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Suicide prevention topic 3:
What is the relative efficacy of
different suicide assessment tools regardless
of the restrictions on who can
administer these?

A critical appraisal of the literature

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LIST OF ABBREVIATIONS

| | | |
|--------------|---|---|
| ANCOVA | – | analysis of covariance |
| ASIQ | – | Adult Suicidal Ideation Questionnaire |
| AUC | – | area under curve |
| BAI | – | Beck Anxiety Inventory |
| BDI | – | Beck Depression Inventory |
| BHS | – | Beck Hopelessness Scale |
| BSI | – | Brief Symptom Inventory |
| c.f. | – | compared with |
| C-DIS-III-R | – | NIMH Diagnostic Interview Schedule, Computerised Version |
| CI | – | confidence intervals |
| CRS | – | clinician-rated suicidality |
| DISC(-2.3) | – | Diagnostic Interview Schedule for Children (- version 2.3) |
| f/u | – | follow up |
| HARS(-R) | – | Hamilton Anxiety Rating Scale (- Revised) |
| HRSD(-R) | – | Hamilton Psychiatric Rating Scale for Depression (- Revised) |
| HSC | – | Hopelessness Scale for Children |
| k | – | kappa |
| MADRS | – | Montgomery-Asberg Depression Rating Scale |
| MANCOVA | – | multivariate analysis of covariance |
| MMPI(-2)(-A) | – | Minnesota Multiphasic Personal Inventory (- version 2)(- adolescents) |
| NIMH-DISC | – | NIMH Diagnostic Interview Schedule for Children |
| NPV | – | negative predictive value |
| ns | – | not significant |
| no. | – | number |
| o/p | – | outpatient |
| OR | – | odds ratio |
| PANAS | – | Positive and Negative Affect Scale |
| PHCS | – | Piers-Harris Children's Self-Concept Scale |
| PPV | – | positive predictive value |
| PRS | – | parent-rated suicidality |
| PSI | – | problem-solving inventory |
| (B)RFL(-A) | – | (Brief) Reasons For Living Inventory (- adolescent) |
| ROC | – | receiver operating characteristic analysis |
| RSQ | – | Risk of Suicide Questionnaire |
| SES | – | socio-economic status |
| SBQ(-R) | – | Suicidal Behaviours Questionnaire (- revised) |
| sens | – | sensitivity |
| SIQ(-Jr) | – | Suicide Ideation Questionnaire (- junior) |
| SIS | – | Suicide Intent Scale |
| spec | – | specificity |
| SPrS | – | Suicide Probability Scale |
| SPS | – | Suicide Potential Scale |
| SSB | – | Spectrum for Suicide Behaviour Scale |
| (M)SSI | – | Scale for Suicidal Ideation |
| SSI-C | – | Scale for Suicide Ideation-Current (current or present moment) |
| SSI-W | – | Scale for Suicide Ideation-Worst (worst time of life) |
| SUAS | – | Suicide Assessment Scale |
| vs | – | versus |
| w.r.t. | – | with respect to |

Scope of systematic review of suicide prevention

The development of this systematic review involved consultation between the NZHTA and the Suicide Working Group.

LITERATURE SEARCH

Main search terms

Medline subject terms (MeSH terms): suicide, suicide-attempted, self-injurious behavior, exp personality tests, psychological tests, sensitivity and specificity, *psychiatric status rating scales, logistic models.

Psychinfo subject terms: suicide, attempted suicide, suicide ideation, suicide prevention, self destructive behavior, self mutilation, test validity, test reliability, questionnaires, exp rating scales.

Additional keywords: suicid*, parasuicid*, (assess* or valid*) adj2 tool*, keyword searches for specific assessment tools.

Principal sources of information

The following databases were searched using the search strategies outlined in **Appendix 1: Search strategies**.

Bibliographic databases

Medline
Embase
Cinahl
Psychinfo
Current Contents
Science/Social Science Citation Index
Index New Zealand

Review databases

Evidence-based medicine reviews
Cochrane Database of Systematic Reviews
DARE
NHS Economic Evaluation Database
Health Technology Assessment Database

The search was restricted to information from 1990 in English.

Note: hand searching of journals, or contacting of authors for unpublished research was not undertaken during the search process.

The complete search strategies are given in **Appendix 1: Search strategies**.

INCLUSION AND EXCLUSION CRITERIA

Inclusion and exclusion criteria were firstly applied to the abstracts captured by the literature searches. Those papers considered for inclusion in the literature appraisal were retrieved and appraised and this warranted the exclusion of some further papers based on the availability of these in full text.

Peer reviewed studies were considered for this review if they used one of the following study designs:

- systematic review or meta-analysis
- randomised controlled trial (RCT)
- controlled clinical trial (CCT)
- cohort study
- case-control study
- quasi-experimental study – e.g., before and after study
- descriptive study.

Note: the ‘grey’ literature was included, where appropriate, for New Zealand specific studies looking at special population groups: Maori, Pacific Island, Asian and the elderly.

STUDY INCLUSION CRITERIA

The following criteria were used for all topics to **include** studies for appraisal:

- study population are persons presenting following suicide attempt, expressing suicidal ideation, suicide threat
- study set in emergency department
- study set in tertiary mental health service
- study published in 1990 or later
- study written in English
- outcomes considered include:
 - repeat presentations for suicidality
 - repeat suicide attempts
 - mortality from suicide.

For topic 3 the following additional inclusion criteria were also used:

- study’s tools meet our agreed definition of ‘suicide assessment tool’ – i.e., ‘a formalised series of questions designed (at least in part) to identify those at risk of future suicide attempts’
- study compares a minimum of two tools to assess relative efficacy. Relative efficacy is defined as determining which tool has the better prognostic value for at least one of the following suicidal outcomes: ideation, plan, attempt, completed suicide
- study includes a minimum of 100 subjects total – i.e., all arms combined
- study measures relative efficacy in at least one of the following ways: by significance tests, by correlations, by other standardised indices of association – e.g., odds ratios, sensitivity, specificity, positive and negative predictive value.

STUDY EXCLUSION CRITERIA

The following criteria were used for all topics to **exclude** studies from appraisal:

- study population primarily (50% or more) those with deliberate self-harm in the absence of suicide intent
- study population primarily (50% or more) those involved in assisted suicide
- study population primarily (50% or more) presentations for self-mutilation
- study population primarily (50% or more) children 12 years of age and under
- study focus is on the treatment of people with drug/substance abuse or dependence, that is treatment directed to their addiction rather than any suicide attempt
- study population are criminal offenders

- studies on suicide prevention interventions specifically for people with HIV/AIDS
- studies with small numbers of case presentations (one to five cases)
- studies concerned with suicide in homicidal people
- studies concerned with school-based suicide prevention interventions
- studies concerned with economic analyses
- citations which are letters to the editor, comments, editorials, abstract only
- studies where population is primarily a specific population – e.g., patients with underlying personality disorder or affective disorder (and therefore potential confounder of study results and treatments).

For topic 3 the following additional exclusion criteria were also used:

- study tool(s) does not meet agreed definition for suicide assessment tool (see inclusion criteria)
- study tool is not compared against at least one other suicide assessment tool
- study included fewer than 100 subjects
- no formal and standardised assessment of relative efficacy given (significance tests, correlations, odds ratios etc).

STUDY SELECTION

Studies were selected for appraisal using a two-stage process. Initially, the titles and abstracts (where available) identified from the search strategy were scanned and excluded as appropriate. The full text articles were retrieved for the remaining studies and these were appraised if they fulfilled the study selection criteria outlined above.

Two hundred and forty-nine papers were identified via the search strategy, 35 retrieved (two as background only), and one further paper was retrieved from cross-references (for background only). Thirteen papers were included for analysis and 20 excluded. Three further papers were also provided by Annette Beautrais for background purposes and one paper obtained for topic 8 was also used for background purposes.

TABLE 1 (EVIDENCE TABLE)

Summaries of appraisal results are shown in tabular form and include:

- study reference and country
- study design
- study quality grading and evidence level
- study arm description of intervention, service, treatment
- patient inclusion and exclusion criteria
- number of patients included in study sample
- study outcomes and p-values and/or 95% confidence intervals
- comments on the study and its internal validity issues arising from the study appraisal.

P-values unless otherwise stated relate to between group comparisons.

APPRAISAL METHODOLOGY

Articles were formally appraised using the checklist schedules and hierarchy of evidence coding system developed by the Scottish Intercollegiate Guidelines Network (SIGN). Validated criteria were used to appraise the studies selected for review. Key facets of the selected studies (including limitations) were documented in the text. Conclusions were drawn based on the study design and the specific problems associated with individual studies. The evidence presented in the selected studies were assessed and classified according to the SIGN grades of guideline recommendation by the suicide prevention guideline group.

Studies retrieved for this topic were all either case-control studies or cross-sectional analyses. No randomised control trials pertaining to this topic were identified.

The final grading (2++, 2+ or 2-) code was allocated based upon the study design and study quality.

