

ZSA

Resources

Evidence Review 4 Risk Management and Screening Tools

Introduction to the ZSA Resources and the Evidence Reviews developed by the Health Innovation Network

The Zero Suicide Alliance (ZSA) secured funding from the Department of Health and Social Care to develop a world leading 'ZSA Resources' digital suicide prevention resource for its members that work across all sectors engaged with or influenced by suicide prevention.

The ZSA Resources are based on our core belief that everyone, everywhere, in every population can take action to promote good mental health, and prevent mental ill health and suicide.

The content of the ZSA Resources has therefore a very practical focus: to constantly seek out the needs of our membership, and to provide members with the resources and implementation tools they tell us they need, to turn their ambition into action. These resources include easy access evidence briefings, new accessible data, visualised into maps of their local area, live examples of implementation solutions in practice, peer learning and support networks, 'help' clinics, virtual conferences and webinars, and links to international communities of practice, research, innovation, and more.

To develop our resource, the ZSA initially commissioned our ZSA Alliance partner, the Health Innovation Network, to undertake a stakeholder consultation of people from each of our membership sectors to identify their needs. This report is available here:

www.zerosuicidealliance.com/ZSA-Resources/introduction/zsa-evidence-briefings

The Health Innovation Network (HIN) is the Academic Health Science Network (AHSN) for south London, one of 15 AHSNs across England. As the bodies that connect NHS and academic organisations, local authorities, the third sector and industry, they are catalysts that create the right conditions to facilitate change across whole health and social care economies, with a clear focus on improving outcomes for patients. The HIN is therefore perfectly placed to identify and spread health innovation at pace and scale; driving the adoption and spread of innovative ideas and technologies across large populations.

At the request of our members, ZSA commissioned the HIN to undertake research, bring together experts, and produce a series of evidence briefings on the state of knowledge in a number of key suicide prevention areas. Rigorous desk top research took place over a period of 10.5 weeks mid May 2019 – 2 August 2019. All sections were subsequently reviewed by relevant Virtual Steering Group members. The information sources in this report are correct at time of research.

The Evidence Reviews will be continuously updated as new knowledge becomes available, and to include the impacts of COVID-19. We will reach out to our members and Alliance partners to secure feedback on how the resources are used, how they can be updated and how they can be improved to support action.

We very much hope you find these briefings useful. Please continue to tell us how we can help you save lives, to get in touch please visit: www.zerosuicidealliance.com/get-involved/contact-us

Introduction

This chapter provides an overview of screening and risk assessment tools for both the general population and specific groups. This chapter is structured as follows:

- Methodology
- Findings:
 - General concepts
 - General populations
 - Custodial populations
 - Veterans and army personnel
 - Adolescents
 - Older adults
 - LGBT+ populations
 - Online tools
- Commentary on the available evidence

Methodology

There is a large number of screening and risk assessment tools available online. To avoid including tools that had not been evaluated Google searches were not conducted and, instead, systematic reviews on screening and risk assessment tools were searched. The following systematic reviews were inspected:

- Runeson et al. (2017)'s systematic review on suicide risk assessment tools
- O'connor et al. (2013)'s systematic review on suicide screening in primary care
- Gould et al. (2018)'s systematic review of offenders for prison populations
- Nelson et al. (2017)'s systematic review of suicide risk assessment and prevention among veterans
- Batterham et al. (2015)'s systematic review and evaluation of measures of suicidal ideation
- Zalsman et al. (2016)'s global review on suicide prevention- only those tool with the level of evidence according the Oxford criteria were inspected to identify resources that had been evaluated in adolescents and older adults
- Lapierre et al. (2017)' systematic review of elderly suicide prevention programmes

Findings

General concepts

Some general concepts that are used throughout the findings sections are described below in order to facilitate understanding - definitions are taken from Lalkhen and McCluskey (2008),

- **Sensitivity:** proportion of people at risk/who will go on to attempt/complete suicide that are identified by the tool
- **Specificity:** proportion of people NOT at risk that are correctly identified as NOT at risk by the tool
- **Positive predictive value (PPV):** likelihood that a person at risk/who will go on to attempt/complete suicide screens positive
- **Negative predictive value (NPV):** likelihood that a person NOT at risk screens negative.

