The GRiST decision support system for mental health risk and safety management

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1   What is GRiST?

The Galatean Risk and Safety Technology, GRiST (www.egrist.org) is a web-based decision support system designed to help practitioners assess and manage risks associated with mental health problems, including suicide, self-harm, self-neglect, vulnerability, and harm to others. It has been developed by cognitive and computer scientists at Aston University over a period of 17 years and has recently been spun out into its own company, eGRiST Ltd.

GRiST integrates patient data, mental-health practitioners expertise and empirical evidence to support comprehensive clinical risk evaluations, risk formulations, and safety plans. Machine learning provides predictions that are compared with the clinician's own judgement to provide real-time benchmarking against data from thousands of colleagues.

GRiST has been adopted by a number of secondary and community mental-health Trusts, charities, and private organsiation. As of May 2018, it held over 1.5 million individual risk judgements in 380,000 completed assessments from 160,000 patients. At present, GRiST provides assessments covering the complete care pathway, from screening to full assessments, focused repeat assessments, and specialist versions for forensic services and learning disabilities. The self-assessment version, myGRiST, gives access to risk predictions and advice for the general public with output reports that an be linked with mental-health providers.

GRiST can help Trusts understand how clinicians make risk judgements, compare these judgments to the expert knowledge held within GRiST and feed these learnings back into the system. Trials have also shown that the system can enrich the risk assessment process by flagging important behavioural cues that practitioners might have not considered incorporating into a risk assessment.

In general, the GRiST data provide a valuable resource for researchers to increase understanding of how risks are identified and managed to improve people's mental health, safety, and well-being. The GRiST team is always looking to work with people and organisations using GRiST, not only to enhance GRiST but also to help increase overall understanding of mental health and service provision.

2   The evidence for GRiST and how it encapsulates intelligence

We have conducted research into the clinical judgements of mental health practitioners and how these can be used to disseminate expertise. Our results show that trained practitioners make reliable and consistent judgements of suicide risk that accord with the person's real risks. That is, people judged to be at higher risk of suicide are more likely to make a suicide attempt. The analysis was based on 104,556 suicide risk assessments.

2.1   Evidence for the reliability of clinical judgements recorded in GRiST

GRiST uses a fine-grained scale for recording clinical risk judgements that goes from zero (minimal risk) to 10 (maximum risk). Research shows that this is the optimal degree of differentiation and the clinicians are very reliable in their risk judgements. Mathematical analysis of the GRiST database shows that:

1. GRiST can predict the suicide risk judgement a clinician would make for the given assessment within plus or minus one on an 11 point scale with an accuracy of 85%.

   (a) If, for example, a clinician gives a risk judgement of 5, GRiST will predict a judgement of between 4, 5, or 6 about 85% of the time.

   (b) This is a reflection of how well clinician judgements correlate with each other: over 0.8.

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2. GRiST can predict judgements within plus or minus 2, 96% of the time: only 4% of the assessments will have predictions that are either 2 scale points higher or lower than the judgement.

3. In terms of clinical significance, anything more than a two-point difference on an 11 point scale is meaningful. A person predicted by GRiST to be at a risk level of 5 but is judged by the clinician to be at a risk level of 2 is in a different risk band: medium risk instead of low. Similarly, a person predicted to be 5 but judged to be 8 is medium instead of high risk. In our data, less than 1% of the assessments have this level of disparity between the individual clinician's judgement and the prediction generated by the clinical expertise within GRiST.

4. The correlation between judgements and predictions is testimony to the reliability of clinicians' judgements: similar profiles produce similar conclusions about the risk levels present.

    (a) It means GRiST collects the right data for supporting clincians risk judgements.
    (b) It means the answers given for a particular patient are consistent with that patient's level of associated risk, according to the clinicians.

5. GRiST helps clinicians identify the right data to collect, record them accurately, and provide the associated judgements: it is an effective support for structured clinical judgement.

2.2 Evidence that clinical judgements recorded in GRIST have outcome validity

Outcome analysis is indicative only, because outcome data is not directly recorded in GRiST and would have to be obtained by linking to patient records for a full analysis. Instead, we can only use outcomes represented by those people whose assessment is followed by a new repeat risk episode: they have had an adverse outcome following an assessment.

1. Out of the 104,556 assessments, 4,122 have a repeat episode, which is just under 4% of the total.

2. If a clinical judgement is more than two below a predicted risk of greater than or equal to 7 (high risk), the probability of a repeat episode increases by one third. This shows that:

    (a) clinical judgements recorded in GRiST have outcome validity because accurate judgements decrease risk of repeat episodes;
    (b) GRiST can detect potential errors in judgements and help reduce the probabilty of a risk episode.

