, more severe, p<0.05
		47	3 (ng) (cognition +e)			
	Illness episodes	41	ng (ng)	34	ng (ng)	After 1 month, p=ns
		47	ng (ng)			
* numbers at follow up used where available, # number randomised or received allocated intervention, ng = result not given						
Greenberg 2 – Results given separately for upper respiratory, musculoskeletal and miscellaneous symptoms for the 4 weeks of follow up separately with significance tests given separately for each group. Also for activity restriction						

Appendix 12. Performance results

Table 21. Performance outcomes – Various results

First author	What outcomes measured	N intervention group*	Results intervention group	N control group *	Results control group	Comments
RCTs with volunteers with pre-existing physical conditions						
Lumley 2	Credit hours attempted	34	13.54 (ng)	34	10.46 (ng)	At next semester, p=ns
	Credit hours earned	34	11.57 (ng)	34	10.46 (ng)	At next semester, p=ns
	GPA	34	2.72 (1.02)	34	2.34 (1.04)	At next semester, improvement in performance, p=0.01
RCTs with psychological inclusion criteria						
Spera	Employment	19	10	21	5	At 8 months more employed p=0.04 (t test)
	Interview log	?16	ng (ng)	?18	ng (ng)	At ?15 weeks p=ns
	No phone calls received	?16	ng (ng)	?18	ng (ng)	At ?15 weeks p=ns
	No letters generated	?16	ng (ng)	?18	ng (ng)	At ?15 weeks p=ns
	(TSBQ)					Not reported
RCTs with physically healthy volunteers						
Cameron	GPA	41	2.99 (0.53) (disclosure)	39	2.68 (0.60)	At end of semester higher scores p<0.05 (between trauma and control)
		42	2.54 (0.65) (self regulation)			
Francis	Days absent	23	0.36 (ng)	17	0.55 (ng)	At 3 months p=ns
Klapow	Total charges paid (US$)	22	3735 (0-19,527)	21	1613 (0-54,371)	At 3 months, medians and ranges, STNG
Klein 1	Working memory	36	62.7 (8.8)	35	61.2 (7.6)	At 6 weeks p=ns
	GPA	27	ng (ng)	25	ng (ng)	At ?10-20 weeks p=ns
Klein 2	Working memory	34#	47.6 (8.3) (negative)	34#	44.2 (8.2)	At 6 weeks p=ns
		33#	44.0 (6.3) (positive)			
	GPA	34#	ng (ng) (negative)	34#	ng (ng)	?At end of semester, STNG
		33#	ng (ng) (positive)			
Penne-baker 2	GPA	79	2.79 (ng)	45	2.64 (ng)	At end of 2nd semester, adjusted means p=ns
	(SAT)					Not reported
Penne-baker 3	GPA	30	3.1 (ng)	31	2.9 (ng)	At end of semester, estimated from graph, p=ns
	Thought generation	30	ng (ng)	31	ng (ng)	At 1 month p=ns
	(SAT)					Not reported

First author	What outcomes measured	N intervention group*	Results intervention group	N control group *	Results control group	Comments
	(adjustment to college)					Not reported
Reynolds	School absences,	63	6.24 (ng)	64	5.30 (ng) (written)	At 2 months p=ns (chi^2)
				64	4.78 (ng) (non-written)	
* numbers at follow up used where available, ng = result not given						

Appendix 13. Psychological results

Table 22. Psychological outcomes – Mood, affect results

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
RCTs with volunteers with pre-existing physical conditions						
Gillis	PANAS-X	ng	ng (ng)	ng	ng (ng)	p=ns
	-ve mood	36#	+0.1 (0.7)	31#	-0.1 (0.6)	At 3 months, change scores, p=ns
Kelley	AIMS-2 affective disturbance	33	3.25 (ng)	35	3.95 (ng)	At 1-6 months better disease state 'adjusted means' p=0.006
Moor	POMS total mood	18	15.7 (4.7)	16	19.8 (5.2)	Adjusted means at max 10 weeks, SE, p=ns
Rosenberg	(POMS)					Not reported
Stanton	POMS	21	ng (ng) (emotions)	18	ng (ng)	At 3 months p=ns
		21	ng (ng) (positive)			
Strough	POMS	?15#	35.62 (8.27)	?15#	41.0 (20.88)	At 8 weeks ?p=ns
Walker	PANAS +ve	14	36.4 (1.6) (3 dose)	14	34.8 (1.8)	At 28 weeks p=ns
		11	39.1 (1.9) (1 dose)			
	PANAS –ve	14	17.1 (1.6) (3 dose)	14	14.1 (1.7)	p=ns
		11	17.1 (1.8) (1 dose)			
RCTs with psychological inclusion criteria						
Batten	PANAS –ve	31	26.22 (10.94)	28	21.3 (9.39)	At 12 weeks STNG
Gidron 1	PANAS +ve	8#	31.4 (8.6)	6#	24.7 (8.8)	At 5 weeks p=ns
	PANAS –ve		32.7 (8.4)		32.0 (9.4)	p=ns
Greenberg 2	NHRC Mood	34#	ng (ng) (real trauma)	29#	ng (ng)	At 4 weeks (see note below)
		32#	ng (ng) (imaginary trauma)			
Lepore 2	POMS-SF	ng ?69	ng (ng)	ng ?69	ng (ng)	At 15 weeks, p=ns
O'Neill/ Smyth	NAS –ve mood	19	15.9 (5.8)	23	17.4 (5.1)	At 2-3 months p=ns
Range 1	MAACL-R hostility	20	0.60 (1.14)	24	0.90 (2.10)	At 6 weeks p=ns
	MAACL-R +ve affect	20	10.6 (6.57)	24	9.95 (6.74)	
	MAACL-R sensation	20	5.55 (2.61)	24	6.14 (3.66)	

