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Integrating service user and practitioner expertise within a web-based system for collaborative mental-health risk and safety management

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ABSTRACT

Objectives: To develop a decision support system (DSS), myGRaCE, that integrates service user (SU) and practitioner expertise about mental health and associated risks of suicide, self-harm, harm to others, self-neglect, and vulnerability. The intention is to help SUs assess and manage their own mental health collaboratively with practitioners.
Methods: An iterative process involving interviews, focus groups, and agile software development with 115 SUs, to elicit and implement myGRaCE requirements.
Results: Findings highlight shared understanding of mental health risk between SUs and practitioners that can be integrated within a single model. However, important differences were revealed in SUs' preferred process of assessing risks and safety, which are reflected in the distinctive interface, navigation, tool functionality and language developed for myGRaCE. A challenge was how to provide flexible access without overwhelming and confusing users.
Conclusion: The methods show that practitioner expertise can be reformulated in a format that simultaneously captures SU expertise, to provide a tool highly valued by SUs. A stepped process adds necessary structure to the assessment, each step with its own feedback and guidance.
Practice Implications: The GRiST web-based DSS (www.egrist.org) links and integrates myGRaCE self-assessments with GRiST practitioner assessments for supporting collaborative and self-managed healthcare.

1. Introduction

Increasing attention is being paid to involving service users (SUs) in their own health care to help them stay living independently in the community. In 2008, the UK-based health foundation established a programme for "co-creating health", specifically designed to improve collaboration and self-management for SUs with long-term conditions. The programme motivation was that "neither practitioners nor SUs are systematically provided with the support, skills and tools that they need to work effectively in this way" [1]. The programme provided some of the resources required and a recent evaluation demonstrated their benefits [2], but none of them specifically exploited information technology (IT) targeted on collaboration between SUs and practitioners. This paper describes research into an entirely new type of IT to this effect: the myGRaCE decision support system (DSS) that helps people assess and manage their own mental health and well-being. It is intended for use by the general public with the aim of improving mental health and reducing risks of suicide, self-harm, harm to others, self-neglect, and vulnerability.

Detecting and managing risks associated with mental-health problems help reduce service and societal costs by preventing relapse and untoward incidents [3,4], and helping people return to work [5]. Not enough people have sufficient expertise to recognise or address these risks effectively. Specialist resources are increasingly thinly stretched, so finding ways of disseminating mental health knowledge to those who lack it, but who need it, is an urgent challenge. Our recent systematic review highlighted this

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as an important gap in online mental-health self-management resources [6] and the Galatean Risk and Safety Tool, GRiST (www.egrist.org), was developed precisely to fill it. GRiST is the origin for the self-assessment version, myGRaCE, and is briefly introduced to show how it operates within mental health, and how the research methodology enabled myGRaCE to be derived from it.

1.1. The GRiST cognitive model and software functionality

The GRiST DSS encapsulates risk-assessment expertise using cognitive modelling [7], a form of computational psychology where the goal is constructing plausible information-processing metaphors for how people think and reason. It is highly relevant to constructing DSSs because humans remain responsible for decision outcomes, need to understand reasons why one decision is supported over another, and are required to make judgements under uncertainty about each decision's efficacy [8]. DSS advice must be understood intuitively by decision makers, with trust in its provenance being an important factor in system adoption [9].

GRiST bases its expertise on a psychological model of classification [10]. SUs are classified into risk categories by evaluating their level of category membership: the higher the membership, the higher the risk. Risk categories are represented by knowledge structures called galateas [10] focusing on "perfect" class members (Galatea was Pygmalion's perfect woman): ones with the highest probability of being in the class and the most memorable. The galatea for each risk is compared with the SU being assessed: the closer the SU profile to the galatea, the higher the risk category membership. This galatean approach to classification resonates with practitioners and SUs alike; they can easily recall individuals with exceptional risk profiles, or themselves when feeling most at risk, to use as benchmarks.

Galateas are hierarchically structured, which enables GRiST to link low-level cues (e.g. realism of a plan to end your life), through higher level concepts (e.g. current intention), to top-level risk categories like suicide. Fig. 1, in the left-hand panel (LHP), shows how this explains the association between data and risks for suicide (or "ending your own life" in myGRaCE). The hierarchy (or tree) has "current intention to end your life" selected and the associated questions are displayed in the right-hand panel (RHP) where the SU provides answers.

There is plenty of evidence for the psychological validity of hierarchical knowledge structuring. Cohen's review [11] concluded that it was a fundamental psychological function, recently shown to relate directly to neural processes [12,13]. Grounding GRiST in a psychological model using hierarchical knowledge structures gives it generic relevance to everyone, not just practitioners. Similarly, the knowledge content is not specific to any practitioner discipline, so there are no language barriers dependent on specialist mental-health training. This is a key methodological driver of the research because it makes it easier to develop GRiST versions for different types of user [14,15]. Users can communicate with each other via the same core knowledge base which provides a common risk 'language', despite differences in the wording or presentation of their own version of GRiST. It makes the approach ideal for collaborative health care [16] because it clarifies ambiguities about what each party is saying and provides a single reference point for their alternative perspectives.