For a case-control or cross-sectional study to receive a 2++ grading the following criteria needed to be fulfilled:

- clearly defined and appropriate study question
- unbiased selection of subjects from a comparable population(s)
- (for case-control studies only) cases and controls clearly defined and differentiated; controls clearly non-cases
- good reporting of baseline variables and inclusion and exclusion criteria
- blinding of investigators to previous test results or other factors that could bias testing
- outcomes measured in a standard, valid and reliable way
- all subjects in study treated equally
- adequate statistical analysis
- an appropriate follow-up period and prospective, longitudinal analysis.

Papers which met the above criteria with the exception of including an appropriate follow-up period and prospective, longitudinal analysis were given a ranking of 2+.

Factors (four or more) that consigned studies to a 2- grading included:

- ill defined and/or inappropriate study question
- poorly described and/or biased selection process
- poorly defined and/or biased inclusion and/or exclusion criteria
- poor reporting of baseline variables and/or significant baseline study differences between groups (case-control studies)
- baseline study differences
- outcome assessment not blinded to allocation and/or blinding of investigators not described
- inadequate statistical analysis
- significant omissions or errors in patient demographic information and outcome results.

Within each grade, papers are presented in alphabetical order according to first author surname.

Study limitations

This question examines the relative efficacy of various different suicide assessment tools independent of the type of health professional administering the test(s). For the purposes of this review the following definitions were used:

1. 'relative efficacy' was defined as 'determining which tool has the better prognostic value for at least one of the following suicidal outcomes: ideation, plan, attempt, completed suicide'
2. 'suicide assessment tool' was defined as 'a formalised series of questions designed (at least in part) to identify those at risk of future suicide attempts'.

For inclusion in the review, relative efficacy needed to be measured in a standardised and statistically validated way – e.g., by a comparison of sensitivities and specificities, odds ratios, and/or positive and negative predictive values. A minimum of two tools had to be compared within a study, and a minimum total sample population of 100 also had to be present for a paper to be included for appraisal. Unfortunately, only four papers provided direct information regarding prognostic value (also termed predictive validity) via longitudinal trials which ascertained suicide and suicidal-related events occurring following study's original assessment of the sample. As per the assessment criteria, they were given a ranking of 2++ in **Table 1 (pages 8-16)**. Studies which met the other criteria for inclusion, but did not have this longitudinal element were included providing the study gave some *implied* prognostic value via a good analysis of the concurrent validity of the assessment tool in question against at least one more established tool. These studies were graded either 2+ or 2- depending on their methodological completeness. These studies were mainly cross-sectional designs, with only three case-control studies. No randomised controlled clinical trials were identified.

Table 1 (pages 8-16) contains all included, critically appraised papers. Four papers were graded 2++, two papers graded 2+ and seven papers were graded 2-. Most assessment tools look at negative factors which may increase the risk of suicidality: a minority of tools examine positive cognitive or coping factors which protect against suicidality or a combination of these. Included papers' references are given in **Appendix 2**. Excluded papers and the reasons for exclusion are presented in **Appendix 3**. Papers were appraised but excluded for several reasons: the total sample size being less than one hundred (seven papers), no comparison with another tool being performed (seven papers), using an excluded sample population type (five papers), and providing expert opinion evidence only (one paper). Papers retrieved for background purposes are presented in **Appendix 4**.

Individual study limitations are described in the comment section in **Table 1 (pages 8-16)**. Unless stated otherwise, all assessment tools were given to all participants in the research.

General limitations to the review methodology that need to be considered in developing the suicide prevention guideline, include restriction to:

- articles published from 1990 onwards
- the published literature
- English language articles only
- reviewing each study by one researcher only.

In developing a guideline for suicide prevention, consideration will need to be given to studies published pre-1990. Important articles of interest were published in the pre-1990 time period, in particular relating to the validation and development of the older assessment tools, which were then used to validate newer tools in the reviewed literature. This review does not address the adequacy of the validation of these older tools.

Restriction to the published literature is likely to lead to bias since the unpublished literature tends to consist of studies not identifying a significant result.

Restriction to English language may result in study bias, but the direction of this bias cannot be determined.

None of the articles appraised were set in New Zealand. One background paper by Cheung (1992) had New Zealand authorship. Therefore, the generalisability of these studies to the New Zealand setting needs to be considered.

The studies were initially selected by examining the abstracts of these articles. Therefore, it is possible that some studies were inappropriately excluded prior to examination of the full text article.

There is a limitation on space in **Table 1 (pages 8-16)**, therefore, study details have been summarised.

This review was conducted over a limited timeframe (February 2002 – May 2002).

Limitations of this review specific to this topic include:

1. the variability in defining suicide, suicidal behaviour and suicidal ideation. This makes it difficult to compare across studies as the homogeneity of the samples is not clear
2. the large number of assessment tools available with no one assessment tool a clearly supported and favoured measure (Jobes et al. 1995)
3. the low base rates of suicide in the population overall
4. rates of suicide have varied markedly over the past several decades and the stability of discriminators and cut-off points of tools with respect to this variation is unknown (Kreitman 1991). Also, positive and negative predictive values are not independent of the underlying base rate in a population
5. some authors (e.g., Cheung 1992) argue that predictors of suicide are highly specific to the population studied and the relevance of study results may alter with the population.

For further information regarding individual study tools, two background sources are recommended as providing a good overview of various assessment tools and listing pertinent pre-1990 literature sources:

Brown, G.K. (2001). *A review of suicide assessment measures for intervention research with adults and older adults. Technical report submitted to MINH under Contract No. 263-MH-914950*. Bethesda, MD: US National Institute for Mental Health. (Available via the Internet at <http://www.nimh.nih.gov/research/adultsuicide.pdf>)

and

Goldston, D. (2000). *Assessment of suicidal behaviors and risk among children and adolescents. Technical report submitted to NIMH under Contract No. 263-MD-909995*. Bethesda, MD: US National Institute for Mental Health.

Brown's study has identified the following tools used for assessing adults as having some research available regarding predictive validity: Scale for Suicidal Ideation (pp 6-7), Scale for Suicidal Ideation – Worst (pp 7-8), Adult Suicidal Ideation Questionnaire (pp 12-14), Suicide Intent Scale (pp 16-17), Risk-Rescue Rating (pp 20-21), Hamilton Rating Scale for Depression (Suicide Item) (pp 24-25), Beck Depression Inventory (Suicide Item) (p25) and Beck Hopelessness Scale (pp 25-27).

Goldston's study (which examined assessment tools for children and adolescents) found the following tools to have research published relating to predictive validity: Diagnostic Interview for Children and Adolescents (pp 21-23), Diagnostic Interview Schedule for Children (pp 24-29), Interview Schedule for Children and Adolescents (pp 30-33), Schedule for Affective Disorders and Schizophrenia School Age – Epidemiologic Version (pp 37-41), Schedule for Affective Disorders and Schizophrenia School Age

– Present State Version IVR (pp 45-49), Child Suicide Potential Scales (pp 54-59), Achenbach Child Behaviour Checklist with Teacher Report Form and Youth Report Form (pp 68-70), Beck Depression Inventory Suicide Item (pp 71-74), Children’s Depression Inventory Suicide Item (pp 75-77), Beck Scale for Suicidal Ideation (p 83), Suicidal Ideation Questionnaire (pp 90-95), Center for Epidemiologic Studies Depression Scale – Appended Suicide Ideation Items (pp 100-103), Columbia Teen Screen (pp 107-109), Middle Adolescent Vulnerability Study Survey (pp 113-114), Beck Hopelessness Scale (pp 122-126), Hopelessness Scale for Children (pp 133-137), Reasons For Living Inventory (pp 153-156), Suicide Probability Scale (pp 160-162) and Beck Suicide Intent Scale (pp 167-169).

Table 1. Evidence table of appraised articles

Title of review: What is the relative efficacy of different suicide assessment tools regardless of the restrictions on who can administer these?