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
Schoutrop 1	MMI	26	ng (ng)	22	ng (ng)	At 6 weeks p=ns
Schoutrop 2[@]	(MMI)					Not reported
RCTs with physically healthy volunteers						
Cameron	Negative mood	41	9.49 (4.90) (disclosure)	39	9.28 (4.45)	At 4 weeks p<0.05
		42	7.89 (3.84) (self-regulation)			
Francis	PANAS +ve and –ve	20	ng (ng)	16	ng (ng)	At 6 weeks p=ns
Greenberg 1	PANAS+ve	16	32.94 (6.27) (undisclosed)	17	28.35 (7.45)	At 2 months p=ns
		17	29.62 (7.06) (disclosed)			
	PANAS –ve	16	22.81 (7.6) (undisclosed)	17	19.32 (7.01)	At 2 months p=ns
		17	19.88 (9.55) (disclosed)			
Pennebaker 2	CAT +ve affect	35[#]	28.3 (ng)	37[#]	28.6 (ng)	At 4 months, p=ns
	CAT -ve affect	35[#]	18.3 (ng)	37[#]	19.2 (ng)	At 4 months, p=ns
Pennebaker 4	Happiness	25[#]	ng (ng)	25[#]	ng (ng)	At 3 months, happier, p<0.05
Petrie	Sadness	14	ng (ng)	17	ng (ng)	At 8 weeks, p=ns
		18	ng (ng) (with suppression)	16	ng (ng) (with suppression)	
	(Affect)					Not reported
Range 2	(MAACL-R)					Not reported
Sheffield	+ve affect	12	11.14 (0.9)	9	10.27 (0.85) (written)	At 30 weeks (?SE) p=ns
				9	8.8 (1.07) (non written)	
* numbers at follow up used where available, ng = result not given						
Greenberg 2 – results given separately for fearful, angry, depressed, happy, active and fatigued mood. Adjusted follow up results p=ns except fearful mood where real trauma group significantly worse than imaginary trauma worse than control.						

Table 23. Psychological outcomes – Anxiety results

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
RCTs with volunteers with pre-existing physical conditions						
Moor	Anxiety (POMS)	18	6.9 (0.8)	16	7.0 (0.9)	Adjusted means at max 10 weeks, SE, p=ns
RCTs with psychological inclusion criteria						
Range 1	MAACL–R anxiety	20	1.0 (1.56)	24	0.81 (1.29)	At 6 weeks more anxiety p=0.009
Richards	CSAQ total	36	22.62 (11.35)	29	21.45 (11.51) (trivial writing)	At 6 weeks p=ns
				29	15.69 (10.99) (non-writing)	
	CSAQ cognitive	36	11.93 (6.94)	29	10.98 (7.04) (trivial writing)	p=ns
				29	9.15 (6.72) (non-writing)	
	CSAQ somatic	36	9.99 (5.38)	29	8.84 (5.46) (trivial writing)	p=ns
				29	6.73 (5.21) (non-writing)	
Schoutrop 1	Anxiety	26[#]	13.5 (4.0)	22[#]	16.2 (6.6)	At 6 weeks, more improved in intervention group p<0.05 (t test)
RCTs with physically healthy volunteers						
Kloss	Trait anxiety	ng ?43	39.4 (11.47) (trauma)	ng ?43	40.63 (11.75)	At 2-3 months p=ns (ANOVA)
		ng ?43	38.26 (11.74) (positive)			
Pennebaker 1	CSAQ	10	ng (ng) (facts+feelings)	11	ng (ng)	At 4 months p=ns
		10	ng (ng) (facts only)			
		11	ng (ng) (feelings only)			
Reynolds	SCAS – total anxiety	63	21.76 (ng)	64	25.77 (ng) (written)	At 2 months ?p=ns
				64	22.69 (ng) (nonwritten)	
	Positive items	63	11.73 (ng)	64	11.58 (ng) (written)	At 2 months less anxiety p<0.05 (ANCOVA)
				64	11.82 (ng) (nonwritten)	
Sheffield	Anxiety/ insomnia – GHQ	12	2.88 (0.7)	9	6.94 (1.21) (written)	At 30 weeks less anxiety (?SE) p=0.02
				9	7.3 (1.26) (non written)	
* numbers at follow up used where available, ng = result not given						