Although other DSSs rely on expert human judgement for their knowledge base, none before myGRaCE have attempted to convert practitioner expertise into a complementary SU model. This is the innovation of myGRaCE. It enables SUs to exploit their own expertise, in collaboration with practitioners, via web-based software. The idea is for data to be entered into myGRaCE as part of the natural assessment flow, in collaboration with the assessor; myGRaCE supports the assessment process to generate a report jointly created by assessors and SUs that represents their consensus. Alternatively, people can do a self-assessment in their own time at home, which can then be compared with practitioner assessments. GRiST enables this by letting practitioners and SUs link their reports for sharing online. The relationship between myGRaCE and the original GRiST DSS is explained next.

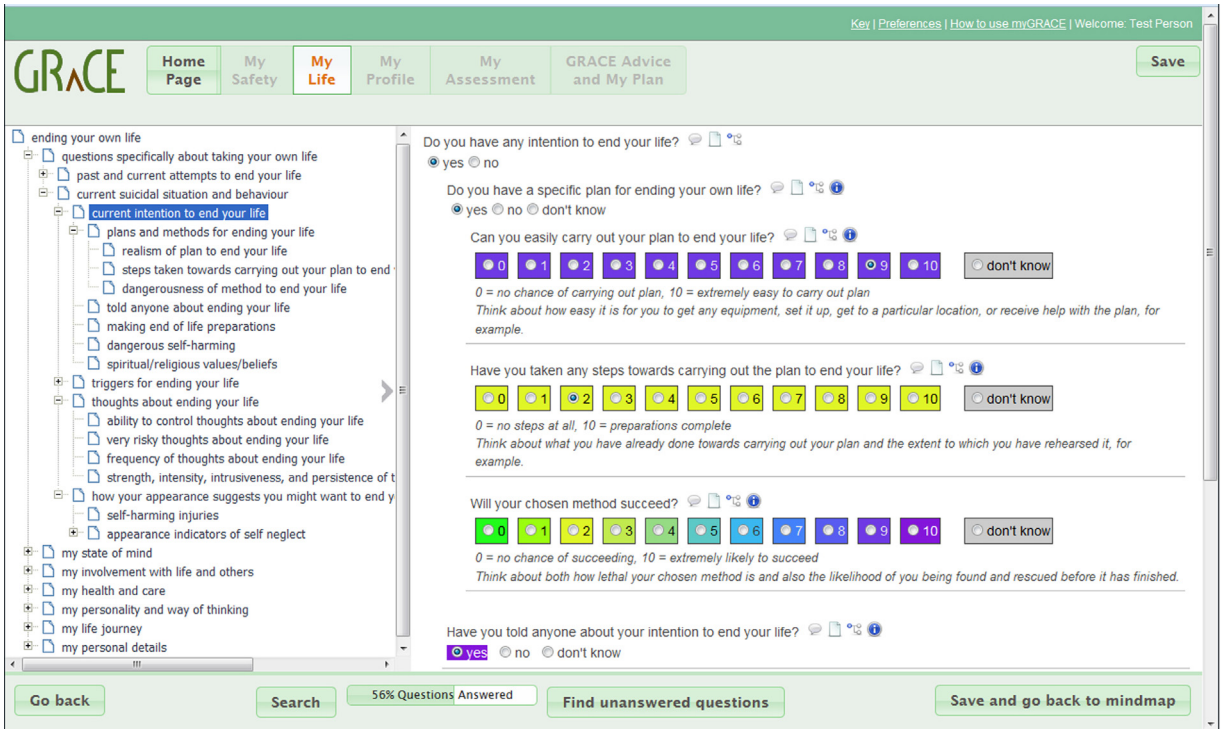

Fig. 1. myGRaCE for self-assessments. The tree structure is shown in the left-hand panel with the selected (highlighted) branch producing the data-collection questions in the right-hand panel.

1.2. The origin of myGRaCE

The original practitioner GRiST was created from detailed qualitative research with multidisciplinary mental health experts who showed remarkable consensus about the information influencing risks [17]. However, usage in different practitioner contexts and with different SU populations highlighted the need for customised presentations [14,15]. This was the starting point for myGRaCE.

The GRiST practitioner version provided a well-established base, having been used by over 3000 practitioners to complete 750,000 risk assessments across each of the six risks covered, but it was clear that SUs also wanted their own customised version of the knowledge and risk process that was more intuitive for them. The practitioner version does not exploit the full hierarchical structure of risk knowledge, is sequential, and disconnects general issues from each risk. That is, concepts such as emotions and social context, which relate to all risks, are separated out in a generic section after the questions specific to each risk have been asked. This is more appropriate if data are being recorded following the assessment rather than during it, and time pressures are paramount, which is how the practitioners wanted to complete GRiST when it was originally released.

This paper focuses on the evolving development and evaluation of myGRaCE prior to its general release for use by practitioners and the public. The aims of myGRaCE are to help SUs:

- understand and manage issues putting themselves or others at risk;
- prepare for and engage in practitioner consultations;
- tell, record and share their 'story' with others;
- play an equal role in their mental health care; and
- self-manage their own safety.

The methods are explained next, including how the myGRaCE requirements were elicited and the software functionality delivered.

2. Methods

myGRaCE has been developed over twelve years, arising from the original funding for GRiST and proceeding in tandem with its evolution. Fig. 2 summarises the methods involved, the main milestones (outputs) for myGRaCE, and the contributions from 115 individual service users, some of whom were regular participants. SUs were recruited for their previous experience rather than necessarily as current patients, and variously accessed via general practice, service-user organisations, third sector organisations using GRiST, and university students and staff.