| Study; design type; evidence grading; country | Intervention/ comparison Outcome measure | Criteria for Inclusion/ Exclusion | Results/Outcome | Comments including methodological issues | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|--|---|--|-------|-------|-----|----|------|-------|------|-------|------------|------------|------------|------|-----|-----|-----|------|-----|-----|-----|-----|------|------|------|--|
| (Beck et al. 1999) Case-control study 2+ Country: USA | Scale for Suicide Ideation – Current (SSI-C) Scale for Suicide Ideation- Worst (SSI-W), & Beck Hopelessness Scale (BHS). Outcome measure: Utility of these tools in identifying high risk patients. | Inclusion criteria: Outpatients evaluated at a university cognitive therapy centre between 1975 and 1994. Exclusion criteria: Nil stated. | 3701 enrolled in study and completed intake interview with all three tools; 30 progressed to commit suicide, 3671 did not. Mean age for suicides (41.1+/-13.68 years) was significantly higher (p<0.05) than mean age for non-suicides (35.8+/-11.84 years). Mean number of years from intake interview to suicide 4.07+/-3.96 years (range 2 weeks to 12 years). Suicide sample scored significantly higher on the SSI-C (p<0.01), SSI-W (p<0.001) and BHS (p<0.001) than the non-suicide sample. Optimal cut-off points identified for all three tools via ROC analyses: Low risk of suicide: 0-1 on SSI-C, 0-15 on SSI-W, 0-7 on BHS. High risk: 2 or 2+ on SSI-C, 16 or 16+ on SSI-W, 8 or 8+ on BHS. Using these cut-off points: <table border="1" data-bbox="824 810 1413 943"> <thead> <tr> <th></th> <th>SSI-C</th> <th>SSI-W</th> <th>BHS</th> </tr> </thead> <tbody> <tr> <td>OR</td> <td>5.42</td> <td>13.84</td> <td>6.43</td> </tr> <tr> <td>95%CI</td> <td>2.63-11.17</td> <td>5.64-33.98</td> <td>1.95-21.25</td> </tr> <tr> <td>sens</td> <td>53%</td> <td>80%</td> <td>90%</td> </tr> <tr> <td>spec</td> <td>83%</td> <td>78%</td> <td>42%</td> </tr> <tr> <td>PPV</td> <td>2.4%</td> <td>2.8%</td> <td>1.3%</td> </tr> </tbody> </table> Logistic regression analysis indicated at least one of the tools was a significant predictor (p<0.001): the likelihood ratio & 95%CI indicated that only SSI-W significantly contributed unique odds to the estimation of eventual suicide. Suicide sample scored significantly higher on the SSI-C (p<0.01), SSI-W (p<0.001) and BHS (p<0.001) than the non-suicide sample. | | SSI-C | SSI-W | BHS | OR | 5.42 | 13.84 | 6.43 | 95%CI | 2.63-11.17 | 5.64-33.98 | 1.95-21.25 | sens | 53% | 80% | 90% | spec | 83% | 78% | 42% | PPV | 2.4% | 2.8% | 1.3% | <ul style="list-style-type: none"> ▪ prospective, longitudinal study with large sample non-suicide group (n=3671) sample characteristics: 1584 male (43%), 2087 female (57%); 3386 Caucasian (92%), 205 African American (6%); 3061 completed college or higher (56%); 1688 single (46%), 1396 married (38%); 2751 employed or student (75%), 742 unemployed (20%); 475 prior suicide attempt (13%), 2255 family history of mental disorder (61%), 232 family history of suicide (6%); 2006 mood disorder (55%), 495 primary, secondary or tertiary substance abuse (14%), 1666 with comorbid axis I disorder (45%), 1487 axis II (personality) disorder (57%) ▪ suicide group (n=30) sample characteristics: 18 male (60%), 12 female (40%); 27 Caucasian (90%), 3 African American (10%); 15 completed college or higher (50%); 10 single (33%) 14 married (47%); 14 employed or student (47%), 16 unemployed (53%); 19 prior suicide attempt (63%), 20 family history of mental disorder (67%), 5 family history of suicide (17%); 28 mood disorder (93%), 6 primary, secondary or tertiary substance abuse (20%), 14 with comorbid axis I disorder (47%), 17 axis II (personality) disorder (57%) ▪ deaths ascertained from the National Death Index and subsequent retrieval of death certificates ▪ methodological concerns: not stated if sample includes all eligible patients, no description or analysis of eligible but not-participating patients (if relevant), not stated if other demographic characteristics apart from age were significantly different between the suicide and non-suicide groups, median, mean and range of follow-up times not given, analysis of suicides would have been improved using matched control techniques (see Nimeus et. al. next page). |
| | SSI-C | SSI-W | BHS | | | | | | | | | | | | | | | | | | | | | | | | | |
| OR | 5.42 | 13.84 | 6.43 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 95%CI | 2.63-11.17 | 5.64-33.98 | 1.95-21.25 | | | | | | | | | | | | | | | | | | | | | | | | | |
| sens | 53% | 80% | 90% | | | | | | | | | | | | | | | | | | | | | | | | | |
| spec | 83% | 78% | 42% | | | | | | | | | | | | | | | | | | | | | | | | | |
| PPV | 2.4% | 2.8% | 1.3% | | | | | | | | | | | | | | | | | | | | | | | | | |

Table 1. Evidence table of appraised articles (continued).

| Study; design type; evidence grading; country | Intervention/ comparison Outcome measure | Criteria for Inclusion/ Exclusion | Results/Outcome | Comments including methodological issues |
|---|---|---|--|---|
| <p>(Nimeus et al. 2000)</p> <p>Cross-sectional and case-control</p> <p>2++</p> <p>Country: Sweden</p> | <p>Suicide Assessment Scale (SUAS) c.f. Montgomery-Asberg Depression Rating Scale (MADRS), BHS & Suicide Intent Scale (SIS).</p> <p>Outcome measure: Comparison and predictive ability of SUAS against other tools w.r.t. completed suicide attempts (minimum 12 month f/u period).</p> | <p>Inclusion criteria: Inpatient admission to a suicide research ward between 1987-1997.</p> <p>Exclusion criteria: Severity of illness requiring immediate treatment prior to enrolment, treatment under commitment, discharge within a few days of hospitalisation.</p> | <p>273 patients asked to participate; 191 consented. Yearly recruitment ranged from 6-30 per annum. Patients enrolled within 1 week of admission.</p> <p>8 participants (4.2%, 2 men, 6 women) committed suicide within 12 months of admission and study enrolment (mean time between index event and suicide = 8.0+/-3.0 months). Completed suicides significantly older (p=0.005); gender, psychiatric diagnosis, co-morbidities, no. of previous attempts all ns. Longer f/u (16 months to 10years & 2 months, median 6 years and 11 months) revealed a further 8 completed suicides.</p> <p>SUAS correlated significantly with MADRS (p<0.01) and BHS (p<0.01) but not SIS.</p> <p>SUAS cut-off score of 39 had 75.0% sens, 86.3% spec, PPV 19.4%. This score significantly (p=0.017) discriminated between patients completing suicide within a year from those committing suicide later.</p> <p>Predictive validity of SUAS: SUAS score (unlike MADRS< BHS and SIS scores) was significantly different (p=0.017) between suicides within 12 months and matched controls. Advanced age was the only other significant risk factor identified between these two groups (p=0.034).</p> | <ul style="list-style-type: none"> ▪ 87 men (mean age 39.3+/-14.4 years) and 104 women (mean age 39.9+/-16.3 years) ▪ nsd with age, gender or previous attempts between those eligible and those consenting to participate ▪ SUAS is an interview-based, expert-rated scale with 20 items taking 20-30 minutes to complete ▪ psychiatric diagnosis made by one (n=117) or two (n=74) psychiatrists ▪ psychiatric diagnosis (n=191): manic-depressive disorder 27.3%, dysthymia 13.6%, depression 11.4%, adjustment disorders 24.6% ▪ women scored significantly higher SUAS scores than men (p=0.006) ▪ due to the small number of suicides, a logistic regression analysis was considered inappropriate: suicides completed within 12 months of index attempt (n=8) were compared with 40 gender and axis I diagnosis-matched controls ▪ methodological concerns: source(s) of data for completed suicides not stated, ethnicity & SES level of sample not stated, blinding of investigators not stated. |

Table 1. Evidence table of appraised articles (continued).

| Study; design type; evidence grading; country | Intervention/ comparison Outcome measure | Criteria for Inclusion/ Exclusion | Results/Outcome | Comments including methodological issues |
|---|---|--|---|--|
| <p>(Osman et al. 1999)</p> <p>Cross-sectional analysis</p> <p>Grade 2++</p> <p>Country: USA</p> | <p>Adult Suicide Ideation Questionnaire (ASIQ) c.f. Reasons for Living Inventory (RFL).</p> <p>Outcome measure: internal and external validity of these 2 tools. 3 month prospective f/u.</p> | <p>Inclusion criteria: 228 consecutive adult admissions to 3 long-term care psychiatric inpatient units.</p> <p>Exclusion criteria: Declining to participate (11), active psychosis (7), low intellectual functioning (5).</p> | <p>Study group of 205 classified into 'suicide attempt' (31 men and 44 women) or 'psychiatric control' (74 men and 56 women) sub-groups on the basis of clinical history, Suicide Intent Scale, the 'standard diagnostic assessment packet' (see notes), and review of medical records. Nsd in age and length of admission between sub-groups. Suicide attempter group had significantly higher ($p < 0.01$) rates of mood disorders, substance-related disorders and co-morbidity of disorders.</p> <p>ANOVA analysis showed significant variation in both ASIQ ($p < 0.001$) and RFL ($p < 0.001$) scores between suicide attempt and psychiatric control subgroups.</p> <p>ROC analysis: ASIQ cut-off score of 14 had best accuracy (sens 96.0%, spec 79.2%, PPV 72.7%, NPV 97.2%).</p> <p>RFL score cut-off score 3.8 had best accuracy (sens 61.3%, spec 81.5%, PPV 65.7%, NPV 78.5%).</p> <p>AUC ($p < 0.001$) and logistic regression analyses ($p < 0.001$ for ASIQ, and $p < 0.005$ for RFL) showed tools likely to have different criterion – measuring abilities.</p> <p>Using ASIQ and RFL combined gave an overall accuracy of 89% (sens 83%, spec 92%, PPV 86%, NPV 90%). Using combined ASIQ, BHS and PANAS gave best results (92% sens, 97% spec, no PPV or NPV provided).</p> <p>Predictive validity: RFL was not a significant predictor, ASIQ significant ($p < 0.001$) contributor to predictive validity as was self-reported measure ($p < 0.001$).</p> | <ul style="list-style-type: none"> ▪ study sample were 105 men and 100 women, mean age 31.4+/-7.7 years (male) 32.2+/-7.9 (female - nsd), 91% Caucasian, 5% Afro-American, 2% Hispanic, 2% Asian American ▪ 'standard diagnostic assessment package' includes MMPI-2, BHS, the Positive and Negative Affect Scale (PANAS), as well as the two study tools under investigation ▪ average length of admission of study group was 44 days (range 11 to 109 days) ▪ psychiatric diagnosis of study group: schizophrenia (30%), major depression (19%), schizoaffective disorder (10%), adjustment disorders (8%), dysthmic disorders (8%), bipolar disorder (7%), substance-related disorders (6%), other (12%) ▪ methodological concerns: no data presented on excluded admissions, data limited to long-stay inpatient adults, study protocol assumes validity of SIS in assignment to sub-groups, sparse detail on method of prospective f/u apart from further hospital admissions, cut-off points for RFL and ASIQ scores may not hold in other patient populations. |

