

Chapter 5

Study 3: Co-designing, user testing and evaluating digital suicide prevention functionality

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Suicide is the leading cause of death for Australians aged 15–44 years.¹ National rates of suicide increased between 2008 and 2017, and the number of deaths from suicide increased by 9% between 2016 and 2017. In 2015 and again in 2017, the number of deaths from suicide was recorded at 12.6 deaths per 100 000 population — the highest recorded rate in 10 years.¹ Given the importance of this issue, the National Mental Health Commission (NMHC) National Review of Mental Health Programmes and Services report, published in 2014, recommended a coordinated nationwide introduction of sustainable, comprehensive, whole-of-community approaches to suicide prevention; a greater focus on suicide prevention for people attending health and mental health services; and, specifically, better integration of e-mental health services.² Similarly, the World Health Organization (WHO) has recognised that mobile devices are an important option for providing support and therapy to people at risk of suicide.³

Digital tools are particularly appealing in mental health care as they provide new pathways for reaching more people, while also addressing a range of other social and community challenges (such as social isolation and poor physical health).^{4–8} Typically, these tools have been developed for young people, particularly those born after the widespread adoption of technology.⁷ A recent systematic review on technology and suicide prevention highlighted the promise of mobile, computer or web-based apps in improving young people's outcomes,⁹ however, the scarcity of evidence on online and mobile interventions for suicide prevention in young people was also noted. Suicide prevention apps and e-tools can range from useful and engaging to poorly designed and ineffective.⁷ Other general population research identified 123 apps in the marketplace that were related to suicide.¹⁰ Of these, 10% contained what was considered potentially harmful content, 25% had obvious technical faults or reliability issues, and fewer than half (41%) were developed by academics or health care institutions. One reason for these problems may be that most design of digital content is structured around positive user journeys (steps or processes by which a user may interact with the content), and that more consideration of people who are in crisis is needed when designing the structure of the content.¹¹ Our own user experience designer and researcher reviewed available Australian mental health websites and found varying levels of success in designing user experience for crisis (Eric Fitzgerald, Creative Director, InnoWell, Sydney, personal communication, 2018). Very few offered more than a simple (often red) call button or urgent help button with a long and static list of services. Only one site was found that offered three levels of immediate support (via a “need help now” option) on the homepage; the three support options were “call us”, “crisis

support chat” and “help resources”. A more recent initiative of the Department of Health is Australia's digital mental health gateway known as Head to Health (<https://headtohealth.gov.au>). This site was developed in collaboration with the community and the mental health sector, and it includes a more refined “need help now” feature. This functionality has a short list of recommendations that are, importantly, guided by a set of rules developed by users. These rules include that recommendations must be local to Australia, provide 24-hour access to support, have multiple modes of communication (ie, telephone and web chat) and be sensitive to cultural diversity.

Much work in Australia in suicide prevention over the past two decades has focused on community-level initiatives rather than active engagement of general health and mental health services as key agents in any large-scale response to this major health challenge. However, some novel applications are starting to emerge; for example, our research group has used new and emerging technologies to identify and respond to suicidality among help-seeking young people.¹²

By contrast, considerable international effort has been directed to develop and evaluate health system-level strategies¹³ (eg, Towards Zero Suicide). The NMHC report specifically highlighted the need for Australian health services to actively adopt a “zero suicide in care” philosophy and develop policies and procedures to support this approach.²

The objectives of this study were to explore with participants (young people, supportive others and health professionals) how best to assess risk and support active suicide prevention strategies; co-design digital suicide prevention functionality for potential integration with a prototypic online platform; and conduct a national online evaluation of the digital solution.

Methods

Participants

For the co-design workshops and user testing sessions, people aged 16–30 years, supportive others and health professionals were initially recruited to participate in this study from the general patient populations of Primary Health Networks (PHNs) in four regions of Australia: Central and Eastern Sydney; Murrumbidgee; Central Queensland, Wide Bay and Sunshine Coast; and Country Western Australia. For the online evaluation study, the same groups (ie, people aged 16–30 years, supportive others and health professionals) were recruited more widely from the general Australian population, as described below. All research was conducted between August and December 2016.