Table 24. Psychological outcomes – Depression, emotional distress results

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
RCTs with volunteers with pre-existing physical conditions						
Meyer	Emotional functioning	74	ng (ng) (stressful)	39	ng (ng)	At 6 months, p=ns
		36	ng (ng) (positive)			
Moor	CES-D >16	18	7% (ng)	16#	25% (ng)	At 4 weeks
	Depression (POMS)	18	7.4 (1.1)	16#	6.6 (1.2)	Adjusted mean at max 10 weeks, SE, p=ns
Stanton	Distress/ vigour	21#	ng (ng) (emotions)	18#	ng (ng)	At 3 months p=ns
		21#	ng (ng) (positive)			
RCTs with psychological inclusion criteria						
Batten	BDI	32	15.38 (11.30)	27	10.48 (11.43)	At 12 weeks STNG
Gidron 1	BDI	8#	39.1 (9.1)	6#	45.2 (13.0)	At 5 weeks p=ns
Greenberg 2	Depressed mood	34#	15.63 (0.86) (real trauma)	31#	9.39 (0.39)	At 4 weeks, SE, more depression, p<0.001 (ANCOVA)
		32#	11.83 (0.88) (imaginary trauma)			
Kovac 1	(Counselling or therapy sought)					Not reported
Kovac 2	SDS	25	41.48 (6.71) (exposure)	24	41.33 (9.09)	At 6 weeks ?p=ns
		25	41.16 (10.95) (reinterpret)			
	SIQ	25	30.84 (21.16) (exposure)	24	23.68 (14.79)	At 6 weeks ?p=ns
		25	28.16 (21.17) (reinterpret)			
	SSF	25	ng (ng) (exposure)	24	ng (ng)	Results given separately for the six subscales
		25	ng (ng) (reinterpret)			
Lepore 1	Depressive symptoms – SCL-90-R	?37	0.75 (0.2)	?37	0.75 (0.2)	At 17 days, estimated from graph, SE, p=ns
Range 1	MAACL-R depression	20	0.45 (0.94)	24	0.52 (0.81)	At 6 weeks less depression p=0.016
	SDS	20	0.47 (0.09)	24	0.43 (0.11)	More depression p=0.001
Schoutrop 1	Depression	26#	24.5 (8.2)	22#	28.9 (9.7)	At 6 weeks more improved in intervention group p<0.05 (t test)
Schoutrop 2@	(depression)					Not reported

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
RCTs with physically healthy volunteers						
Donnelly	'Emotional health'	34#	ng (ng) (trauma)	34#	ng (ng)	At 3 months p=ns
		34#	ng (ng) (psycho-therapy)			
	(consulted a mental health professional)					Not reported
	(felt down or emotionally distressed)					Not reported
Klapow	Distress symptoms	22	4.0 (0-32.0)	21	8.0 (0-27.0)	At 3 months (medians and ranges)
Kloss	BDI	ng ?43	6.11 (7.27) (trauma)	ng ?43	5.55 (4.38)	At 2-3 months STNG
		ng ?43	5.56 (5.84) (positive)			
Marlo	(No times consulted a mental health professional)					Not reported
Murray 2	Psychological health	30#	ng (ng) (written)	30#	ng (ng) (written)	At 3 months p=ns
		30#	ng (ng) (vocal)	30#	ng (ng) (vocal)	
	(change in psychological health state)					Not reported
Pennebaker 4	Depression	25#	2.7 (ng)	25#	2.67 (ng)	At 3 months p=ns
	(Subjective distress)					Not reported
Petrie	Depression	14	ng (ng)	17	ng (ng)	At 8 weeks, p=ns
		18	ng (ng) (with suppression)	16	ng (ng) (with suppression)	
Range 2	SIQ	24	12.86 (17.16)	25	10.48 (12.83)	At 6 weeks p=ns
	SIS	24	12.23 (3.7)	25	11.26 (3.73)	p=ns
Reynolds	Birleston depression inventory,	63	9.55 (ng)	64	10.09 (ng)	At 2 months ?p=ns
				64	9.53 (ng)	
* numbers at follow up used where available, ng = result not given						