3. GRiST can also evaluate the reliability of a person's stated intention not to carry out a suicide attempt and use this to improve detection of potential risk episodes.

    (a) There were 3,138 repeat episodes following an assessment where people were assessed as having no intention of carrying out a suicide attempt.
    (b) Only 1,849 people of these 3,138 who made a new suicide attempt had enough data in their assessment to evaluate their current intention.
    (c) GRiST data analysis showed that 1,231 (67%) of them had an unreliable current intention.
    (d) GRiST identifies the data required for determining the reliability of current intention and can ensure that assessments collect this minimum data set.
    (e) 32,580 patients did not have the minimum data set and 1,289 suicide attempts were missed in them;
    (f) GRiST would have flagged up two thirds of these as requiring a bit more attention due to the unreliability of their negative current intention.

3 What GRiST provides

Patient safety and continuity of risk information

- As a cloud computing service, GRiST provides a safe, whole health and social care system approach to risk assessment and its management. This is because patients' risk information can be accessed at any point along their care pathway, thus ensuring continuity of risk information and making sure that important risk information is not missed. Continuity is further enhanced because risk information can be shared seamlessly between the different versions of GRiST, as patients cross service boundaries; and also between different organisations using GRiST. An assessment started in IAPT can be completed by secondary care in-patient services for example, with no loss of important risk information or double data entry.

A holistic approach to patients' situations

- GRiST collects both risk-specific information and also generic information about patients' life contexts, to inform risk formulation and management decisions, as well as clinical risk judgments. GRiST therefore seamlessly connects risk assessment, risk formulation and risk management processes.

Evidence-based practice

- GRiST has been developed through a 15 year research and development programme conducted within two research-active UK universities (Aston and Warwick). A large number of funding bodies have supported the work, including: the European Union EIT Health KIC, the Department for Health, the National Institute for Health Research, the Economic and Social Research Council, the Engineering and Physical Sciences Research Council, the US National Institutes of Health, the American Foundation for Suicide Prevention, the Health Foundation, and the Judi Meadows Memorial Fund.

- Research is on-going, so GRiST is continually being updated and improved. In particular, we now have a large database of over one million patient risk profiles and associated clinical risk judgments for which we have NHS Research Ethics Committee approval to analyse. This permits us to understand more about risk and risk judgment behaviours, and how they link to outcomes, to support improved risk prediction and prevention.

- We plough what we learn back into GRiST, so that our customers have access to the latest knowledge about risk prediction and prevention, and the technology designed to support it. For example, an upcoming important new feature will alert assessors if their clinical risk judgment is significantly out of kilter with what GRiST would predict. This is based on matching the new assessment with similar ones in the database, and the clinical risk judgments given for them by the thousands of mental health practitioners already using GRiST. Assessors can then re-consider their judgment or else justify why this is an unusual case. This represents an important safety net for clinical practice.

  Please note, though: GRiST will never replace a practitioner's own clinical judgement, which will always be required first before any GRiST evaluations are seen.

An intuitive approach to risk assessment

- GRiST is easy to use because it is reflects how mental health practitioners naturally think and reason about risk. The first piece of research we did was designed to find this out and we built GRiST on the resulting consensual model of risk that emerged. As a result, the risk reports which GRiST generates provide an intuitive explanation of patients' risks.

- GRiST output reports are presented in a format that is easy to read and assimilate, so that key areas of risk in a patient's profile are immediately obvious at first glance. The reports provide a transparent audit trail for decision making about risk, to support clinical risk judgments. The audit trail GRiST provides has proven very useful during enquiries into patients' cases.

Risk assessment by those without a specialist mental health clinical training

- The key motivation for developing GRiST was to disseminate mental health knowledge and expertise into the community. Front-line health and social care professionals who regularly encounter people with mental health problems, but who lack specialist training, can be supported in making good decisions. These are decisions about the presence and level of patients' risk, and about whether or not to refer them for specialist help. Dissemination of expertise was made possible through our research, which clarified the information specialists work with when assessing risk, and how they put it together to come up with clinical risk judgments, and building this into GRiST.

- GRiST is easy to use and requires no specialist training to get started. For learners it provides an excellent educational resource about risk assessment and the factors in people's lives which influence risk.

Shared decision making about risk and its management

- A companion self-assessment version of GRiST (myGRaCE) is available to complement the range of clinical versions of the tool, and also one for carers. These were developed with the help of over 100 mental health service users and carers, to ensure that the GRiST model of risk was presented in the right format and via an appropriate interface and language, so that service users and carers can collect equivalent information to practitioners. This allows all parties to speak a common risk language, and empowers service users and carers to participate in shared decision making and the co-production of risk assessment and management.