Table 1. Evidence table of appraised articles (continued).

| Study; design type; evidence grading; country | Intervention/ comparison Outcome measure | Criteria for Inclusion/ Exclusion | Results/Outcome | Comments including methodological issues |
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| (Rudd and Rajab 1995) Cross-sectional analysis Grade 2++ Country: USA | Modified Scale for Suicidal Ideation (MSSI) c.f. Beck Depression Inventory (BDI), Beck Hopelessness Scale (BHS), Suicide Probability Scale (SPS), Problem-Solving Inventory (PSI), & NIMH Diagnostic Interview Schedule, Computerised Version (C-DIS-III-R). Outcome measures: 1. cross-validation of MSSI 2. predictive validity of MSSI at 30 days and 6 months 3. utility of MSSI in clinical setting. | Inclusion criteria: Individuals being evaluated prior to entry into a long-term study of intensive outpatient care for suicidal behaviour in young adults (timeframe not given). Exclusion criteria: None stated. | 244 in sample; 148 attemptors and 96 ideators. MSSI significantly ($p < 0.0001$) correlated with total SPS score and SPS-Suicidal Ideation subscore, and the BDI and BDI-suicide item, BHS and PSI. MSSI scores for suicide ideators were significantly ($p < 0.001$) lower than for suicide attemptors. The MSSI was the only measure (c.f. BDI, BHS, PSI and SPS) to effectively discriminate ideators from attemptors at intake. MSSI scores for clinically depressed (as diagnosed by C-DIS-III-R) were significantly ($p < 0.0001$) higher than those who were not diagnosed with depression. MSSI predictive validity, measured by correlating MSSI scores with 'SPS-T' scores, showed these scores significantly ($p < 0.0001$) correlated at both 1 and 6 months follow-up (ideation scores rather than suicide attempts were used to test predictive validity due to the small number of attempts (i.e., 3) in the follow-up period). | <ul style="list-style-type: none"> ▪ MSSI is specifically designed to identify those at highest risk from within a specific high risk population (e.g. psychiatric patients openly expressing suicidal ideation, threats and/or behaviour) ▪ sample characteristics: male 204 (84%), female 40 (16%); mean age 22 years (no SD given), range 18-37 years; 62.7% Caucasian, 20.5% African American, 11.4% Hispanic, 0.8% Pacific Islander, 0.8% Asian, 2.9% other ▪ investigators blinded to results of previously administered tests (test scoring done by computerised system) ▪ methodological limitations: heavy male bias in sample, no exclusion criteria given. |

Table 1. Evidence table of appraised articles (continued).

| Study; design type; evidence grading; country | Intervention/ comparison Outcome measure | Criteria for Inclusion/ Exclusion | Results/Outcome | Comments including methodological issues |
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| (Horowitz et al. 2001) Cross-sectional analysis Grade 2+ USA | Risk of Suicide Questionnaire (RSQ) c.f. Suicide Ideation Questionnaire (SIQ). Outcome measure: Validation of RSQ c.f. SIQ. | Inclusion criteria: 155 children presenting to a Boston teaching hospital ED between 1997 and 1998 'with a chief complaint to be psychiatric in nature'. Exclusion criteria: Five children excluded due to severe cognitive impairment; four excluded because of missing data; one excluded due to refusal to participate. | 145 children and adolescents in study. Firstly completed RSQ then SIQ on presentation to ED. Agreement between individual RSQ items and suicidality (as determined by the SIQ) was fair to poor (kappas 0.54-0.02). Little improvement in predictive ability obtained after including 4 RSQ items. Best combination of 4 items (Items 1, 5, 8, 13 (see below)) had sensitivity=0.98, NPV=0.97 and overall prediction of suicidality c.f. SIQ c statistic=0.87. Recommended four items to use are: 1='Are you here because you tried to hurt yourself?', 5='In the past week have you been having thoughts about killing yourself?', 8= 'Have you ever tried to hurt yourself in the past other than this time?' and 13='Has something very stressful happened to you in the past few weeks?' | <ul style="list-style-type: none"> ▪ initial selection of study group made by triage nurse on duty at time of presentation to ED ▪ mean age 13.6 +/- 2.48 years; male 46%, female 54%; Caucasian 49%, African American 26%, Hispanic 15%, Asian 1%, other 4%, unknown 9% ▪ post evaluation provisional diagnosis: depressive disorders (35%), attention-deficit disorder (10%), bipolar disorder (8%) and adjustment disorder (8%) ▪ RSQ contained 14 items selected via a pilot phase: SIQ contains 30 items ▪ RSQ administered by triage nurse: SIQ administered by psychologist blinded to RSQ results ▪ 4 item RSQ version takes less than 2 minutes and can be administered by triage nursing staff c.f. SIQ requiring 30 minutes and trained psychologist to administer ▪ prevalence of suicidality (attempt, ideation, threat) in study population was 0.44. Unknown how RSQ would perform in populations with different prevalence ▪ RSQ assesses suicidal ideation and not necessarily suicidal behaviour. |
| (Prinstein et al. 2001) Cross-sectional analysis Grade 2+ USA | NIMH Diagnostic Interview Schedule for Children (NIMH-DISC) c.f. SIQ, Clinician-Rated Suicidality (CRS) & Parent-Reported Suicidality (PRS). | Inclusion criteria: Consecutive daily adolescent inpatient admissions to psychiatric unit in New England (dates not specified). Exclusion criteria: Active psychosis, mental disability, incomplete data due to early discharge, readmissions during study period (only counted once). | 153 adolescents included in study, 54 boys, 99 girls. 70 excluded (59 for incomplete data). SIQ identified significantly (p<0.001) more suicidal ideation than NIMH-DISC. NIMH-DISC identified significantly (p<0.003) more suicide attempts than CRS. Overall agreement between all measures was low to moderate (k=0.21-0.49). Poor agreement between PRS and other measures. Non-significant trend for greater agreement between measures for boys c.f. girls. No age-related trends found. No SES trend data given. | <ul style="list-style-type: none"> ▪ mean age 14.8 +/- 1.6 years; range 12-17 years ▪ ethnicity 72.9% Caucasian, 10.4% Hispanic ▪ SES status 15.6% high, 39.2% moderate, 17.6% low, 13.0% poverty, 14.3% unknown ▪ psychiatric diagnosis not provided ▪ excluded adolescents did not differ significantly from included in age, ethnicity or S/E status ▪ only 41% of PRS data completed: adolescents with completed PRS significantly more likely to have lower suicidal ideation, as measured by SIQ (p<0.05) and NIMH-DISC (p<0.05) than those with incomplete PRS ▪ all measures assessed suicidality in the month immediately prior to admission rather than life-long prevalence ▪ methodological concerns: PRS data may be biased towards non-reporting due to structure of instrument and only small subset had PRS data completed (see above); non-prospective study with no external measures of validity; limited population sample (inpatient, psychiatric hospital). |

Table 1. Evidence table of appraised articles (continued).