Table 25. Psychological outcomes – IES results

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
RCTs with volunteers with pre-existing physical conditions						
Moor	IES total	18	17.4 (1.7)	16	14.6 (1.8)	Adjusted means at max 10 weeks, SE, p=ns
	IES avoidance	18	10.5 (1.0)	16	9.1 (1.0)	
	IES intrusive thoughts	18	6.9 (2.2)	16	5.5 (2.2)	
Stanton	IES avoidance	21	ng (ng) (emotions)	18	ng (ng)	At 3 months p=ns
		21	ng (ng) (positive)			
Walker	IES avoidance	14	9.5 (2.4) (3 dose)	14	9.3 (2.5)	At 28 weeks p=ns
		11	10.7 (2.8) (1 dose)			
	IES intrusion	14	8.5 (1.9) (3 dose)	14	6.0 (2.0)	p=ns
		11	10.5 (2.3) (1 dose)			
RCTs with psychological inclusion criteria						
Barry[@]	IES-R	ng	ng (ng)	ng	ng (ng)	At ? weeks, significant difference p=0.023 ?which way
Gidron 1	IES-avoidance	8	17.6 (10.1)	6	14.2 (12.5)	At 5 weeks STNG
	IES-intrusion		23.2 (9.2)		13.2 (10.8)	
	IES total		40.9 (16.1)		27.3 (21.6)	
Greenberg 2	IES-avoidance	34[#]	14.83 (1.19) (real trauma)	28[#]	10.28 (1.31)	At 4 weeks Adjusted means, SE, more avoidance p<0.5, intrusion p=ns (ANCOVA)
		31[#]	11.06 (1.24) (imaginary trauma)			
	IES-intrusion	34[#]	9.42 (1.08) (real trauma)	28[#]	8.18 (1.18)	
		31[#]	7.12 (1.12) (imaginary trauma)			
Kovac 1	IES total	19[#]	19.87 (19.66)	21[#]	20.93 (15.45)	At 6 weeks p=ns
	IES avoidance	19[#]	10.6 (12.93)	21[#]	10.73 (9.29)	STNG
	IES intrusion	19[#]	9.27 (7.84)	21[#]	10.20 (8.55)	STNG
Lepore 1	IES intrusive thoughts	ng	ng (ng)	ng	ng (ng)	At 17 days p=ns
Lepore 2	(IES)					Not reported

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
O'Neill/ Smyth	IES – R avoidance	19	11.2 (9.4)	23	12.4 (9.9)	At 2-3 months p=ns
	IES – R intrusion		8.0 (6.1)		10.6 (7.0)	
	IES – R hyperarousal		5.4 (5.1)		7.0 (6.2)	
Range 1	IES total	20	18.25 (17.36)	24	17.43 (17.72)	At 6 weeks more affected by event p=0.001
	IES avoidance	20	8.50 (9.27)	24	8.09 (8.83)	More avoidance p=0.001
	IES intrusion	20	9.75 (9.18)	24	9.35 (9.67)	More intrusion p=0.001
Schoutrop 1	IES avoidance	26#	13.2 (5.1)	22#	15.4 (5.1)	At 6 weeks less in intervention group p<0.05
	IES intrusion	26#	11.7 (3.6)	22#	16.1 (3.8)	p<0.01 (ANOVA)
Schoutrop 2@	IES avoidance, intrusion, and re-experiencing	ng	ng (ng)	ng	ng (ng)	At 6 weeks, avoidance and re-experiencing p<0.01, Significant decrease in all 3 groups compared to control
		ng	ng (ng)			
		ng	ng (ng)			
Stroebe	IES avoidance	21	12.8 (3.7) (emotions)	27	15.1 (4.7)	At 6 months p=ns
		24	13.2 (3.1) (problems)			
		15	12.6 (3.6) (both)			
	IES intrusion	21	19.7 (4.5) (emotions)	27	20.0 (5.0)	At 6 months p=ns
		24	19.5 (4.6) (problems)			
		15	19.5 (4.5) (both)			
RCTs with physically healthy volunteers						
Klein 2	IES	34#	ng (ng) (negative)	34#	ng (ng)	At 7 weeks ?p=ns
		33#	ng (ng) (positive)			
Smyth 2	Avoidant thoughts	ng	2.6 (ng) (narrative)	ng	1.9 (ng)	At 5 weeks, estimated from graph, p=ns
		ng	2.3 (ng) (fragmented)			
	Intrusive thoughts	ng	ng (ng) (narrative)	ng	ng (ng)	At 5 weeks, p=ns
		ng	ng (ng) (fragmented)			
* numbers at follow up used where available, ng = result not given						