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Design and procedures

Following Project Synergy's research and development cycle, the co-design, user testing and evaluation of the digital suicide prevention functionality were carried out in sequential phases (see Chapter 2 for a detailed description of each phase and the terminology used):

- Phase 1 – co-design workshops with participants from the four PHN regions; after each workshop, findings were translated into draft wireframes by a knowledge translation team (see below) to inform generation of subsequent wireframes and build of the functionality;
- Phase 2 – one-on-one 90-minute user testing sessions of the functionality; and
- Phase 3 – a national online evaluation study which involved giving participants 7 days of unlimited access to view the functionality (but not use it) and then having them complete a 10-minute survey.

Participants were recruited for each phase via posters and postcards displayed at services within the PHNs and using existing social media channels of the University of Sydney's Brain and Mind Centre and ConNetica (a mental health and suicide prevention consulting practice). After reading a detailed study information sheet, online informed consent was obtained from participants. Importantly, a health professional was present at all co-design workshops and user testing sessions in case the subject matter caused participant distress.

The knowledge translation team was recruited, using local services, from the Central and Eastern Sydney PHN. All participants received a voucher to thank them for sharing their knowledge and expertise. The value of the voucher varied depending on the activity type and duration.

This research was approved by the University of Sydney Human Research Ethics Committee (Protocol No. 2016/529).

Measures

The online survey used in Phase 3 collected demographic information including: sex, age, postcode, and whether the participant was a young person, supportive other and/or health professional. Technology and internet use were assessed with two items. The first asked participants to indicate the device(s) they used to access the functionality, with multiple responses being provided such as iPhone, PC or Mac computer. The second assessed participants' internet connection quality on a five-point Likert scale (1 for "poor" to 5 for "great"). Feedback on the likeability of various components of the functionality was subsequently provided by participants. This was done by asking respondents to indicate the best liked and least liked features of the digital solution, including: a mapping system to find local or closest mental health services; recommended apps and e-tools; a "rant" feature (space for users to privately express their feelings or experiences); simple clean design; and colour scheme. Participants were also asked to give the functionality a star rating on a five-point Likert scale (one to five stars) and to rate it on an adapted version of the 10-item System Usability Scale (SUS)¹⁴ provided on a five-point Likert scale (1 for "strongly disagree" to 5 for "strongly agree"). Participants were then asked: "Do you think this functionality is useful/helpful for young people with mental health concerns?" (response options: no, maybe and yes); "If you were experiencing distress, how likely would you be to use this functionality?" (answered on a five-point Likert scale; 1 for "not at all" to 5 for "very likely"); and "If

a friend or family member was experiencing distress, how likely would you be to refer them to this functionality?" (answered on a five-point Likert scale; 1 for "not at all" to 5 for "very likely"). At the end of the questionnaire, open-ended qualitative feedback was gathered from participants using questions such as "What were your first impressions of the functionality?"

Analysis

Details describing the process of knowledge translation and user testing in Phases 1 and 2 are provided in Chapter 2. For Phase 3, all statistical analyses were conducted using SPSS, version 22 (IBM Corporation). No missing values were imputed. A SUS score was calculated for each participant by summing scores for the ten individual SUS items, and then multiplying the sum by two to convert the original scores of 0–50 to a SUS score of 0–100. Two comparison groups were created, with the first group being all young people aged 30 years or younger, and the second group being supportive others or health professionals who were over 30 years of age. For each questionnaire item, descriptive and frequency data were analysed. In addition, a two-tailed *t*-test (set at a 95% level of confidence) was conducted to test whether there was a significant difference between the SUS ratings of the two comparison groups. Basic qualitative coding of the question "What were your first impressions of the functionality?" was also carried out using NVivo 10 software (QSR International).

Results

For Phase 1, ten co-design workshops were run with young people, supportive others and health professionals across the four PHNs, with 80 participants in total (15 from Central and Eastern Sydney, 20 from Murrumbidgee, 21 from Central Queensland, Wide Bay and Sunshine Coast, and 24 from Country WA). Of these Phase 1 workshops, 42 participants attended the five workshops that were targeting young people.

For Phase 2, 23 new participants (young people, supportive others and health professionals) completed one-on-one 90-minute user testing sessions across the four PHNs (five from Central and Eastern Sydney, seven from Murrumbidgee, five from Central Queensland, Wide Bay and Sunshine Coast, and six from Country WA). Participants could identify with more than one group, with equal numbers of young people ($n = 13$) and health professionals ($n = 13$) taking part, and a smaller number of supportive others ($n = 5$).

For Phase 3, 101 people participated in the online survey across Australia. Again, participants could identify with more than one group, with the largest group being young people ($n = 54$), followed by health professionals ($n = 47$) and then supportive others ($n = 9$).