Initially, when the focus was on understanding and modelling practitioner expertise [17], ten semi-structured interviews were conducted with SUs to see how their consideration of risk factors compared to practitioners. Five years later, after the practitioner version of GRiST had been constructed [15,17], development of myGRaCE began, with full involvement of SUs [18]. A focus group

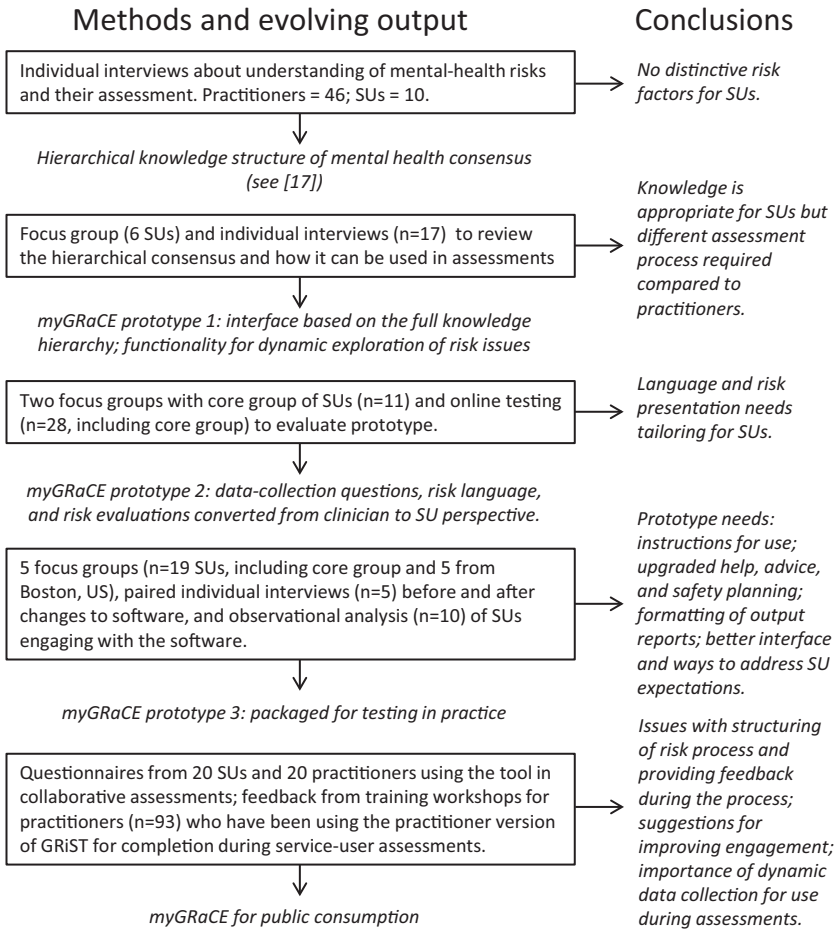

Fig. 2. Summary of methods, conclusions, and outputs for the evolution of myGRaCE. The core group was from a Service User (SU) organisation involved throughout, with other SUs recruited as and when required for the various research projects and activities. Each stage has the methods in a box that point to the main output in italics, which then becomes the input to the next stage.

and 17 individual semi-structured interviews were conducted first, to explore SU perspectives on risk assessments and how they relate to the practitioner version of GRiST. They considered the questions: 'Is the content of GRiST relevant for SUs?', 'Are there any important areas of risk missing?', and 'Is any of the content redundant from the SU perspective?' Results led to the first software prototype of myGRaCE.

The subsequent focus was on evaluating and evolving myGRaCE prototypes, starting with the risk language and particularly SU data-collection questions. Methods included focus groups, semi-structured interviews, and feedback from software testing. In later stages, observational techniques recorded how SUs engaged with myGRaCE without previous training or instruction.

In general, audio recordings of interviews and field notes from focus groups and workshops were analysed for key actions, with any queries fed back to SUs for clarification and validation. This process was incorporated into agile software engineering methods [19], which means developing and evaluating myGRaCE prototypes in iterative cycles.

The final stage evaluated myGRaCE when used by practitioners in conjunction with SUs for collaborative assessments. It incorporated knowledge-centered as well as user-centered design to take a holistic approach to understanding user requirements, in the context of their organisational and environmental contexts [20]. Questionnaires with Likert scales were created to elicit SU and practitioner opinions. Training workshops with an organisation that was using the GRiST practitioner version with service users during assessments (i.e. recording data in real-time collaboratively with SUs) had a session discussing practitioners' views on it and comparing the alternative myGRaCE functionality.

The mixture of evaluation methods helped cover the different perspectives needed for ensuring interactive software meets end-user requirements [21]. Overall, 115 SUs took part, with eleven core participants engaged in multiple research phases. Practitioners were formally involved, as shown in Fig. 2, but also gave informal feedback on myGRaCE during training workshops, dissemination activities, and risk-management meetings in mental-health organisations using GRiST. These have discussed how myGRaCE could support clinical practice and were an important barometer for practitioners' attitudes to it and its potential impact on services.