Table 26. Psychological outcomes – CAT results

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
RCTs with physically healthy volunteers						
Cameron	CAT	41	29.8 (6.42) (disclosure)	39	29.51 (6.75)	At 4 weeks better adjustment in self-regulation group p<0.01
		42	30.17 (5.84) (self regulation)			
Hughes	CAT	19	3.11 (ng) (negative emotion)	14	0.93 (ng)	At 6 months ?p=ns
		15	3.38 (ng) (positive emotion)			
		13	1.57 (ng) (negative + insight)			
		12	3.82 (ng) (positive + insight)			
Klein 1	CAT	?36	ng (ng)	?35	ng (ng)	At 6 weeks p=ns
Pennebaker 2	CAT adjustment	35[#]	83.9 (ng)	37[#]	82.9 (ng)	At 4 months p=ns
	Homesickness	35[#]	20.8 (ng)	37[#]	22.1 (ng)	
* numbers at follow up used where available, ng = result not given						

Table 27. Psychological outcomes – SCL-90 and SCL-90-R results

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
RCTs with volunteers with pre-existing physical conditions						
D'Sousa	(SCL-90-R somatisation)					Not reported
Rosen-berg	(SCL-90-R)					Not reported
RCTs with psychological inclusion criteria						
Barry[@]	SCL-90-R	ng	ng (ng)	ng	ng (ng)	At ?weeks significant difference p=0.002 ?which way
Batten	SCL-90-R	32	1.16 (0.81)	27	0.82 (0.65)	At 12 weeks STNG
Gidron 2	Somatisation – Hopkins SCL	22	2.4 (3.6)	19	4.7 (2.6)	At 3 months less somatisation, p<0.05
Green-berg 2	SCL-90	34[#]	77.44 (6.34) (real trauma)	31[#]	69.51 (6.82)	At 4 weeks, adjusted means, SE, p=ns (ANCOVA)
		32[#]	75.2 (6.55) (imaginary trauma)			
Schou-trop 1	SCL-90-R total	26[#]	ng (ng)	22[#]	ng (ng)	At 6 weeks more improvement, p<0.05
	Somatisation		17.4 (5.4)		19.5 (7.8)	STNG
	Insufficiency of thought and action		13.7 (5.1)		15.4 (4.5)	
	Hostility		7.6 (2.0)		8.7 (3.4)	
	Sleeping problems		5.0 (2.1)		5.6 (2.7)	
Schoutrop 2[@]	(SCL-90-R)					Not reported
* numbers at follow up used where available, ng = result not given						

Table 28. Psychological outcomes – Various results in people with pre-existing physical conditions

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
RCTs with volunteers with pre-existing physical conditions						
Gillis	Low support	36[#]	-0.2 (0.7)	31[#]	-0.3 (1.0)	At 3 months, change scores, p=ns
Mann	LOT	20	28.13 (0.90)	20	27.23 (1.10)	At 4 weeks, SE, ?p=ns
Moor	PSQI	18	6.8 (0.6)	16	8.7 (0.7)	Adjusted means at max ten weeks, SE, less sleep disturbance p<0.05
	PSS	18	19.8 (0.9)	16	20.5 (0.9)	Adjusted means at max ten weeks, SE, p=ns
Rosenberg	Psychological symptoms	16	ng (ng)	14	ng (ng)	At 6 months p=ns
	(FACT)					Not reported
	(SF-36)					Not reported
Stanton	COPE	21	ng (ng) (emotions)	18	ng (ng)	At 3 months p=ns
		21	ng (ng) (positive)			
	FACT	21	ng (ng) (emotions)	18	ng (ng)	At 3 months p=ns
		21	ng (ng) (positive)			
Strough	Rumination	?15[#]	19.85 (7.72)	?15[#]	24.71 (8.41)	At 8 weeks ?p=ns
	Barriers efficacy	?15[#]	51.68 (31.11)	?15[#]	44.41 (33.88)	At 8 weeks ?p=ns
	Rehabilitation efficacy	?15[#]	92.31 (13.21)	?15[#]	70.39 (29.47)	At 8 weeks p=0.01 better efficacy (ANOVA)
* numbers at follow up used where available, ng = result not given						

Table 29. Psychological outcomes – Various results in physically healthy volunteers