| Study; design type; evidence grading; country | Intervention/ comparison Outcome measure | Criteria for Inclusion/ Exclusion | Results/Outcome | Comments including methodological issues |
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| (Beck et al. 1997) Cross-sectional analysis Grade 2- Country : USA | SSI-C c.f. SSI-W, Beck Anxiety Inventory (BAI), BDI, BHS, Hamilton Psychiatric Rating Scale for Depression-revised (HRSD-R), Hamilton Anxiety Rating Scale-revised (HARS-R). Outcome measure: Reliability and construct validity of SSI-C and SSI-W. | Inclusion criteria: Consecutive outpatient evaluation with completed SSI-C and SSI-W at university-based, cognitive therapy centre between January 1975 and June 1996. Exclusion criteria: None specified. Implied (but not clearly stated) patients who had not completed both SSI-C and SSI-W were not included (these instruments were introduced progressively over the study period). | 4063 in study group. SSI-C and SSI-W both significantly correlated ($p < 0.001$) with BDI total score, BDI item 9, total HRSD-R score, HRSD-R suicide item 3 only, BAI, HARS-R and BHS. Correlation between SSI-C and SSI-W scores was 0.51 ($p < 0.001$). MANCOVA analysis: Mean SSI-C and SSI-W scores differed significantly ($p < 0.001$) between those who had never attempted suicide and those who had attempted suicide at least once. Current suicidal ideators were more likely to be past ideators and non-ideators in the past were less likely to be current ideators ($p < 0.001$). | <ul style="list-style-type: none"> ▪ this paper supplements the data presented in Beck et al. 1999 at the start of this table ▪ sample characteristics: 56% female and 44% male; 91% Caucasian, 6% African American, 1% Asian, 1% Hispanic, 1% other; mean age 35.86+/-11.85 years old; 58% college graduates; 47% never married; 21% unemployed; 79% received previous psychotherapy, 56% received previous psychopharmacotherapy, 18% previously hospitalised; 13% self-reported making 1 or more suicide attempts in the past; current psychiatric diagnosis – 54% principal Axis I mood disorder, 26% principal anxiety disorder, 20% other Axis I disorder, 15% diagnosed with tertiary Axis I alcohol or substance abuse disorder, 56% comorbid Axis I disorder, 42% with Axis 2 personality disorder ▪ methodological limitations: no specific exclusion criteria stated, no comparison with non-included patients, sample predominantly Caucasian and well-educated, uncertain how recall bias may affect SSI-W score. |
| (Glassmire et al. 2001) Cross-sectional analysis Grade 2- Country: USA | Suicide Potential Scale (SPS) c.f. two telephone interview questions. Outcome measure: validation of SPS against telephone questions (f/u 3 weeks). | Inclusion criteria: Presentation to low fee, urban o/p psychotherapy clinic (no time frame specified). Exclusion criteria: None stated. | 113 in study group (no control). First intervention (telephone questions) given at time of initial contact with clinic. Second intervention (SPS scale) obtained via administering the MMPI-2 within 3 weeks of initial contact. Positive endorsement rates for the six items of the SPS 6.0-20.7% c.f. 3.5% (current suicidal ideation) and 15.7% (self-harm attempts) for telephone questions. Two items 506 ('I have recently considered killing myself') and 520 ('Lately I have thought a lot about killing myself') endorsed significantly more often than the interview question 'Are you currently suicidal?' (chi squared test, $p < 0.001$ for item 506, $p < 0.05$ for item 520). | <ul style="list-style-type: none"> ▪ mean age of participants 35.7+/-11.1 years ▪ patients predominantly Caucasian, highly educated and 69% female ▪ study group not followed longitudinally to compare self-reporting rates with actual future suicide attempts ▪ very limited inclusion and no exclusion criteria. Unknown enrolment rate ▪ telephone questions were: 'Have you ever intentionally hurt yourself or tried to hurt yourself?' and 'Are you currently suicidal?' ▪ SPS tool comprised 6 items asking about suicidal intent taken from MMPI-2 (items 150, 303, 506, 520, 524, 530) ▪ 69 patients did not report suicidal behaviour and/or intent via either method ▪ both tools reliant on self-reporting by participants ▪ delay of up to 3 weeks before administering SPS may introduce bias to results. |

Table 1. Evidence table of appraised articles (continued)

| Study; design type; evidence grading; country | Intervention/ comparison Outcome measure | Criteria for Inclusion/ Exclusion | Results/Outcome | Comments including methodological issues |
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| (Gutierrez et al. 2000) Cross-sectional analysis Grade 2- Country: USA | Reasons for Living Inventory for Adolescents (RFL-A) c.f. Lineham's Suicide Behaviour Questionnaire (SBO), Suicide Probability Scale (SPs), BHS, Piers-Harris Children's Self-Concept Scale (PHCS) & MMPI-A. Outcome measure: validation of RFL-A against other tools. | Inclusion criteria: Consecutive admissions to a long-term care adolescent psychiatric inpatient unit (time frame not specified). Exclusion criteria: Low intellectual level, severe psychosis. | 225 (111 male, 114 female) initially recruited into study: 206 completed full study divided into 3 sub-groups - 'attempters' n=64 (positive history of past attempts), 'first-attempters' n=32, and 'non-suiciders' n=110. MANOVA analysis of attempters vs non-suiciders, and first-attempters vs non-suiciders showed RFL-A significantly ($p<0.001$) discriminated both overall and for all five scales between the groups. Logistic regression analysis showed the suicide-related concerns ($p<0.02$) and self-acceptance scales ($p<0.01$) were most useful, in combination, in differentiating between the groups. (NB data on attempters vs first-attempters not given). Logistic regression analysis of RFL-A vs SPs vs BHS showed only RFL-A ($p<0.001$) and SPs (0.01) were useful in discriminating between non-suiciders vs attempters. Combined use of RFL-A and SPs correctly classified 86.2% of the 116 cases. A RFL-A cut-off score of 4.63 had sens 76.6%, spec 90.4%, PPV 90.7% and NPV 75.8%. | <ul style="list-style-type: none"> ▪ RFL-A is a 32 item self-report measure comprising 5 scales; future optimism, suicide-related concerns, family alliance, peer acceptance and support, and self-acceptance ▪ mean age of participants male 15.71+/-0.95 years, female 15.68+/-1.02 years (ns) ▪ ethnicity 84.5% Caucasian, 7.1% African American ▪ psychiatric diagnosis: major depression 33%, conduct disorder 35.4%, oppositional defiant disorder 15%, adjustment disorder 8.3%, other 8.3% ▪ methodological limitations: no epidemiological data presented to confirm comparability of sample to population, high Caucasian ethnicity limits generalisability to other groups, no non-clinical comparison group used, no prospective longitudinal measure of validity used, limited analysis of confounding factors, independence (blinding) of tests unstated. |
| (King et al. 1997) Cross-sectional analysis Grade 2- Country: USA | Diagnostic Interview Schedule for Children version 2.3 (DISC-2.3) c.f. Spectrum of Suicide Behavior Scale (SSB) & Suicidal Ideation Questionnaire-junior (SIQ-Jr). Outcome measures: Correlation and reliability of DISC-2.3 with established measures of suicidality and depression (results for depression not presented here). | Inclusion criteria: Consecutive admissions over two year period (years not stated) to an adolescent inpatient program of a major teaching hospital. Exclusion criteria: no parental consent, <5-day admission, mental incapacity, developmental disorder, other organic mental disorder, research staff shortages at time of admission. | 265 participants in study. Across suicidality measures of DISC-2.3 there was no difference between adolescent and parental completion of the measure for suicidality items. For both adolescent and parent informants, subjects who scored positive on DISC-2.3 major depressive episode criteria were significantly more likely ($p<0.001$) to score above the SIQ-Jr cut-off. Significant associations ($p<0.001$) between SSB and DISC-2.3 responses also found. | <ul style="list-style-type: none"> ▪ sample characteristics: mean age 14.9+/-1.4 years (range 12-18 years), 149 females and 117 males, 83% Caucasian 11% African American, 85% lived with parent or guardian ▪ major analysis of paper is relationship of DISC-2.3 to <i>depression</i> rather than suicidality, therefore only some results (those related to suicidality) are presented here ▪ methodological limitations: representativeness of sample not tested, predominantly Caucasian, exclusively inpatient, applicability of results to other groups unknown, limited statistical testing of the results, blinding unstated, no longitudinal or prospective analysis, no analysis of predictive power of tools. |

Table 1. Evidence table of appraised articles (continued).