Phases 1 and 2: Co-design workshops and user testing sessions

Through participant idea generation and feedback, the co-design workshops resulted in development of the digital suicide prevention functionality, which enhanced traditional "need help now" buttons. The co-designed solution, which was consolidated by the knowledge translation team, included:

- three levels of user response options to address different levels of suicide prevention needs (Services, Talk and !Help);
- recommended apps, e-tools and other types of online resources;

- machine learning which would use artificial intelligence to provide the prototypic online platform with the ability to learn and respond to users without being explicitly programmed (details of how machine learning would be applied to the rant feature are provided as an example below); and
- a mapping system to indicate local mental health services, or the closest services available, to users.

The co-design workshops and user testing sessions emphasised the need for digital content to be personalised, appealing for young people in terms of content and style, accessible and non-stigmatising. Participants also emphasised that the functionality should consolidate and provide links with other online services, face-to-face services, and options for support and information (covering the full spectrum of young people’s needs, ranging from prevention and early intervention stages to the crisis stage). Illustrative quotes regarding important features of the digital suicide prevention functionality collected during user testing are presented in Supporting Information, chapter 5, box 1.

Creation of three levels of support

Feedback from young people, supportive others and health professionals during the co-design workshops demonstrated a clear need for any digital solution to be interactive and to provide a greater breadth of options, catering for different individuals’ needs, rather than traditional static information-based “need help now” functionality. In response to this, the co-designed digital suicide prevention functionality included three levels of support options – Services, Talk and !Help. These three levels of support were designed based on a traffic light rating system: Services (yellow), Talk (amber) and !Help (red).

The Services level of support (highlighted in yellow) was co-designed to provide information about support services that are available online or nearby (within close physical proximity). The page that lists online services allows users to select from a range of apps, e-tools and other online resources that were quality assured using the Mobile App Rating Scale¹⁵ (see Chapter 3 for further detail), including: apps available in the App Store and Google Play (eg, BeyondNow, My3, Conversations for Life and MYPLAN), e-tools (eg, Mental Health eClinic) and other online resources (eg, Lifeline, Kids Helpline, Beyond Blue, eheadspace, ReachOut). The page that lists nearby services includes integration of an interactive digital atlas for mental health, whereby a user can select service attributes via tags (eg, open now or walk-in) and using smartphone GPS functionality or a postcode to be automatically directed to local mental health services (an example is shown in Box 1, illustrating this feature at the initial knowledge translation phase and the final prototype stage).

The Talk level of support (highlighted in amber) was co-designed to provide additional supportive connections for young people using the functionality when they were not in an immediate emergency but wanted to connect with others to talk about their situation. This includes call, online chat and rant options. The call page enables users to select and be directed to a real-time telephone service to speak with someone. The online chat page is where users can select and be directed to an online chat

service and converse with someone by text. The rant page provides a space for users to privately express their feelings or experiences by typing or voice recording how they feel.¹⁶ The rant text or voice recording can then be saved to the user’s personal built-in mood journal or deleted in a visually appealing way. The rant feature would be supported by machine learning using natural language processing and generation tools¹⁷ that filter rant content, sort rants and escalate concerning content so that human moderators can respond efficiently and appropriately.

Finally, the !Help level of support was co-designed to be highlighted in red to reflect the need for immediate emergency support. This feature provides an instant clickable link to talk with emergency services (Triple Zero [000]) and other 24-hour services including Lifeline, Suicide Call Back Service and Kids Helpline. This feature is shown in Box 2, at the initial knowledge translation phase and the final prototype stage.

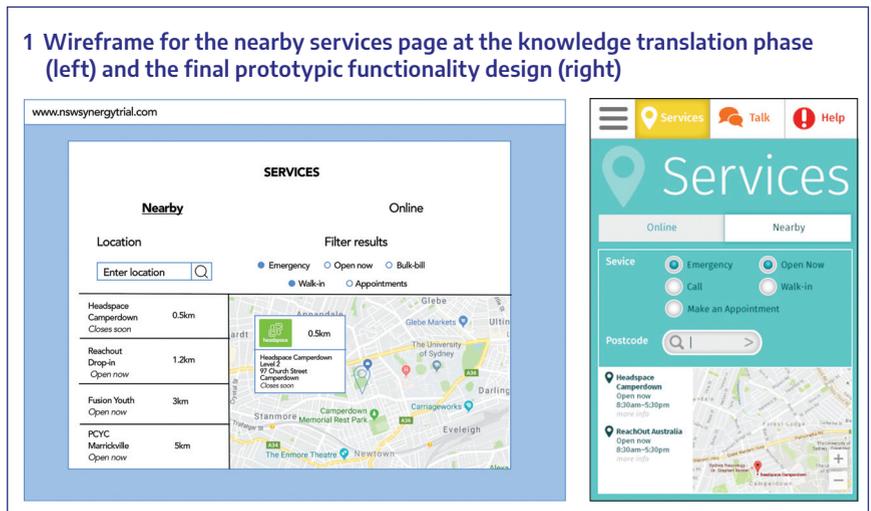
Phase 3: National online evaluation study