3. Results

Fig. 2 shows the sequential order of myGRaCE development, ending with myGRaCE available for public consumption. The original SU interviews were compared with those of mental-health practitioners and gave little indication that the two groups' understanding of important risk factors differed. When practitioners' risk models were combined into a single hierarchical model representing their consensus [17], SUs did not dispute the relevance of the practitioner risk knowledge in GRiST, or its hierarchical structuring, although they sometimes disputed the emphasis given to risk concepts (e.g. allocating more influence to social context than practitioners did). It was therefore agreed that the practitioner GRiST model was suitable for adaptation to create an SU self-assessment version. This was confirmed by subsequent fieldwork. However, there were interesting comparisons between the way each group perceived and evaluated risks, described next.

3.1. Insight and abstraction in myGRaCE

Risk assessors want to know whether people have insight into their actions, which raised the question of whether people with mental health problems can answer such questions themselves e.g. about the dangerousness of their chosen suicide method or consequences of their behaviour. Can they have insight about their lack of insight? SUs reassured us these questions can be answered and are important. Conversely, questions about how other people view SUs (e.g. GRiST questions about how a person presents during assessment and how they make the assessor feel) were deemed too difficult and could exacerbate mental-health problems. They require SUs to abstract from themselves and view themselves "externally" as others do, which SUs thought could spark paranoid thoughts. In actuality, this is difficult for people to do whatever their mental health status.

3.2. The risk-assessment process

Differences between practitioners and SUs were more marked when it came to the risk-assessment process. Time-pressed practitioners wanted the most efficient data-gathering interface that asked questions sequentially, and thus separated risk-specific behaviours from generic information underpinning all risks, such as social context, life history, and emotional state. SUs, on the other hand, have the time and inclination for a more dynamic interface, where their developing thoughts and ideas lead data collection rather than following a fixed sequence. They wanted to see how the generic information relates to each risk and explains it rather than being considered in isolation.

Findings led to very different interfaces built on the same underlying machine representation of risk expertise (see www.egrist.org to compare myGRaCE and practitioner GRiST interfaces). The SUs' decision-support interface was grounded in the fully-expanded, hierarchical or "tree" knowledge model for each risk, as illustrated for suicide risk in Fig. 1. The left-hand panel (LHP) shows suicide risk, with the specific risk issues first and the generic ones, starting with feelings/emotions, beneath. The right-hand panel (RHP) displays the questions for the selected part of the tree in the LHP and demonstrates the dynamic nature of answering questions, because any branch can be selected at any time. A clear message from focus groups was that SUs wish to have control over the order in which they answer questions, and want to see the explicit relationships between input data, risk concepts, and top-level risks.

Despite these radical differences in risk navigation and display, SUs opted to maintain much of the functionality of the practitioner's version. They found it easy and intuitive to answer questions by rating information relevant to risk, and the overall risk judgements themselves, on a 0–10 scale. Qualitative free-text "narrative" could be added to any question using text boxes, which both SUs and practitioners liked for providing additional context to quantitative answers. Some SUs mooted using them like a diary, to capture how their risk factors and thoughts change over time. Text boxes were also used for recording self-management actions associated with risk items, to reduce risks. This was deemed helpful because answering risk questions stimulated ideas about how they can improve aspects of their lives (the comment and action box icons are respectively the two left-hand ones of the four icons at the end of each question in Fig. 1).

3.3. Risk language and representation

The most marked difference between SUs and practitioners is that SUs do not want an unrelentingly negative focus on their lives. They wanted questions asked positively whenever possible. For example, the practitioner-version question: 'Does the person lack an external network of relationships?' appears in myGRaCE as 'Do you have a good network of people in your life?' The "polarity" of the question was changed, which correspondingly required changing the direction of risk accumulation (reducing rather than increasing as the scale value increased). Specifications for all these

customisations were embedded in the GRiST knowledge base to ensure flexible delivery of functionality [14,15].

The language of myGRaCE was made as positive and sensitive as possible, with words or phrases SUs found judgemental, stigmatising or constraining, removed when appropriate. This included words like 'judgement', 'behaviour' and 'system', for example. The end result was an interaction that resonated more closely with the SUs' perspective. Table 1 illustrates some typical views reflecting question changes.

Similarly, SUs requested changed question orders in some sections, starting with more positive and easy questions, working up to the difficult and challenging ones, and ending on a positive note. This was particularly important when assessing feelings and emotions for example, reflecting SUs' concern to manage their mood when completing myGRaCE. To combat mood deterioration or flagging concentration, SUs could suspend the assessment and resume it later.

The positive-mood theme continued with the GRiST colour scheme. SUs found the use of red for high risk too alarming and suggested an alternative colour scheme, ranging from green (no or low risk), through yellow and blue to purple, denoting high risk (see Fig. 1).

3.4. The full system and building in sources of advice

Once the second myGRaCE prototype had been developed, the focus shifted to the user experience of it as a full DSS. Having opted for an explorative approach to self-assessment, maintaining SUs' orientation was crucial as fieldwork highlighted the potential for them to become 'lost' in the tool. The tree for a complete risk (shown in the LHP of Fig. 1) was too overwhelming at the start of assessments. Although only questions associated with the selected part of the tree in the LHP are shown in the RHP, as illustrated for current intention in Fig. 1, SUs wanted a higher-level "overview" where they could select areas to explore and jump straight to them only, rather like the area map of a city that orientates a person before descending to street level. The solution for myGRaCE was a mind-map [22] front-end launch pad for exploring risks, shown in Fig. 3. It presents the entire risk structure at a glance, in the non-linear, radiant and associative layout that makes mind maps so intuitive. The map is selectable so that any branch will show only that part of the tree in the data-collection screen layout of Fig. 1. Table 1 contains representative comments about navigation that suggest these developments had addressed the problems.