| Study; design type; evidence grading; country | Intervention/ comparison Outcome measure | Criteria for Inclusion/ Exclusion | Results/Outcome | Comments including methodological issues |
|--|--|---|---|--|
| <p>(Osman et al. 2001)</p> <p>Case-control study</p> <p>Grade 2-</p> <p>Country: USA</p> | <p>Suicidal Behaviours Questionnaire – Revised (SBQ-R)</p> <p>c.f. standard suicide screening tool (see comments) and BHS.</p> | <p>Four groups studied:</p> <ol style="list-style-type: none"> 1. adult psychiatric inpatients 2. adolescent psychiatric inpatients 3. high-school students* 4. university students* <p>Group 1 Inclusion criteria: 120 consecutive admissions to a state psychiatric hospital.</p> <p>Exclusion criteria: Nil stated.</p> <p>Group 2 Inclusion criteria: 120 consecutive admissions to an adolescent unit at a state psychiatric hospital.</p> <p>Exclusion criteria: Nil stated.</p> <p>(*Inclusion/exclusion criteria and results for these groups are not presented in this table as these did not meet the inclusion criteria for this review).</p> <p>No timeframe reported for recruitment period.</p> | <p>Each group subdivided into suicidal or non-suicidal sub-group based on (for groups 1 and 2) recent history and/or serious threats of suicide attempts at time of admission to hospital. Group 1 suicidal subgroup n=51, non-suicidal subgroup n=69; group 2 suicidal subgroup n=53, non-suicidal subgroup n=67.</p> <p>All members of all suicidal subgroups scored 1 or higher on the screening tool assessment.</p> <p>SBQ-R total scores correlated significantly with age for group 1 (p<0.02); no correlation with age for group 2.</p> <p>SBQ-R total scores correlated significantly with Caucasian ethnicity for group 2 (p<0.034) but no correlation seen with group 1.</p> <p>Mean total SBQ-R score for group 1 suicidal subgroup was 11.18+/-3.99 c.f. 5.19+/-2.20 for non-suicidal subgroup (ANCOVA ‘statistically significant’ (p value not provided)).</p> <p>Mean total SBQ-R score for group 2 suicidal subgroup was 12.45+/-3.02 c.f. 5.46+/-2.41 for non-suicidal subgroup (ANCOVA p<0.001).</p> <p>Logistic regression analysis: Group 1; both BHS and SBQ-R adequately differentiated between suicidal and non-suicidal subgroups (BHS p<0.001, OR=1.56, 95%CI=1.27,1.92; SBQ-R p<0.001, OR=1.47, 95%CI=1.19,1.82) Group 2; SBQ-R only adequately differentiated between suicidal and non-suicidal subgroups (p<0.001, OR=2.19, 95%CI=1.65, 2.92).</p> <p>ROC analysis: Using SBQ-R single item (item 1 – past suicide attempts, cut-off score =2) to distinguish suicidal and non-suicidal subgroups; for group 1 has 0.80 sens, 0.97 spec, PPV 0.95, NPV 0.87; for group 2 has 1.00 sens, 0.96 spec, PPV 0.95, NPV 1.00.</p> <p>Using SBQ-R total score to distinguish suicidal and non-suicidal subgroups (cut-off score=8); for group 1 has 0.80 sens, 0.91 spec, PPV 0.87, NPV 0.86; for group 2 has 0.87 sens, 0.93 spec, PPV=0.90, NPV 0.99.</p> | <ul style="list-style-type: none"> ▪ study’s purpose is to develop screening tool to assess one risk factor for suicidality; i.e. previous suicidality ▪ data for the suicide screening tool’s validity briefly presented in this paper (further details <i>in press</i> to Journal of Clinical Psychology): validity based on significant (p<0.01) correlation with ASIQ and SPS ▪ suicide screening tool has 5 true-false items (measuring depressed affect, life stress, hopelessness, interpersonal conflict and satisfaction with recent life events) and 2 open-ended questions (intention to die, methods used) ▪ SBQ-R has 4 items: 1. lifetime suicide ideation and attempt(s) 2. frequency of suicidal ideation in past 12 months 3. threat of suicidal behaviour 4. self-reported likelihood of suicidal behaviour ▪ demographic characteristics group 1 (adult psych. inpatients): 65 male, 55 female; mean age 32.14 years (male), 33.47 years (female); 80% Caucasian; 4.2% married, 57.5% single or never married; psychiatric diagnosis schizophrenia (32.5%), major depression (16.7%), adjustment disorder (13.3%), other (37.5%) ▪ demographic characteristics group 2 (adolescent psych. inpatients): 65 male, 55 female; mean age 15.6 years (male), 15.6 years (female); 80% Caucasian; psychiatric diagnosis conduct disorder (33.3%), major depression (30.0%), oppositional defiant disorder (17.5%), other (11.2%) ▪ group 1 suicidal subgroup was significantly (p<0.05) older than the non-suicidal; MANCOVA controlling for age showed SBQ-R scores significantly (p<0.001) higher in suicidal subgroup ▪ group 2 suicidal subgroup was significantly (p=0.04) more likely to be Caucasian than the non-suicidal group; MANCOVA controlling for ethnicity showed SBQ-R scores significantly (p<0.001) higher in suicidal group ▪ methodological limitations (lack of inclusion and exclusion criteria, no information if eligible but not-enrolled participants existed, relatively small sample sizes, reliance on self-reporting suicidal behaviour as the source of information for sub-group formation and limited ethnic diversity, studying retrospective acts only) have resulted in a 2- rather than 2+ score. |

Table 1. Evidence table of appraised articles (continued).

| Study; design type; evidence grading; country | Intervention/ comparison Outcome measure | Criteria for Inclusion/ Exclusion | Results/Outcome | Comments including methodological issues |
|---|---|---|--|--|
| (Osman et al. 1996) Cross-sectional analysis Grade 2- Country: USA | Brief Reasons for Living Inventory for Adolescents (BRFL-A) c.f. SPS, Suicidal Behaviours Questionnaire (SBQ), Brief Symptom Inventory (BSI) & MMPI-A. | Inclusion criteria: Consecutive admissions (timeframe not given) to an inpatient adolescent unit at a state psychiatric hospital. Exclusion criteria: Low intellectual ability, severe psychosis, 'invalid MMPI-A protocols'. | 120 in study sample. 27 admissions due to actual suicide attempts and 30 due to serious threats and/or ideation. Relation of BRFL-A to other suicide assessment tools: BRFL-A subscales Fear of Social Disapproval and Fear of Suicide did not significantly correlate with any other tools. Survival and Coping Beliefs subscale scores significantly (all $p < 0.001$) correlated with SPS-Suicide Probability, SBQ-Suicide Ideation and SBQ-Suicide Likelihood scores. Responsibility to Family subscale scores significantly (all $p < 0.001$) correlated to SPS-Suicide Probability and SBQ-Suicide Likelihood scores. Moral Objections subscale scores correlated significantly with SPS-Suicide Probability ($p < 0.01$) and SBQ-Suicide Likelihood ($p < 0.05$) scores. When controlled for general psychological distress (using BSI scores), results for the Survival and Coping Beliefs and Responsibility to Family subscales remained statistically significant. Logistic regression analysis showed that combined use of BRFL-A and SPS had 84.2% sens & 88.9% spec (PPV & NPV not given) for correctly identifying nonsuicidal admission (n=63) from combined attempts, ideation, &/or threats group (n=57). | <ul style="list-style-type: none"> ▪ 2-part study: part one = details of construction of the novel tool (BRFL-A – results not included in this table) and part two validating this tool against established measures (results presented here) ▪ sample characteristics: male 50%, female 50%; mean age 16.05 +/-0.77 years, range 15-17; primary diagnosis major depression (n=21), conduct disorder (n=46), adjustment disorder with depressed mood (n=16), oppositional defiant disorder (n=19), adjustment disorder with mixed emotional features, alcohol abuse (n=10) ▪ internal validity data for BRFL-A, and validation with MMPI-A results not presented in this table ▪ methodological limitations: inpatient population only, no ethnicity data presented, limited analysis controlling for confounding variables, testing performed over long period of time (2 weeks), blinding of investigators to results not discussed. |
| (Pinto et al. 1998) Cross-sectional analysis Grade 2- Country: USA | RFL c.f. SIQ, Beck Depression Inventory (BDI) & Hopelessness Scale for Children (HSC). Outcome measures: 1. internal validity of RFL in adolescents 2. validity of RFL in differentiating suicidal from non-suicidal patients 3. validity between RFL and measures of suicidal ideation, hopelessness and depression. | Inclusion criteria: Consecutive in-patient admissions (timeframe not given) to a child and adolescent psychiatric unit. Exclusion criteria: Non-consent, psychosis, delirium, impaired intellectual ability, English as a second language. | 256 consented, 3 subsequently excluded due to incomplete data and a further 18 excluded due to exclusion criteria (see notes-methodological concerns). Review of records identified 40% (? of n=253) as suicide attemptors, 30% as suicide ideation, 30% as non-suicidal. MANOVA analysis showed non-suicidal and suicidal (i.e. attemptors and ideators) significantly differed in Survival and Coping Belief ($p < 0.01$), Responsibility to Family ($p < 0.05$), Moral Objections ($p < 0.05$) and total RFL scores ($p < 0.01$). Suicidal Ideators and Suicide attemptors significantly differed in Fear of Failure and Social Disapproval ($p < 0.05$) and Fear of Suicide ($p < 0.01$) scores. Pearson product-moment correlations between RFL factors and SIQ, HSC and BDI showed significant (all $p < 0.001$) correlation between Survival and Coping Beliefs, Responsibility to Family and Total RFL scores and SIQ, HSC and BDI scores. Fear of Failure and Social Disapproval, Moral Objections and Fear of Suicide factors significantly ($p < 0.001$) correlated with SIQ and HSC but not BDI. | <ul style="list-style-type: none"> ▪ mean age of study group (?n=256) 15.38 +/-1.05 years (range 13-18 years), ethnicity (?n=253) 64% Caucasian, 11% Afro-American, 2% Hispanic, 1% Asian, 21% did not answer ▪ all tests administered on same day ▪ due to poor goodness of fit, the factors Fear of Failure and Fear of Social Disapproval in the RFL were merged into a single factor Fear of Failure and Social Disapproval ▪ methodological limitations: unknown how many patients refused to give initial consent and whether these significantly differed from the study group in any way, psychiatric diagnoses for study group not given, ambiguous and inconsistent use of data with some analysis using a sample of 256, and other sample sizes not clearly specified, sparse description and no cross-validation of allocation process into subgroups, testing order and procedures not well described, blindness of analysis not described. |