Sensitivity and specificity values are provided for most of the tools described below (with data on NPV and PPV provided when available).

General tools are presented first followed by tools for prison populations, veterans and army personnel, adolescents and older adults and a brief commentary on the lack of tools for LGBT+ populations and one risk that might be associated with online self report tools.

Commentary on the available evidence

The National Confidential Inquiry into Suicide and Safety in Mental Health (NCISH) find that the majority of patient suicide deaths occur in people not deemed to be at high risk at their last clinical review. There is substantial evidence to indicate risk assessment tools used in mental health should not be used to predict future suicidal behaviour or to determine who will be offered treatment.

Last year the NCISH recommended that, if used, any risk assessment tools should be part of a wider assessment process. The report's recommendations stated: 'The management of risk should be personal and individualised, but it is one part of a whole system approach that should aim to strengthen the standards of care for everyone, ensuring that supervision, delegation and onward referral are all managed safely'. The National Institute for Health and Care Excellence (NICE) guidelines on the long term management of self harm, state risk assessment tools and scales should not be used to predict future behaviour.

General populations

There are a large number of suicide screening/risk assessment tools available. To facilitate understanding, tools are classified based on the setting in which they were evaluated:

- primary care- table 1
- specialist mental health care- table 2
- emergency care- table 3

Tables 1,2 and 3, below provide information on the sensitivity, specificity, positive predictive value, (PPV) negative predictive value (NPV) (when available) and sample populations of suicide screening tools. In addition, for those tools included in Runeson et al. (2017)'s review, the quality of available evidence (according to the GRADE criteria) for each tool is stated. Note that this refers to the certainty of evidence around the estimates specificity, selectivity, PPV and NPV and not to the quality of the tool itself (for example, low quality of evidence around high selectivity of a tool does not mean that selectivity is low, but only that additional studies might not replicate the results).

These tables also include information on the type of data that was used to validate the results:

- suicide attempts
- completed suicides
- other screening tools/clinical interviews

Table 1: Tools evaluated in primary care

Tool	Sensitivity (95%CI)	Specificity (95%CI)	PPV (95%CI)	NPV (95%CI)	Study	Population; N	Data used to validate the tool	Strength of evidence (Runeson 2017)
SRS	87 (80.2-92.6)	60 (55.1-64.3)	37.8 (32.2-43.6)	94.4 (91-96.8)	(Thompson and Eggert, 1999)	Primary care patients aged 18-70 (n=1001)	Other screening tools/ clinical interviews	N/A
GDS- cut score >=1	79.7 (68.3-88.4)	80.4 (76.9-83.6)	33.5 (26.4-41.3)	97 (95-98.3)	(Heisel et al., 2010)	Primary care patients 65-95 (n=626)	Other screening tools/ clinical interviews	N/A
GDS- cut score >=2	55.1 (42.6-67.1)	92.8 (90.3 - 94.8)	48.7 (37.2-60.3)	94.3(92.1-96-1)	(Heisel et al., 2010)	Same as above	Other screening tools/ clinical interviews	N/A
GDS- cut score >=3	34.8 (23.7-47.2)	97.8 (96.2-98.9)	66.7 (49-81.4)	92.4 (89.9-94.4)	(Heisel et al., 2010)	Same as above	Other screening tools/ clinical interviews	N/A

Adapted from O'Connor et al. (2013). GDS-Geriatric Depression Score (Suicidal ideation); SRS- Suicide Risk Screen