Like the practitioner versions, myGRaCE generates an output report showing SUs' self-assessments of risk, and a detailed, colour-coded information profile with the data and qualitative contextual text supporting their conclusions. These reports are considered particularly useful for collaborative healthcare: for practitioners, they save time on history taking and asking sensitive questions; for SUs, they help express their problems and avoid having to keep repeating painful information, as illustrated by the communication comments in Table 1.

3.5. Evaluating myGRaCE in practice

The third myGRaCE prototype was evaluated by practitioners and SUs in a practice setting. Questionnaire feedback from two third-sector organisations piloting myGRaCE collaboratively with SUs provided encouraging support for its efficacy in vivo. For 20 SUs, myGRaCE: improved their ability to assess their personal safety (75%); understand what makes them unsafe (80%); see where they need to make changes in their lives (85%); explain how they feel to family, friends and healthcare professionals (75%); notice when they are becoming unwell (75%); have more 'say' in their care (75%); and take better care of themselves (80%). Of the 20 practitioners, 85% agreed GRiST and myGRaCE help them explain their risk judgements to SUs and carers, and all agreed they support shared risk assessment. These positive answers are

Table 1
Selected comments from service users and, occasionally, service providers about myGRaCE, noting that it was called myGRiST originally.

Comments on the question wording	
Patient interview, Feb 2012	"Instructions [are] very clear and easy to understand. They would be easy for people whose first language is not English"
Patient interview, Feb 2012	"Nice, easy to read English. The structure and wording are such that they could be understood by the majority of people"
Psychologist's on-line comment, Sept 2010	"The questions have been very well developed and ask many questions I wouldn't have thought of which would prove very useful in gathering a mental health history"
Comments on the use of myGRiST for communication	
Patient interview, Jan 2012	"I think that when using GRiST [during an assessment] I would feel that I had expressed myself better and had been better understood"
Focus group member, Aug 2009	myGRiST is "wide-ranging, insightful and captures a large amount of information relevant to risk . . . very useful for patients"
Patient interview, Mar 2012	[myGRiST] would be useful in "relaying information that I find very difficult to talk about"
Comments on the navigation and usability	
Patient interview, Jan 2012	[I] didn't need to use the instructions, so that's a good thing—quite user friendly . . . the form flowed nicely"
Patient interview, Feb 2012	"Once [I] got into the system, it was easy to use and navigate . . . the tool was fairly self-explanatory"
Comments on the overall efficacy of myGRiST	
Patient interview, Nov 2011	"It is an excellent concept to include the person in their own assessment. The process may be life-changing in itself to some people, who may never have been involved in any part of an assessment before. It is part of the process of saying to the person 'you're important in this case, you are central, your input and insights are valued and valuable'. This in itself may well be profoundly healing"
Patient interview, Jan 2012	"You go through life and you can plunge very easily into a dangerous state but you are not aware of it, so having a tool like that can bring it to the fore"
Patient interview, Nov 2011	"myGRiST allows a lot of opportunity to discover insights about the person's health and state of mind. It is an excellent concept to include the person in their own assessment"
Individual interview, Jan 2012	"I found myGRiST a helpful way to explore my own vulnerability and to help me analyse my thoughts and how at risk I might be. I think I would have benefitted from using this tool when I first started to suffer from suicidal ideation"
GP email about a patient's myGRiST, Dec 2012	"One of my patients . . . brought in a myGRIST assessment . . . I found it helpful as the GP as it gave me a very detailed picture of how he is feeling and helped me empathise with him, so it led to a useful consultation"
Individual communication, third sector manager, May 2013	"it's easy for me to promote GRiST and myGRiST as it's something I really believe in and find so easy to integrate into my service. I am very passionate about giving individuals control and choice, and myGRiST, especially, is all about that"

confirmed by qualitative data. Table 1 shows typical responses in the comments about overall use of GRiST and underline the potential role for myGRaCE in helping SUs manage their own mental-health.

On the other hand, increasing complexity of the myGRaCE interface for delivering sophisticated functionality was causing problems. Six out of 20 SUs found it was not easy to use and observational analyses revealed difficulties when users access myGRaCE without any prior introduction or collaboration with assessors: the flexibility of access that SUs wanted becomes the system's Achilles heel. For example, users were unclear about when and why they needed to switch between the mind map overview and the data collection interface.

Part of the trouble was the lack of obvious feedback or outputs from SUs' efforts. Although they receive a full report on the data and associated judgements they give, it only comes after they submit the assessment: nothing happens prior to that apart from data entry. For some, this was too long a wait and the payback was not always understood. When used with practitioners, the communication role is clearer and they see the benefits of these reports; when used alone, more direct and targeted advice based on their input data was expected. In short, the tool seemed more accessible for SUs when used in partnership with practitioners, who can explain its rationale and provide support.