Appendix 1: Search strategies

MEDLINE

- 1 suicide/ or suicide, attempted/ (23695)
- 2 exp Self-Injurious Behavior/ (3553)
- 3 suicid\$.tw. (23481)
- 4 parasuicid\$.tw. (401)
- 5 or/1-4 (35274)
- 6 exp Personality Tests/ (30393)
- 7 Psychological Tests/ (22774)
- 8 5 and (6 or 7) (1123)
- 9 limit 8 to (english language and yr=1990-2002) (542)
- 10 from 9 keep [SELECTED REFERENCES] (65)
- 11 ((assess\$ or valid\$) adj2 tool\$).tw. (5617)
- 12 5 and 11(23)
- 13 12 not 9 (20)
- 14 limit 13 to (english language and yr=1990-2002) (16)
- 15 from 14 keep 8-9 (2)
- 16 "Sensitivity and Specificity"/ (81124)
- 17 (5 and 16) not (14 or 9) (78)
- 18 limit 17 to (english language and yr=1990-2002) (76)
- 19 from 18 keep [SELECTED REFERENCES] (11)
- 20 *logistic models/ (413)
- 21 *psychiatric status rating scales/ (4843)
- 22 (5 and (20 or 21)) not (18 or 14 or 9) (101)
- 23 limit 22 to (english language and yr=1990-2002) (53)
- 24 from 23 keep [SELECTED REFERENCES] (9)
- 25 24 or 19 or 15 or 10 (87)
- 26 beck.tw. (2574)
- 27 kiddie sads.tw. (17)
- 28 k-sads.tw. (49)
- 29 sbq.tw. (14)
- 30 csrli.tw. (1)
- 31 reason for living.tw. (8)
- 32 sad-person\$.tw. (9)
- 33 risk-rescue.tw. (8)
- 34 harvard.tw. (1346)
- 35 harkavy\$.tw. (5)
- 36 asnis gm.au. (99)
- 37 suicidal behaviors questionnaire.tw. (8)
- 38 or/26-37 (4125)
- 39 (5 and 42) not (9 or 14 or 18 or 23) (152)
- 40 limit 39 to (english language and yr=1990-2002) (87)
- 41 from 40 keep [SELECTED REFERENCES] (17)
- 42 25 or 41 (104)

EMBASE

- 1 Suicide/ (7898)
- 2 suicidal behavior/ or self poisoning/ or suicide attempt/ (5688)
- 3 Automutilation/ (1878)
- 4 suicid\$.tw. (13683)
- 5 parasuicid\$.tw. (274)
- 6 or/1-5 (18587)
- 7 psychologic assessment/ (4184)
- 8 reliability/ (16939)
- 9 "sensitivity and specificity".mp. (18050)
- 10 validation process/ (9082)
- 11 personality test/ (1210)
- 12 or/7-11 (46296)
- 13 6 and 12 (326)
- 14 limit 13 to (english language and yr=1990-2002) (299)
- 15 from 14 keep [SELECTED REFERENCE] (17)
- 16 beck.tw. (2017)
- 17 kiddie sads.tw. (14)
- 18 k-sads.tw. (50)
- 19 sbq.tw. (32)
- 20 csrli.tw. (1)
- 21 reasons for living.tw. (51)
- 22 sad-person.tw. (0)
- 23 risk-rescue.tw. (7)
- 24 harvard.tw. (574)
- 25 harkavy\$.tw. (1)
- 26 asnis g\$.au. (62)
- 27 suicidal behaviors questionnaire.tw. (6)
- 28 or/16-27 (2792)
- 29 (6 and 28) not 14 (197)
- 30 limit 29 to (english language and yr=1990-2002) (170)
- 31 from 30 keep [SELECTED REFERENCES] (14)
- 32 17 or 34 (31)

CINAHL

- 1 suicide, attempted/ or suicide/ or "suicide prevention (iowa nic)"/ (1848)
- 2 Suicidal Ideation/ (212)
- 3 suicid\$.tw. (2193)
- 4 parasuicid\$.tw. (38)
- 5 Injuries, Self-Inflicted/ (222)
- 6 or/1-5 (3026)
- 7 exp Research Instruments/ (71427)
- 8 Psychological Tests/ (5981)
- 9 Clinical Assessment Tools/ (9439)
- 10 "Sensitivity and Specificity"/ (2629)
- 11 or/7-10 (73152)
- 12 6 and 11 (496)
- 13 limit 12 to (english and yr=1990-2002) (486)
- 14 from 13 keep [SELECTED REFERENCES] (7)
- 15 beck.tw. (1137)
- 16 kiddie sads.tw. (7)
- 17 k-sads.tw. (10)
- 18 sbq.tw. (11)
- 19 csrli.tw. (0)

- 20 reasons for living.tw. (7)
- 21 sad-person.tw. (0)
- 22 risk-rescue.tw. (1)
- 23 harvard.tw. (136)
- 24 suicidal behavior questionnaire.tw. (1)
- 25 asnis g\$.au. (2)
- 26 or/15-25 (1296)
- 27 (6 and 26) not 13 (2)
- 28 limit 27 to yr=1990-2002 (1)
- 29 from 28 keep [SELECTED REFERENCES] (1)
- 30 14 or 29 (8)

PSYCHINFO

- 1 attempted suicide/ or suicidal ideation/ or suicide/ or suicide prevention/ (12930)
- 2 self destructive behavior/ or self mutilation/ (2026)
- 3 suicid\$.tw. (19275)
- 4 parasuicid\$.tw. (497)
- 5 or/1-4 (21153)
- 6 clinical psychological testing.cc. (18253)
- 7 test validity/ (21555)
- 8 test reliability/ (14249)
- 9 questionnaires/ (6343)
- 10 exp Rating Scales/ (10884)
- 11 or/6-10 (45219)
- 12 5 and 11 (479)
- 13 limit 12 to (english language and yr=1990-2002) (280)
- 14 from 13 keep [SELECTED REFERENCES] (109)

CURRENT CONTENTS

- 1 suicid\$.mp. (13306)
- 2 parasuicid\$.mp. (351)
- 3 deliberate self harm.mp. (230)
- 4 or/1-3 (13437)
- 5 validity.mp. (49224)
- 6 reliability.mp. (46853)
- 7 psychological test\$.mp. (819)
- 8 assessment.ti. (45274)
- 9 "sensitivity and specificity".tw. (11584)
- 10 tool\$.ti. (17466)
- 11 questionnaire\$.ti. (4046)
- 12 or/5-11 (157949)
- 13 4 and 12 (638)
- 14 limit 13 to english language (616)
- 15 from 14 [SELECTED REFERENCES] (40)
- 16 beck.tw. (2182)
- 17 kiddie sads.tw. (11)
- 18 k-sads.tw. (47)
- 19 sbq.tw. (51)
- 20 csrli.tw. (1)
- 21 reasons for living.tw. (48)
- 22 sad-person.tw. (0)
- 22 risk-rescue.tw. (6)

- 23 harvard.tw. (1339)
- 24 harkavy\$.tw. (17)
- 25 asnis g\$.au. (22)
- 26 suicidal behaviors questionnaire.tw. (7)
- 27 or/16-26 (3714)
- 28 (4 and 27) not 14 (169)
- 29 limit 28 to english language (162)
- 30 from 29 keep [SELECTED REFERENCES] (5)
- 31 15 or 33 (45)

Appendix 2: Bibliography of included studies

INCLUDED, CRITICALLY APPRAISED STUDIES

Beck, A. T., Brown, G. K., Steer, R. A., Dahlsgaard, K. K., & Grisham, J. R. (1999). Suicide ideation at its worst point: A predictor of eventual suicide in psychiatric outpatients. *Suicide & Life-Threatening Behavior*, 29.

Beck, A. T., Brown, G. K., & Steer, R. A. (1997). Psychometric characteristics of the Scale for Suicide Ideation with psychiatric outpatients. *Behaviour Research & Therapy*, 35, 1039-1046.

Glassmire, D. M., Stolberg, R. A., Greene, R. L., & Bongar, B. (2001). The utility of MMPI-2 suicide items for assessing suicidal potential: Development of a suicidal potential scale. *Assessment*, 8, 281-290.

Gutierrez, P. M., Osman, A., Kopper, B. A., & Barrios, F. X. (2000). Why young people do not kill themselves: the reasons for living inventory for adolescents. *Journal of Clinical Child Psychology*, 29, 177-187.

Horowitz, L. M., Wang, P. S., Koocher, G. P., Burr, B. H., Smith, M. F., Klavon, S., & Cleary, P. D. (2001). Detecting suicide risk in a pediatric emergency department: development of a brief screening tool. *Pediatrics*, 107, 1133-1137.

King, C. A., Katz, S. H., Ghaziuddin, N., Brand, E., Hill, E., & McGovern, L. (1997). Diagnosis and assessment of depression and suicidality using the NIMH Diagnostic Interview Schedule for Children (DISC-2.3). *Journal of Abnormal Child Psychology*, 25, 173-181.