Table 2: Tools evaluated in mental health

Tool	Sensitivity (95%CI)	Specificity (95%CI)	PPV (95%CI)	NPV (95%CI)	Study	Population; N	Data used to validate the tool	Strength of evidence (Runeson 2017)
BHS (4 studies)	89 (78, 95)	42 (40, 43)	N/A	N/A	Nimeus et al., 1997/Keller and Wolfersdord 1993/ Beck et al., 1990/ Beck et al., 1999	Psychiatric outpatients; n= 5 932	Suicide number; 62 suicides in 5932 people	Moderate
BDI	76 (50, 93)	62 (60,65)	N/A	N/A	Beck et al. 2006	Psychiatric outpatients; n= 1 944	Suicide number; 17 suicides in 1944 people	Low
SSI-C	53 (34, 72)	83 (82, 84)	N/A	N/A	Beck et al. 1999	Psychiatric outpatients; n=3 701	Suicide number; 30 suicides in 3701 people	Low
SSI-W	80 (61, 92)	78 (77, 79)	N/A	N/A	Beck et al. 1999	Psychiatric outpatients; n=3 701 / 30	Suicide number; 30 suicides in 701 people	Moderate
SIS	59 (36, 79)	77 (74, 81)	N/A	N/A	Niméus et al., 2002	Adolescents and adults with recent serious attempt of suicide; n= 555	Suicide number; 22 suicides in 555 people	Very Low
SIS	76 (62, 87)	49 (47, 51)	N/A	N/A	Harriss and Hawton (2005)	Adolescents and adults presenting after self harm / suicide attempt; n= 719	Suicide number; 54 suicides in 719 people	Low

Tool	Sensitivity (95%CI)	Specificity (95%CI)	PPV (95%CI)	NPV (95%CI)	Study	Population; N	Data used to validate the tool	Strength of evidence (Runeson 2017)
SAD PERSONS Scale (2 studies)	15 (8, 24)	97 (96, 98)	N/A	N/A	Bolton et al., 2012 and Sidley et al. 1999	Self-harm/ adult psychiatric emergency departments; n= 972 /471	Suicide attempts; 471 attempts in 972 people	Strong
Modified SAD PERSONS Scale	29 (19, 40)	89 (88, 90)	N/A	N/A	Bolton et al. 2012	Adult psychiatric emergency departments; n= 2 713	Suicide attempts; 76 attempts in 2713 people	Low
MINI Suicide module	61 (47, 73)	75 (69, 80)	N/A	N/A	Roakset et al. 2012	Acute psychiatric emergency departments, all ages; n= 307	Suicide attempts; 64 attempts in 307 people	Low
ERRS	26 (20, 33)	84 (82, 86)	N/A	N/A	Carter et al. 2002	Self-harm/suicide attempt, adults; n= 1 317	Suicide attempts; 180 attempts in 1317 people	Moderate
SPS	48 /29, 67)	80 (77, 83)	N/A	N/A	Larzelere et al. 1996	Children/adolescents, victims of abuse/ behavioural disorders=834	Suicide attempts; 29 attempts in 834 people	Low

Adapted from Runeson et al. (2017)'s. BHS- Beck's Hopelessness Scale, BDI-Beck Depression inventory, SSI-C- Scale for Suicide Ideation–Current, SSI-W-Scale for Suicide Ideation–Worst, SIS-Beck's Suicide Intent Scale; SAD PERSONS Scale, Modified SAD PERSONS Scale, MINI Suicide Module, ERRS-Edinburgh Risk of Repetition Scale, SPS-Suicide Probability Scale.

Table 3: Tools evaluated in emergency

Tool	Sensitivity (95%CI)	Specificity (95%CI)	PPV (95%CI)	NPV (95%CI)	Study	Population; N	Data used to validate the tool	Strength of evidence (Runeson 2017)
ReACT	90 (82, 95)	17 (18, 18)	N/A	N/A	Steeg et al 2012	Self harm, adolescents and adults; n= 18 680 / 92	Suicide number; 92 suicides in 18680 people	Moderate
ReACT	94 (93, 94)	24 (23, 25)	N/A	N/A	Steeg et al 2012	Self harm, adolescents and adults; n=18 680 / 92	Suicide attempts; 92 attempts in 18680 people	Moderate
MSHR (5 studies)	97 (96, 97)	20 (20, 21)	N/A	N/A	Cooper et al. 2006, Randall et al 2012, Steeg et al 2012, Bilen et al., 2013a and Bilen et al 2013b	Self harm/suicide attempts/suicide, adults; n= 29 772/9523	Suicide attempts; 9523 attempts in 29772 people	Strong
SOS-4 (2 studies)	90 (86, 93)	17 (15, 19)	N/A	N/A	Bilen et al., 2013a and Bilen et al 2013b	Deliberate self harm/suicide attempt, adults; n= 1 849	Suicide attempts; 389 attempts in 1849 people	Strong

Adapted from. Runeson et al. (2017)'s. SOS-4 Sodersjukhuset Self Harm Rule;), ReACT -Recent Self harm in the past year–Alone or homeless, Cutting used as a method, Treatment for a psychiatric disorder; MSHR- Manchester Self Harm Rule.