Even with this limitation, it was clear that myGRaCE was a useful resource, which was underlined by discussions with practitioners during training workshops (the 93 shown in the bottom box of Fig. 2) who were using the sequential version of GRiST for collecting data during assessments. When they were shown myGRaCE as an alternative, they universally requested this be made available to them, and their employing organisation has now formally activated that request.

The final outcome of the research is myGRaCE for public consumption. Fig. 4 shows the home page where the more structured, stepped approach to risk assessments is controlled. When beginning an assessment, data collection takes place, with options for risk screening (Step 1, My Safety) or evaluating the person's life in general (Step 2, My Life). After that, people are able to review their profile (Step 3, My Profile) and explore areas that have been highlighted by the underlying GRiST expertise.

Step 4 (My Assessment) lets people record their own risk evaluations and Step 5 (GRaCE Advice and My Plan) shows them the practitioners' evaluations and accompanying advice. This advice is based on analysis of completed assessments by mental-health practitioners in the GRiST database (more than 150,000 for each risk by June, 2015). It means myGRaCE provides accurate predictions of the judgements practitioners would have given for a person's risk profile [23]. The myGRaCE technology explains how

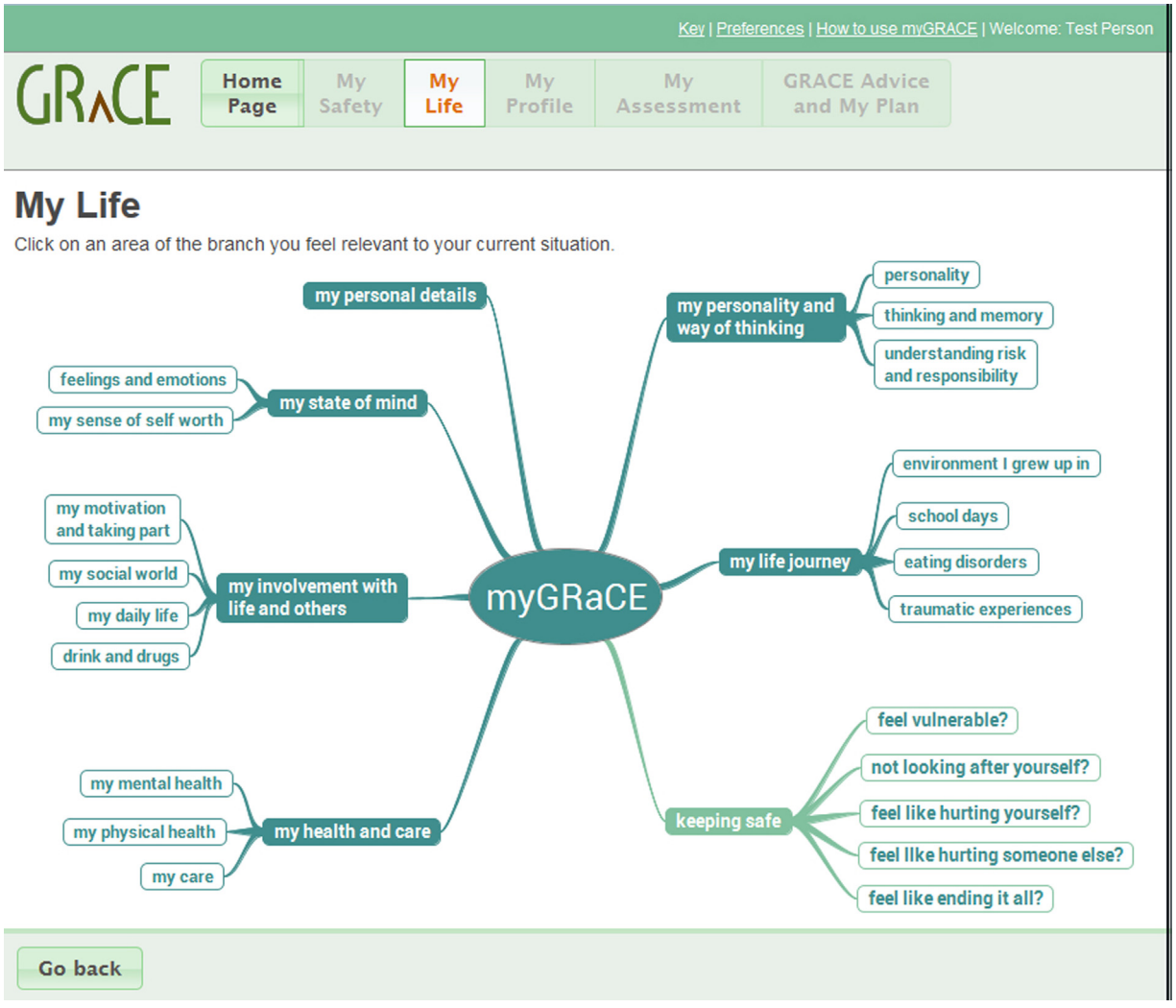

Fig. 3. myGRaCE mind-map overview page for easy and dynamic navigation of risk issues.