Nimeus, A., Alsen, M., & Traskman-Bendz, L. (2000). The Suicide Assessment Scale: an instrument assessing suicide risk of suicide attempters. *European Psychiatry*, 15, 416-423.

Osman, A., Bagge, C. L., Gutierrez, P. M., Konick, L. C., Kopper, B. A., & Barrios, F. X. (2001). The Suicidal Behaviors Questionnaire-Revised (SBQ-R): Validation with clinical and nonclinical samples. *Assessment*, 8, 443-454.

Osman, A., Kopper, B. A., Linehan, M. M., Barrios, F. X., Gutierrez, P. M., & Bagge, C. L. (1999). Validation of the Adult Suicidal Ideation Questionnaire and the Reasons for Living Inventory in an adult psychiatric inpatient sample. *Psychological Assessment*, 11, 115-123.

Osman, A., Kopper, B. A., Barrios, F. X., Osman, J. R., Besett, T., & Linehan, M. M. (1996). The brief reasons for living inventory for adolescents (BRFL-A). *Journal of Abnormal Child Psychology*, 24, 433-443.

Pinto, A., Whisman, M. A., & Conwell, Y. (1998). Reasons for living in a clinical sample of adolescents. *Journal of Adolescence*, 21, 397-405.

Prinstein, M. J., Nock, M. K., Spirito, A., & Grapentine, W. L. (2001). Multimethod assessment of suicidality in adolescent psychiatric inpatients: preliminary results. *Journal of the American Academy of Child & Adolescent Psychiatry*, 40, 1053-1061.

Rudd, M. D., & Rajab, M. H. (1995). Use of the modified scale for suicidal ideation with suicide ideators and attempters. *Journal of Clinical Psychology*, 51, 632-635.

Appendix 3: Bibliography of excluded studies

EXCLUDED, RETRIEVED STUDIES

Aish, A. M., & Wasserman, D. (2001). Does Beck's Hopelessness Scale really measure several components? *Psychological Medicine*, 31, 367-372.

No comparison of one tool (BHS) against another tool. Does present interesting data suggesting that this tool could be shortened from the original list of 20 items to 4 items, or even 1 item ('the future looks dark to me'), from the confirmatory factor analysis.

Archer, R. P., & Slesinger, D. (1999). MMPI-A patterns related to the endorsement of suicidal ideation. *Assessment*, 6, 51-59.

No comparison of one tool (MMPI-A) against another tool.

Cochrane-Brink, K. A., Lofchy, J. S., & Sakinofsky, I. (2000). Clinical rating scales in suicide risk assessment. *General Hospital Psychiatry*, 22, 445-541.

Sample size too small for inclusion (106 eligible, 55 enrolled and 28 completed full study).

Cotton, C. R., & Range, L. M. (1992). Reliability and validity of the suicide intervention response inventory. *Death Studies*, 16, 79-86.

Only one tool studied and sample population were trainee counsellors.

Goldstein, R. B., Black, D. W., Nasrallah, A., & Winokur, G. (1991). The prediction of suicide. Sensitivity, specificity, and predictive value of a multivariate model applied to suicide among 1906 patients with affective disorders. *Archives of General Psychiatry*, 48, 418-422.

Study population is exclusively those with affective disorders. Analysis of a statistical model based on risk factors showed no ability to predict subsequent attempts.

Gutierrez, P. M., Rodriguez, P. J., & Garcia, P. (2001). Suicide risk factors for young adults: Testing a model across ethnicities. *Death Studies*, 25, 319-340.

Focus of study is inter-ethnic differences in reporting rates using various tools rather than the relative efficacy of each tool.

Ivanoff, A., Sung Joon, J., Smyth, N. J., & Linehan, M. M. (1994). Fewer reasons for staying alive when you are thinking of killing yourself: The brief reasons for living inventory. *Journal of Psychopathology & Behavioral Assessment*, 16, 1-13.

Study population is exclusively criminal offenders.

Koslowsky, M., Bleich, A., Greenspoon, A., Wagner, B., Apter, A., & Solomon, Z. (1991). Assessing the validity of the Plutchik Suicide Risk Scale. *Journal of Psychiatric Research*, 25, 155-158.

Sample size too small for inclusion (n=80).

Lall, R., Bongar, B., Johnson, W. B., Jain, V. K., & Mittauer, M. W. (1999). Efficacy of the Millon Clinical Multiaxial Inventory--II in discriminating mental health patients with and without suicidal ideation. *Military Psychology*, 11, 423-432.

No comparison of one tool – the Millon Clinical Multiaxial Inventory-II – with another tool.

Larzelere, R. E., Smith, G. L., Batenhorst, L. M., & Kelly, D. B. (1996). Predictive validity of the suicide probability scale among adolescents in group home treatment. *Journal of the American Academy of Child & Adolescent Psychiatry*, 35, 166-172.

No comparison of one tool (SPS) against another. Study shows some predictive validity for SPS (at $p<0.05$) in predicting future suicide attempts in a group of 855 adolescents in residential care.

Neimeyer, R. A., & Bonnelle, K. (1997). The Suicide Intervention Response Inventory: a revision and validation. *Death Studies*, 21, 59-81.

Focus of study was on improving discriminatory power of tool for counsellors: sample size too small (n=31) and participants were counsellors.

Pfeffer, C. R., Jiang, H., & Kakuma, T. (2000). Child-Adolescent Suicidal Potential Index (CASPI): A screen for risk for early onset suicidal behavior. *Psychological Assessment*, 12, 304-318.

Study population was too young; over 50% were aged 12 years or less.

Osman, A., Gutierrez, P. M., Kopper, B. A., Barrios, F. X., & Chiros, C. E. (1998). The positive and negative suicide ideation inventory: development and validation. *Psychological Reports*, 82, 783-793.

Study population was undergraduate psychology students.

Reynolds, W. M., & Mazza, J. J. (1999). Assessment of suicidal ideation in inner-city children and young adolescents: Reliability and validity of the suicidal ideation questionnaire-JR. *School Psychology Review*, 28, 17-30.

Sample size too small for inclusion (n=91).

Sidley, G. L., Calam, R., Wells, A., Hughes, T., & Whitaker, K. (1999). The prediction of parasuicide repetition in a high-risk group. *British Journal of Clinical Psychology*, 38, 375-386.

Sample size too small for inclusion (n=66). Using the assessment tools of the Autobiographical Memory Test, the Personal Future Test and the Beck Hopelessness Scale the best predictor was the latter with little improvement adding in the other two scores.

Uncapher, H., & Sandberg, D. A. (1998). Using the Geriatric Depression Scale to detect suicidal ideation in inpatient older adults. *Journal of Clinical Geropsychology*, 4, 349-358.

Sample size too small for inclusion (n=60).

Van Gastel, A., Schotte, C., & Maes, M. (1997). The prediction of suicidal intent in depressed patients. *Acta Psychiatrica Scandinavica*, 96, 254-259.

Study population exclusively had affective disorder (depression). Comparison of the Hamilton Depression Rating Scale, Beck Depression Inventory and Zung Self-Rating Depression and Anxiety Scales in a group of 338 patients showed that suicidal ideation was significantly related to severity of depression.

Watson, D., Goldney, R., Fisher, L., & Merritt, M. (2001). The measurement of suicidal ideation. *Crisis*, 22, 12-14.

Too small sample size studied (n=39) for inclusion.

Westefeld, J. S., & Liddell, D. L. (1994). The Beck Depression Inventory and its relationship to college student suicide. *Journal of College Student Development*, 35, 145-147.

No comparison of one tool (BDI) against another.

Yeaworth, R. C., McNamee, M. J., & Pozehl, B. (1992). The Adolescent Life Change Event Scale: its development and use. *Adolescence*, 27, 783-802.

Expert opinion review of the Adolescent Life Change Event Scale: very small amount of data presented regarding suicide and all published in 1980s.

Appendix 4: Background papers

The following papers were reviewed for background purposes only:

Brown, G.K. [2001]. *A review of suicide assessment measures for intervention research with adults and older adults. Technical report submitted to MINH under Contract No. 263-MH-914950.* Bethesda, MD: US National Institute for Mental Health.

Cheung, P. (1992). Suicide precautions for psychiatric inpatients: a review. *Australian & New Zealand Journal of Psychiatry*, 26, 592-598.

Goldston, D. (2000). *Assessment of suicidal behaviors and risk among children and adolescents. Technical report submitted to NIMH under Contract No. 263-MD-909995.* Bethesda, MD: US National Institute for Mental Health.

Jobes D. A., Eyman J. R., and Yufit R. I. (1995). How clinicians assess suicide risk in adolescents and adults. *Crisis Intervention*, 2, 1-12.

Kreitman, N., & Foster, J. (1991). The construction and selection of predictive scales, with special reference to parasuicide. *British Journal of Psychiatry*, 159, 185-192.

Motto, J. A., Heilbron, D.C., and Juster, R.P. (1985). Development of a clinical instrument to estimate suicide risk. *American Journal of Psychiatry*, 142, 680-686.

Range, L. M., & Knott, E. C. (1997). Twenty suicide assessment instruments: evaluation and recommendations. *Death Studies*, 21, 25-58.