Custodial populations

In their systematic review of screening tools for use in prison populations, Gould et al. (2018) suggest that the most effective tools in identifying those at risk are the VISCI and Dutch tools. However, they also stress that these tools only have one or two studies supporting their effectiveness and that these studies analysed sensitivity and specificity based on the application of these tools to inmate records rather than on a clinical assessment. The characteristics of these two resources are described in more detail below while the reader is referred to Gould et al. (2018) for information on additional tools. The authors highlight the poor quality of evidence and general lack of validation of the available tools and the fact that the two promising tools described above have not been tested in English speaking countries.

Table 4: Screening tools for custodial populations

Instrument (no. of studies)	Country	N	Domains assessed	Study	Validity
VISCI	28 prisons in Austria	165; 55 suicides; 110 controls Remand and sentenced	Demographic info, Suicidal ideation, psychiatric diagnoses, family history, previous offences	Frottier et al. 2009	sensitivity/ specificity: 96%/ 52%
Dutch Screening tool	Prison in the Netherlands	9 5 suicides; 221 interviews	Drug use, no fixed address, mental health disorders, suicide attempts, age 40+	Blaauw et al. 2001	This study used records to design the tool
Dutch Screening tool	Pre-trial detention setting: Berlin, Germany	60 (30 cases, 30 control)	Drug use, no fixed address, mental health disorders, suicide attempts, age 40+	Dahle et al. 2005	Sensitivity: 70%; Specificity: 93%; PPP: 64%; NPP: 82%*

Adapted from Gould et al (2018); VISCI (Viennese Instrument for Suicidality in Correctional Institutions)

Veterans and army personnel

Five of the studies included in Nelson et al. (2017) assessed screening tools in veteran/army personnel populations. The results of these studies are presented below - note that the HIN was unable to access Hartl et al (2005) in full text and therefore the information below is based on the abstract. It must be noted that the authors of the review suggest that risk assessment methods have been shown to be sensitive predictors of subsequent suicide and suicide attempts, but the frequency of false positives limits their clinical utility.

Table 5: Veterans and army personnel population screening tools

Instrument (no. of studies)	Population	Types of analysis	N	Study	Results
PAI	Veterans with traumatic brain injury	Retrospective analysis of record	154	Breshears et al. 2010	Cut off score of ≥ 11 yielded specificity of 86. and a sensitivity of 100.0 and generated 20 (14%) false positives.
ASQ	Veterans	Questionnaire on admission	240	Hendin et al. 2010	The ASQ had a sensitivity of 60% for predicting suicidal behaviour over the follow up period, and specificity of 74%
Army STARRS	Hospitalised soldiers	Machine learning algorithm based on records of hospitalised soldiers	53,769	Kessler et al. 2015	Sensitivity and specificity nor reported but 52.9% of suicides occurred after the 5% of hospitalisations with highest predicted risk.
Predictive Modelling and Concentration of the Risk of Suicide	Patients of the veteran health administration	Algorithm based on records	5 969 662	McCarthy et al. 2015	Sensitivity and specificity not reported but modelling demonstrated that suicide rates were 82 and 60 times greater than the rate in the overall sample in the highest 0.01% stratum for calculated risk for the development and validation samples, respectively; 39 and 30 times greater in the highest 0.10%; 14 and 12 times greater in the highest 1.00%; and 6.3 and 5.7 times greater in the highest 5.00%.

PAI- Personality Assessment Inventory, Army STARRS; Army STARRS Army Study to Assess Risk and Resilience in Servicemembers; ASQ- Affective States Questionnaire

It must also be explained that studies based on records (either retrospective analysis or algorithm) might not be as applicable to a real world setting as those based on prospective examination of outcomes after questionnaire completion.