- Clinical versions of GRiST are also available via the myGRaCE interface, which presents the GRiST risk model in the form of a selectable mind map (Figure 1). It means the content of GRiST is visible at a glance, and that risk can be explored in any order, rather than following a fixed sequence of questions. This version works well when assessing risks with patients, as it allows data collection to mirror the practitioner-patient conversation and the order in which patients provide accounts of their situations.

Best practice in managing risk

- GRiST was one of only three multiple risk tools recommended for use by government in the Department of Health policy document *Best Practice in Managing Risk* (2007, updated 2009). This remains the latest best practice guidance about risk assessment tools.

- GRiST is unique in combining structured clinical judgment with actuarial evidence: thus encompassing the two major approaches to risk assessment.
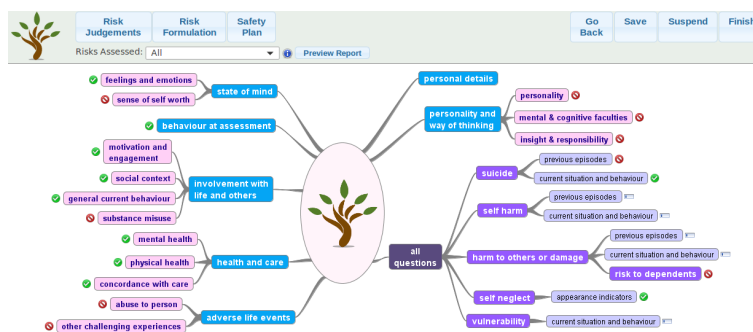
Data security

Figure 1: *The mind-map screen for the dynamic version of GRiST. Each branch of the mind map can be selected and it takes you to the screen showing only questions associated with that branch. The particular mode is for rapid-repeat assessments so the small "progress bars" show those branches with rapid-repeat questions. Ticks next to branches mean all the questions have been answered for those branches.*

- GRiST is launched from the patient record, where all patient identification information is held. The only link to the risk data on GRiST is via an encrypted identifier (technically, a one-way salted hash function) that means the risk data *cannot* be linked back to the patient record, even assuming someone managed to access it without authorisation.

- All communications with the GRiST assessments are via an encrypted channel so that nobody can intercept messages and read them.

4   Why use GRiST?

Here are some further compelling reasons to use GRiST:

Saving precious clinical time

- GRiST is designed so that you can complete it quickly. Filter questions allow you to focus rapidly on the areas where risk is present, and to record those where it is not.

- Repeat assessments are efficient and flexible:

  - GRiST carries forwards historical data that will not change, or data that are unlikely to change.
  - You don't have to update every risk every time but can focus on those that are of current concern.
  - GRiST gives you the option of conducting rapid repeat assessments that only show the questions with answers that can change on a daily basis .

- Ideas about managing specific risk factors recorded during assessments can be imported into overall risk management plan boxes, for rapid editing.

- Finding a particular question or subset of questions you want to answer is easy. This is facilitated by the 'mind map' interface for GRiST, where the risk model structure is visible (Figure 1). Additionally, all versions have a search function.

Ease of access

Ideally, GRiST can be accessed via your own patient record system. We are already connected to Rio, CareNotes, and IAPTus for various organisations and it is a straightforward process to link us to any other patient record system, including organisations' own bespoke ones. When this is done:

- GRiST is available at the click of a button with no additional login information required from you.

- All security issues are handled "behind the scenes" by the way the patient record system and GRiST are linked.

- All practitioners need to do is find their patient and then select the "launch GRiST" button alongside.

Visual impact

- Accruing risk is immediately visible with GRiST. Once answered, all scale questions change colour to reflect their individual contribution to patients' overall risk.

- GRiST allows you to make graphs of patients' changing risk status over time, both at the level of overall risks e.g. risk of suicide, and individual risk factors e.g. anxiety. This is a helpful facility for exploring patterns in patients' histories and current situation, to give new insights into their behaviour and how best to support them.

Facilitating Audit

- GRiST has the capacity to facilitate audit trails of risk for individuals, services and organisations. For each patient there is a dashboard where past assessments can be viewed, including a diary of comments and graphs of how risks have changed over time.

- Service managers or administrators can receive an 'admin' login, through which they can generate statistics about risk assessment activity and patterns of risk amongst their patient population.