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
RCTs with psychological inclusion criteria						
Kovac 1	GEQ	19[#]	90.29 (25.56)	21[#]	106.14 (27.54)	At 6 weeks less grief p=0.008 (ANOVA)
	GRQ	19[#]	29.0 (14.92)	21[#]	38.0 (14.73)	At 6 weeks, more grief recovery p=0.046 (ANOVA)
Kovac 2	ATQ-R	25	92.96 (18.35) (exposure)	24	101.04 (27.47)	At 6 weeks ?p=ns
		25	93.6 (22.82) (reinterpret)			
	BRFL	25	32.64 (10.55) (exposure)	24	39.87 (10.33)	At 6 weeks ?p=ns
		25	37.76 (10.47) (reinterpret)			
Lepore 2	Reunited with partner	?69	6	?69	1	At 15 weeks, p=ns
	New relationship	?69	ng	?69	ng	At 15 weeks, p=ns
Range 1	GRQ,	20	33.50 (17.22)	24	27.78 (14.10)	At 6 weeks less grief recovery p=0.02
	(GEQ)					Not reported
Sloan[@]	(overall level of improvement in ?PTSD)					Not reported
Stroebe	GHQ	21	8.9 (7.1) (emotions)	27	8.5 (8.1)	At 6 months p=ns
		24	7.2 (6.6) (positive)			
		15	7.7 (7.4) (both)			
RCTs with physically healthy volunteers						
Hughes	(CABQ)					Not reported
King 2	LOT and SWLS combined	22[#]	ng (ng)	16[#]	ng (ng)	At 3 weeks better psychological wellbeing p<0.05
		19[#]	ng (ng)			
		22[#]	ng (ng)			
Klapow	Patient satisfaction	22	30.18 (5.7)	21	31.75 (5.0)	At 3 months STNG
Klein 1	(perceived stress)					Not reported
Murray 2	Psychological health	30[#]	ng (ng) (written)	30[#]	ng (ng) (written)	At 3 months, p=ns
		30[#]	ng (ng) (vocal)	30[#]	ng (ng) (vocal)	

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
Pennebaker 1	Marlowe-Crowne SDS	10	ng (ng) (facts+ feelings)	11	ng (ng)	At 4 months p=ns
		10	ng (ng) (facts only)			
		11	ng (ng) (feelings only)			
Range 2	RFL	24	4.39 (0.58)	25	4.58 (0.66)	At 6 weeks p=ns
Reynolds	SDQ total minus prosocial	63	9.43 (ng)	64	11.73 (ng)	At 2 months ?p=ns
				64	9.27 (ng)	
	Prosocial	63	6.58 (ng)	64	7.03 (ng)	At 2 months ?p=ns
				64	6.61 (ng)	
	(LEQ)					Not reported
Sheffield	GHQ	12	ng (ng)	9	ng (ng) (written)	At 30 weeks p=ns
				9	ng (ng) (non writing)	
Ullrich	PTGI	41	65.5 (ng) (emotions)	34	71.5 (ng)	After 1 month, Estimated from graph, group x time interaction, $p<0.05$
		47	76.0 (ng) (cognition +emotions)			
* numbers at follow up used where available, ng = result not given						

Appendix 14. Physiological and haematological/immunological results

Section 1. Immediate results

Table 30. Immediate – Blood pressure results

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
RCTs with psychological inclusion criteria						
Klein 3[@]	BP	ng	ng (ng)	ng	ng (ng)	'Elevated during the disclosure period relative to baseline across trauma disclosure conditions'
Schoutrop 2[@]	Diastolic BP	ng	ng (ng)	ng	ng (ng)	Within session decrease, $p<0.05$
		ng	ng (ng)			
		ng	ng (ng)			
	(BP)					Not reported
Spera	(BP)					Not reported
RCTs with physically healthy volunteers						
Murray 1	BP	18	ng (ng) (trauma)	17	ng (ng)	p=ns
		21	ng (ng) (psychotherapy)			
Pennebaker 1	BP	11	ng (ng) (fact+ feelings)	12	ng (ng)	p=ns
		12	ng (ng) (fact only)			
		11	ng (ng) (feelings only)			
Pennebaker 4	BP	25[#]	ng (ng)	25[#]	ng (ng)	p=ns
* numbers at follow up used where available, # number randomised or received allocated intervention, ng = result not given						

Table 31. Immediate – Heart rate results

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
RCTs with volunteers with pre-existing physical conditions						
Stanton	(heart rate)					Not reported
RCTs with psychological inclusion criteria						
Klein 3[@]	Heart rate	ng	ng (ng)	ng	ng (ng)	'Elevated during the disclosure period relative to baseline across trauma disclosure conditions'
Spera	(heart rate)					Not reported
RCTs with physically healthy volunteers						
Murray 1	Heart rate	18	ng (ng) (trauma)	17	ng (ng)	'Uninterpretable'
		21	ng (ng) (psychotherapy)			
Pennebaker 1	Heart rate	11	ng (ng) (fact+ feelings)	12	ng (ng)	p=ns
		12	ng (ng) (fact only)			
		11	ng (ng) (feelings only)			
Pennebaker 4	Heart rate	25[#]	ng (ng)	25[#]	ng (ng)	p=ns
* numbers at follow up used where available, # number randomised or received allocated intervention, ng = result not given						