Adolescents

Zalsman et al. (2016)'s global review on suicide prevention includes several studies on suicide screening in adolescent populations. Randomised or quasi-randomised trials with a degree of evidence of 1b or above according to the Oxford criteria (Centre for Evidence-Based Medicine, 2009) were inspected: Gould et al. (2005), Kaess et al. (2014) and King et al. (2012). These studies did not assess the sensitivity or specificity of screening tools but inspecting them allowed us to identify the following tools:

Table 6: Tools for adolescent populations

Instrument (no. of studies)	Country	N	Study	Results
CSS	US	1729 (14 -17 year olds)	Shaffer et al. 2004	The most balanced algorithm had a sensitivity of 0.75, specificity 0.83, and positive predictive value 16%.
SIQ	US	121 (14-18-year olds)	Reynolds, 1991	Sensitivity ranging from 83% to 100%, with specificity from 49% to 70%.
SRS	US	581	Thompson and Eggert (1999)	The Suicide Risk Screen's use among 581 students in 7 high schools had a sensitivity ranging from 87% to 100%, with specificity from 54% to 60%.

CSS- Columbia Suicide Screen, SIQ- Suicidal Ideation Questionnaire, SRS- Suicide Risk Screen

Data from Posner et al. (2011) relating to Columbia Suicide Severity Rating Scale, which has been validated in adolescents could not be extracted (note that this is different to the Columbia Suicide Screen). The reader is therefore referred to this article for further information.

Older adults

The HIN identified one tool specifically designed for and validated for older adults. The characteristics of this tool across three different cut off scores are presented in table 7 below.

Table 7: Characteristics of three different cut offs of GDS tool for older adults

Tool	Positive test result (%)	Sensitivity (95%CI)	Specificity (95%CI)	PPV (95%CI)	NPV (95%CI)	Study	Population; N
GDS-cut score ≥ 1	26.2	79.7 (68.3-88.4)	80.4 (76.9-83.6)	33.5 (26.4-41.3)	97 (95-98.3)	(Heisel et al., 2010)	Primary care patients 65-95
GDS-cut score ≥ 2	12.5	55.1 (42.6-67.1)	92.8 (90.3 - 94.8)	48.7 (37.2-60.3)	94.3(92.1-96-1)	(Heisel et al., 2010)	Same as above
GDS-cut score ≥ 3	5.8	34.8 (23.7-47.2)	97.8 (96.2-98.9)	66.7 (49-81.4)	92.4 (89.9-94.4)	(Heisel et al., 2010)	Same as above

Adapted from Runeson et al. (2017)'s. GDS - Geriatric Depression Score (Suicidal ideation).

Oyama et al. (2010), Oyama et al. (2008) and Oyama et al. (2005) suggest that a combination of community based depression screening and follow up is effective in reducing suicide rates in elderly populations with high suicide prevalence rates. However, they do not report on the sensitivity or specificity of the screening tools they employed.

LGBT+ populations

The HIN could not find any screening tools specifically designed for assessing risk in LGBT+ populations or validated in this group. In their article on the initial mental health assessment of LGBT+ service users, Moe et al. (2015) also suggest that there is a lack of tools specific to this population.

Online tools

In light of the increased popularity of online self report suicide screening tools, the challenges associated with the assessment of risk online must be taken into account. For example, analysing three independent samples of undergraduate students, Podlogar et al. (2016) suggest that those who did not disclose whether they experience "current on suicidal thoughts" might be a particularly high risk group. They also suggest that flagging up and following up on this group might be a way of increasing the sensitivity of these online tools.

Commentary on the available evidence

Some recurrent themes were found across the inspected reviews (and were also raised by a member of the project's virtual steering group):

- There is a challenge in terms of striking the right balance between high sensitivity (to avoid high risk individuals not being flagged up) and high specificity (to avoid wasting limited resources on low risk individuals who screen positive)
- The available evidence is context specific. Sensitivity, specificity, PPV and NPV are dependent on the sample population, the selected cut off score and the data used to validate the tool (suicide data vs comparison with a previously validated tool/clinical interviews)
- It is also likely that studies assessing tools by retrospectively examining records and those based prospective examination of outcomes after questionnaire completion will yield different results
- Even in the context of high sensitivity, care must be taken to not to immediately rule out risk (high risk individuals might screen negative). There is even a debate as to whether screening tools should be used at all.

All of these points need to be accounted for when deciding which tools (if any) to include in the ZSA Resources.

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