Value for money

- GRiST is available to you on payment of an annual software licence fee. This is calculated on a sliding scale, depending on the number of assessors using it in your organisation. The fee includes annual meetings with the developers to update you about developments, and for two-way discussion about how to make best use of GRiST, and how it can be made to work better for you. You will also automatically receive all updates to GRiST without additional cost. We are a small, agile and responsive organisation, which welcomes dialogue with our customers. We will give you early warning of any planned changes to GRiST, and you will have opportunities to comment on these if you wish.

Participate in research

- With GRiST, there are always opportunities to be involved in research and to increase your organisation's patient accrual numbers.

5   GRiST in the community?

GRiST was originally developed to disseminate mental-health expertise to people without specialist training or, indeed, any clinical training at all. The idea was to point people to the right questions to ask and provide expert advice based on the answers given. This makes it possible to detect mental-health problems and associated risks at an early stage, in front-line services where they are often presented but are often not recognised or are not acted upon due to lack of knowledge.

GRiST's expertise is based on the way it structures mental-health risk and safety knowledge to point people towards those issues of concern that relate to a particular individual's profile. Its one million encapsulated clinical judgements covering suicide, self-harm, harm to others, vulnerability, and self neglect gives GRiST the power to provide its own accurate clinical evaluations and identify the most appropriate help. It connects people in the community to expert advice so that they are able to live safely and with confidence. Primary and community-based care services can use GRiST to help monitor people remotely and for activating interventions when needed. It means clinical services can be more confident of providing the necessary care without having to remove people from their own homes, which is expensive and often unwelcome.

5.1   GRaCE-AGE: GRiST for older adults in the community

GRaCE-AGE is a project based on GRiST that is running within the EIT Health Knowledge Innovation Community (KIC) funded by the European Union. It is web-based software that helps older adults assess their own mental health, safety and wellbeing at home, in collaboration with friends, family, carers, and clinicians. It is psychologically valid, designed for use by people with or without any mental-health background, and encapsulates personal preferences and circumstances. In addition to manual data input, sensors will directly supply data to GRaCE-AGE to enable autonomous monitoring of mental-health and well-being. It facilitates shared decision making and co-creation of health, which is achieved by having a common knowledge model that captures both clinical expertise and the older adults' understanding of their life circumstances. The end product will be a software system that creates a "canopy of care" that can continuously monitor and support older adults within their care network.

Apart from Aston University, the other partners in GRaCE-AGE include Worcester Health and Care Partnership Trust, the University of Leuven, a sensor company in Belgium called BeWellInnovations, another sensor company in Holland, Maastricht Instruments, and a local company linked to GRiST called Galassify Ltd. In 2018, we are expanding our collaborations to include ExtraCare and Evolyst. ExtraCare provides older adults with residential villages for independent living and has a number of villages within the West Midlands region that will be used as pilot sites for GRaCE-AGE and to help develop and deliver training. Evolyst is a healthcare technology company with expertise in creating bespoke mobile applications. It will provide advice and technical input to the mobile GRaCE-AGE versions.

The GRaCE-AGE project intends to build on GRiST to provide opportunities for extending mental health and wellbeing care into the community for all age groups and linking to all services. Part of this includes education and training of carers from different backgrounds and with varying care responsibilities, where their care is explicitly linked to a supporting information technology infrastructure.

5.2   Impact and opportunities for GRaCE-AGE via GRiST

The research and development programme of GRiST is expanding due to the need for better care in the community and the opportunities to exploit technological advances. The increasingly sophisticated sensor technologies, the range of data they collect, and the variety of methods for collecting them all open up avenues for autonomous round-the-clock supervision. The key is for the data to be interpreted by

software that understands the clinical significance of data and empowers both service users and practitioners to make informed decisions based on the information. Collaborative care in the community with confidence on both sides, carers and the public receiving the care, becomes viable.

General mental health and wellbeing of the public is improved because people's needs are being recognised earlier and appropriately supported. Costs are also significantly reduced through fewer face-to-face consultations and the ability to maintain people living at home rather than having to implement higher levels of residential support.

GRiST's technology and expertise provides support to other community services such as schools and voluntary organisations. The aim is to distribute mental-health and wellbeing care across the community as a whole, not just restrict it to clinical services themselves.

6   Try GRiST

- Why not try GRiST out for yourself at www.egrist.org and selecting the 'Try GRiST' tab.

- You can also play with the service-user version called myGRaCE for self assessments by selecting the myGRaCE button.

7   Contact us

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https://www.egrist.org/contact-us

Invite us to come and speak to your team because we would be delighted to demonstrate GRiST to you.