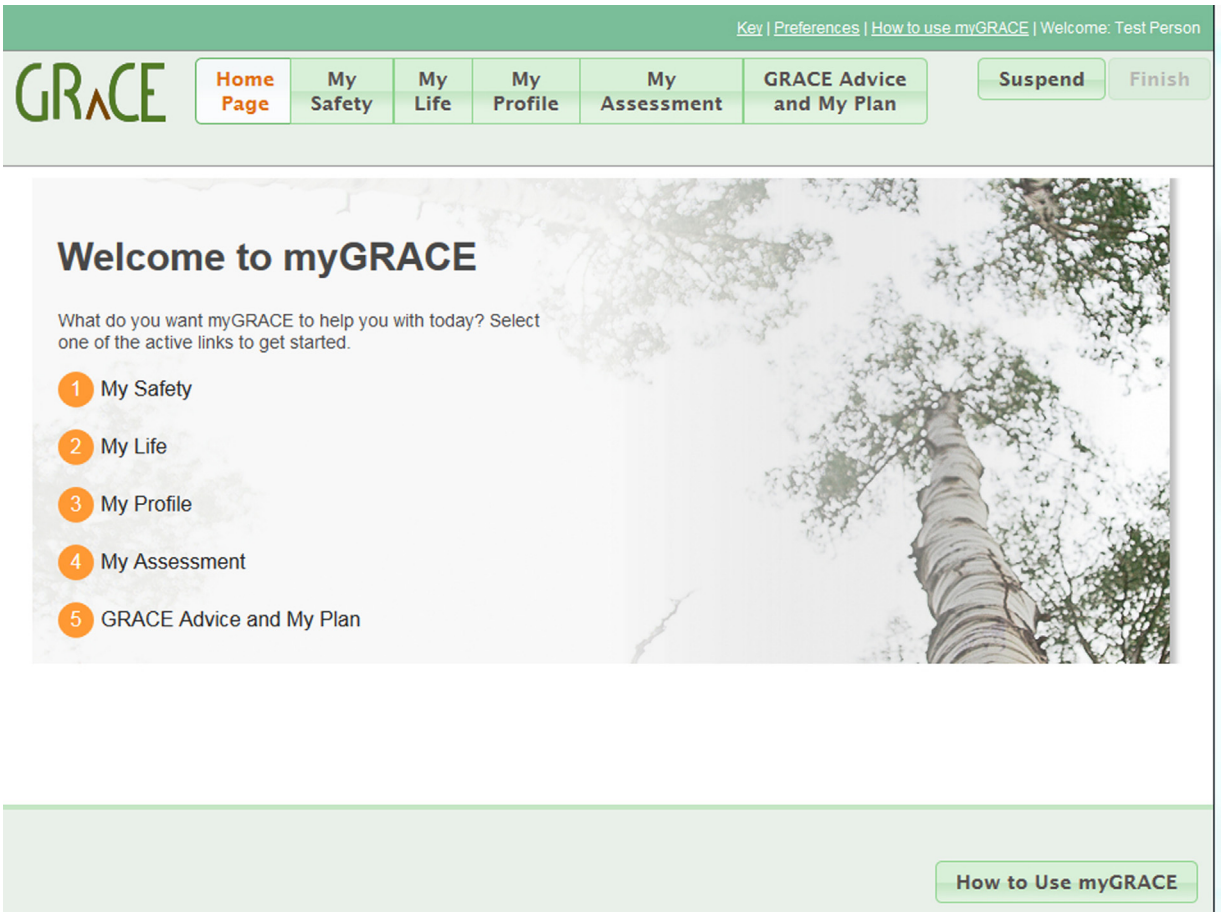

Fig. 4. Stepped process for structuring interaction with myGRaCE and controlling staged feedback.

the data have led to the risk judgements and provides targeted advice for lowering risks that is directly related to the person's individual circumstances. People can activate the advice automatically (e.g. by myGRaCE taking them to online resources, sending an email to friends or carers, or posting a message on social networks) as well as creating their own self-management plan based on the advice.

Each step, then, is a stage along the way to the full process of collecting data, accessing expert advice, understanding how to manage risks, and sharing profiles with others in their care network. This controlled and structured portal to interacting with myGRaCE is one of the most significant outcomes of the research and represents this paper's end-point, prior to the release of myGRaCE for the general public and its subsequent evaluation.

4. Discussion and conclusions

4.1. Discussion

GRiST is a well-established DSS that helps practitioners assess and manage risks associated with mental-health problems. This paper has described a method for generating a SU version and demonstrated its feasibility with the development of myGRaCE. It shows that GRiST's representation of practitioner expertise by a psychological model applicable to people in general facilitates adaptation of that expertise for use by SUs, because it removes any educational and training barriers that might otherwise obscure practitioners' reasoning and thinking processes.

Having a single formal specification of risk expertise common to all types of end user enables the GRiST technology to make precise comparisons between SU and practitioner assessments, despite differences in delivery interfaces and the language of risk questions. Comparisons can highlight similarities, differences, and where collaborative decision making needs to concentrate. They provide SUs with a voice, which they can use through myGRaCE by recording information at their own pace, in the privacy of their own home. SUs are then free to control when and where they share their assessments, which can, in theory, be accessed at all points of the care pathway, including in front-line services, because the overall GRiST DSS is universally available as a cloud computing service.

4.2. Conclusions

Development of myGRaCE has been an evolutionary, detailed, and most importantly, SU-led process. It has demonstrated the feasibility of SUs being able to access and directly exploit practitioner expertise to understand and promote their own mental-health. However, it also showed the challenges of delivering the sophisticated functionality required in a web-based decision support system for use without any face-to-face introduction or training. These have been addressed in the version ready for release to the public that is the conclusion of the research described here.