Table 32. Immediate – Skin conductance results

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
RCTs with volunteers with pre-existing physical conditions						
Stanton	(Skin conductance)					Not reported
RCTs with psychological inclusion criteria						
Schoutrop 2[@]	Skin conductance	ng	ng (ng)	ng	ng (ng)	Larger across session decrease p<0.05
		ng	ng (ng)			
		ng	ng (ng)			
RCTs with physically healthy volunteers						
Booth 1	Skin conductance	20[#]	25 to 17 (ng)	20[#]	22 to 24 (ng)	Estimated from graph of results over 4 days of writing, decrease in intervention group p<0.05 (ANOVA)
Pennebaker 4	Skin conductance	25[#]	ng (ng)	25[#]	ng (ng)	p=ns
* numbers at follow up used where available, # number randomised or received allocated intervention, ng = result not given						

Table 33. Crossover trial physiological results

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
Czajka	BP – diastolic	16	2.16 (ng) (negative)	16	-0.21 (ng) (shoes)	Immediate change from baseline, higher SBP, DBP, p<0.001
			2.89 (ng) (positive)		0.79 (ng) (chair)	
	BP – systolic	16	-0.96 (ng) (negative)	16	-3.47 (ng) (shoes)	
			-0.04(ng) (positive)		-1.84 (ng) (chair)	
Pennebaker 5	BP – diastolic	24	82 (ng)	24	78 (ng)	Immediate, estimated from graph p<0.01 (ANOVA)
	BP – systolic	24	120 (ng)	24	115 (ng)	
Czajka	HR	16	3.56 (ng) (negative)	16	3.25 (ng) (shoes)	Immediate change from baseline, higher, p<0.008
			3.72 (ng) (positive)		3.45 (ng) (chair)	
Pennebaker 5	HR	24	ng (ng)	24	ng (ng)	Immediate, p=ns
Czajka	Skin conductance	16	-0.52 (ng) (negative)	16	-1.13 (ng) (shoes)	Immediate change from baseline, higher, p<0.008
			-0.99(ng) (positive)		-1.36 (ng) (chair)	
Pennebaker 5	Skin conductance	24	1.0 (ng)	24	0.5 (ng)	Immediate change scores, estimated from graph, p=ns
* numbers at follow up used where available, # number randomised or received allocated intervention, ng = result not given						

Table 34. Immediate – Haematological / immunological results

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
RCTs with psychological inclusion criteria						
Sloan[@]	Salivary cortisol	ng	ng (ng)	ng	ng (ng)	'Only participants in the emotional disclosure condition had cortisol reactivity'
RCTs with physically healthy volunteers						
Booth 1	CD4	20[#]	0.85 (0.05)	20[#]	1.12 (0.10)	On day after writing, SE, CD4 p<0.05, basophils p<0.01
	CD8		0.55 (0.07)		0.63 (0.06)	
	CD56		0.35 (0.07)		0.31 (0.03)	
	NK		185.4 (18.4)		198.6 (21.4)	
	Basophil		0.061 (0.007)		0.081 (0.005)	
Booth 2	CD4	19[#]	0.85 (0.05)	19[#]	1.0 (0.1)	On day after writing, estimated from graph, SE, significantly fewer lymphocytes
	CD8		0.5 (0.05)		0.55 (0.05)	
	total lymphocytes		2.2 (0.1)		2.2 (0.1)	
Dickerson [@]	B2M	31[#]	ng (ng)	18[#]	ng (ng)	p=ns
	cortisol		ng (ng)		ng (ng)	p=ns
	sTNF-R11		ng (ng)		ng (ng)	Increase, p<0.05
Pennebaker 4	Lymphocyte reaction (to Concavalin A)	25[#]	ng (ng)	25[#]	ng (ng)	After writing, p=ns
	to 5µg PHA stimulation	25[#]	4.96 (ng)	25[#]	4.82 (ng)	After writing, STNG
	10µg PHA stimulation		5.0 (ng)		4.88 (ng)	
	20µg PHA stimulation		4.94 (ng)		4.81 (ng)	
Petrie	Total lymphocytes	14[#]	2.4 (0.3) (without suppression)	17[#]	2.2 (0.2) (without suppression)	Average result before and after session, p<0.05
		18[#]	2.3 (0.2) (with suppression)	16[#]	2.2 (0.2) (with suppression)	
	CD3	14[#]	160.7 (18.9) (without)	17[#]	154.1 (18.9) (without)	p=ns
		18[#]	150.5 (20.1) (with)	16[#]	144.7 (10.1) (with)	
	CD4	14[#]	90.9 (10.3) (without)	17[#]	85.7 (9.2) (without)	p<0.05
		18[#]	90.4 (13.5) (with)	16[#]	85.7 (5.4) (with)	
	CD8	14[#]	80.6 (11.0) (without)	17[#]	75.3 (10.7) (without)	p=ns
		18[#]	74.8 (10.3) (with)	16[#]	73.0 (7.2) (with)	
	CD16	14[#]	25.6 (6.5) (without)	17[#]	23.7 (4.2) (without)	p=ns
		18[#]	23.8 (5.4) (with)	16[#]	21.9 (5.5) (with)	