The next step is to evaluate myGRaCE when used both independently by the general public and in collaboration with practitioners as part of a shared, collaborative assessment process. The general public will be granted free access to the software and it will be included in the overall GRiST service that mental-health organisations currently access by paying a licence fee. A warm

welcome is anticipated because feedback from practitioners is unanimous: the current "clinical" version of GRiST is highly efficient for completion after an assessment but the myGRaCE dynamic interface is ideal for use during assessments. One large organisation using GRiST has already adopted the myGRaCE interface for shared assessments and others are about to follow.

4.3. Practice implications

GRiST provides an important resource for SUs, carers and practitioners, which has hitherto been lacking. All versions, including myGRaCE, can be seen and used at www.egrist.org. They support the UK policy vision of SUs living in the community maintaining as normal and autonomous a life as possible in the knowledge that they still have practitioner supervision. GRiST makes practitioner expertise universally accessible, links it to SUs' own expertise within the myGRaCE interface, and supports collaborative health care in the community.

Conflict of interest

There are no conflicts of interest but the authors are also the developers of myGRaCE and of the parent technology, GRiST. This authenticates the report on how myGRaCE was developed but may introduce potential bias with respect to interpreting its ultimate effectiveness. However, the latter is not the focus of the paper.

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References

[1] The Health Foundation, Co-creating Health, Briefing Document, The Health Foundation, London, 2008.
[2] L. Wallace, A. Turne, J. Kosmala-Anderson, S. Sharma, J. Jesuthasan, C. Bourne, A. Realpe, Co-creating Health: Evaluation of First Phase, The Health Foundation, London, 2012.
[3] Department of Health, Best Practice in Managing Risk, HMSO, London, 2009.
[4] N.H.S. Litigation Authority, Risk Management Standards for Mental Health and Learning Disability Trusts, NHS Litigation Authority, London, 2010.
[5] British Occupational Health Research Foundation (BOHRF), Workplace Interventions for People with Common Mental Health Problems: Evidence Review and Recommendations, BOHRF, London, 2005.
[6] E. Karasouli, A. Adams, Assessing the evidence for e-resources for mental health self-management: a systematic literature review, JMIR Ment. Health 1 (2014) e3, doi:http://dx.doi.org/10.2196/mental.3708.
[7] S. Farrell, S. Lewandowsky, Computational Modeling in Cognition: Principles and Practice, Sage, London, 2011.
[8] A. Jalote-Parmar, P. Badke-Schaub, W. Ali, E. Samset, Cognitive processes as integrative component for developing expert decision-making systems: a workflow centered framework, J. Biomed. Inform. 43 (2010) 60–74.
[9] R. Shibl, M. Lawley, J. Debuse, Factors influencing decision support system acceptance, Decis. Support Syst. 54 (2013) 953–961.
[10] C.D. Buckingham, Psychological cue use and implications for a practitioner decision support system, Med. Inform. Internet Med. 27 (2002) 237–251.
[11] G. Cohen, Hierarchical models in cognition: do they have psychological reality? Eur. J. Cogn. Psychol. 12 (1) (2000) 1–36.
[12] M. Declercq, J. De Houwer, Evidence for a hierarchical structure underlying avoidance behaviour, J. Exp. Psychol. Anim. Behav. Process. 35 (2009) 123–128.
[13] J.Z. Tsien, The memory code, Sci. Am. 297 (2007) 52–59.
[14] C.D. Buckingham, A. Ahmed, A. Adams, Designing multiple user perspectives and functionality for practitioner decision support systems, Federated Conference on Computer Science and Information Systems, FedCSIS, IEEE (2013) 211–218.
[15] C.D. Buckingham, A. Ahmed, A. Adams, Using XML and XSLT for flexible elicitation of mental-health risk knowledge, Med. Inform. Internet Med. 32 (2007) 65–81.
[16] D. de Silva, Evidence: Helping People Help Themselves, The Health Foundation, London, 2011.
[17] C.D. Buckingham, A. Adams, C. Mace, Cues and knowledge structures used by mental health professionals when making risk assessments, J. Ment. Health 17 (2008) 299–314.
[18] G. Thornicroft, M. Tansella, Growing recognition of the importance of SU involvement in mental health service planning and evaluation. Available at http://www.psychiatry.univr.it/page_eps/doscs/2005_1_thornicroft.pdf, 2011 (accessed 05.08.11).
[19] O. Hazzan, Y. Dubinsky, I. MacKie, Agile Software Engineering, Springer, London, 2008.
[20] D. Fogli, G. Guida, Knowledge-centered design of decision support systems for emergency management, Decis. Support Syst. 55 (2013) 336–347.
[21] M.R. Boland, A. Rusanov, Y. So, C. Lopez-Jimenez, L. Busacca, R.C. Steinman, S. Bakken, J.T. Bigger, C. Weng, From expert-derived user needs to user-perceived ease of use and usefulness: a two-phase mixed-methods evaluation framework, J. Biomed. Inform. 52 (2013) 141–150.
[22] T. Buzan, The Mind Map Book, Pearson Education Limited BBC Active, London, 2009.
[23] S.N. Saleh, C.D. Buckingham, Handling varying amounts of missing data when classifying mental-health risk levels, Stud. Health Technol. Inform. 207 (2014) 92–101.