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
	Monocytes	14#	0.7 (0.2) (without)	17#	0.7 (0.2) (without)	p=ns
		18#	0.7 (0.2) (with)	16#	0.6 (0.1) (with)	
	RBC	14#	4.9 (0.1) (without)	17#	5.0 (0.2) (without)	p=ns
		18#	4.9 (0.1) (with)	16#	4.9 (1.0) (with)	
	Hb	14#	140.4 (5.5) (without)	17#	140.8 (8.2) (without)	p=ns
		18#	142.4 (2.5) (with)	16#	143.1 (3.2) (with)	
* numbers at follow up used where available, # number randomised or received allocated intervention, ng = result not given						

Section 2. Follow up results

Table 35. Follow up physiological results

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
RCTs with physically healthy volunteers						
Pennebaker 3	Reaction time	?30	ng (ng)	?31	ng (ng)	At 1 month p=ns
Pennebaker 4	BP	25#	ng (ng)	25#	ng (ng)	At 6 weeks p=ns
	heart rate	25#	ng (ng)	25#	ng (ng)	p=ns
	skin conductance	25#	ng (ng)	25#	ng (ng)	p=ns
* numbers at follow up used where available, # number randomised or received allocated intervention, ng = result not given						

Table 36. Follow up – Haematological / immunological results

First author	What outcomes measured	N intervention group*	Results intervention group	N control group*	Results control group	Comments
RCTs with volunteers with pre-existing physical conditions						
Meyer	ESR	74	ng (ng) (stressful)	39	ng (ng)	At 6 months, p=ns
		36	ng (ng) (positive)			
Rosenberg	CD4	16	1.8 (1.5)	14	1.8 (1.0)	At 6 months p=ns
	CD8		0.4 (0.5)		0.6 (0.6)	p=ns
	IL4		ng (ng)		ng (ng)	p=ns
	IL10		3.5 (1.3)		2.9 (1.0)	p=ns
	TNFα		ng (ng)		ng (ng)	p=ns
RCTs with physically healthy volunteers						
Booth 1	CD4	20#	0.84 (0.06)	20#	0.90 (0.08)	At 6 months, SE, p=ns
	CD8		0.57 (0.05)		0.50 (0.04)	
	CD56		0.18 (0.03)		0.17 (0.03)	
	NK		196.4 (12.6)		181.6 (13.0)	
	Basophil		0.053 (0.006)		0.062 (0.006)	
	hepatitis B antibodies	?20#	3.5 (0.1)	?20#	3.3 (0.1)	At 6 months, estimated from graph, SE p<0.05 (ANOVA)
Booth 2	(CD4, CD8, total lymph-ocytes)					Not reported
Esterling	EBV-VCA antibodies	21	6.42 (0.29) (written)	19	7.53 (0.27)	At 1 (?3) weeks, SE, fewer p<0.001
		17	5.48 (0.38) (verbal)			
Francis	SGOT	20	17.90 (ng)	16	18.31 (ng)	At 6 weeks, reduced, p=0.03
	SGPT		13.4 (ng)		14.0 (ng)	Reduced, p=0.01
	Uric acid		3.98 (ng)		3.41 (ng)	p=ns
	Globulin		2.76 (ng)		2.68 (ng)	p=ns
	Albumin		4.28 (ng)		4.16 (ng)	p=ns
	Triglycerides		88.65 (ng)		80.25 (ng)	p=ns
	Cholesterol		192.45 (ng)		186.13 (ng)	p=ns
	HDL		53.5 (ng)		62.33 (ng)	p=ns
	LDL		121.3 (ng)		107.47 (ng)	p=ns
Pennebaker 4	Lymphocyte reaction (to Concavalin A)	25#		25#		Not reported
	to 5µg PHA stimulation	25#	5.43 (ng)	25#	5.37 (ng)	At 6 weeks condition by day interaction p=0.04 but disputed (see text)
	10µg PHA stimulation		5.42 (ng)		5.39 (ng)	
	20µg PHA stimulation		5.34 (ng) (average SD intervention 0.260)		5.30 (ng) (average SD control 0.262)	

* numbers at follow up used where available, # number randomised or received allocated intervention, ng = result not given

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