A total of 101 participants (56 young people [56%], nine supportive others [9%] and 36 health professionals [36%]) enrolled to participate in the online evaluation study. Their demographic characteristics and data on their technology use are shown in Box 3. The median age band was 20–24 years for young people, 35 years and older for supportive others and 30–34 years for health professionals. Most participants were women (78%). Almost half of the participants were from the Sydney region (49%), close to a quarter were from Western Australia (24%), and the remainder were residing in other regions across Australia (27%). Most participants used either a PC or Mac computer, whereas smaller numbers used an iPhone or other smartphone, and most had an average or better than average internet connection.

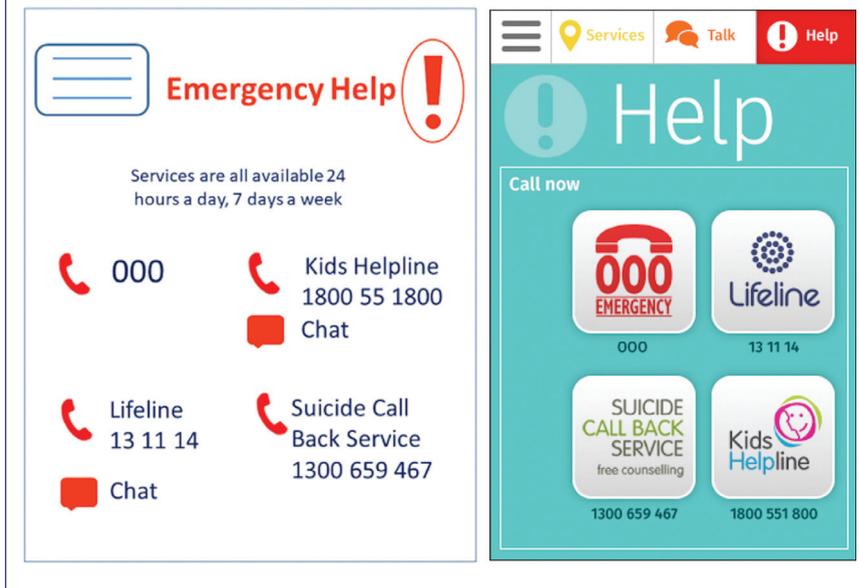
Engagement

Data on engagement of young people, supportive others and health professionals with the functionality are presented in Supporting Information, chapter 5, table 1. The components that were liked the most by participants included: the mapping system (young people, 64%; supportive others and health professionals, 49%); recommended apps and e-tools (young people, 53%; supportive others and health professionals, 42%); and the simple and clean design of the functionality (young people, 42%; supportive others and health professionals, 53%). The rant component was one of the best liked for a large proportion of participants, particularly young people (young people, 58%;

1 Wireframe for the nearby services page at the knowledge translation phase (left) and the final prototypic functionality design (right)



2 Wireframe for the !Help page at the knowledge translation phase (left) and the final prototypic functionality design (right)



supportive others and health professionals, 36%). However, it was also the most divisive component, with the largest proportion of participants rating it as the least liked component (young people, 16%; supportive others and health professionals, 22%) outside of a “don’t know” response. Importantly, the vast majority agreed that the functionality was designed appropriately for young people (young people, 93%; supportive others and health professionals, 93%) and, to a lesser extent, there was agreement that it was designed appropriately for adults (young people, 44%; supportive others and health professionals, 42%).

Acceptability and usability

The acceptability and usability of the functionality as rated by all participants (young people, supportive others and health professionals) is presented in Box 4. When participants were asked whether they thought the functionality would be useful or helpful for young people with mental health concerns, all said either “yes” or “maybe”. Young people were slightly more likely to endorse the functionality as useful or helpful than supportive others and health professionals (96% *v* 87%). In total, only 2% indicated they would not be likely to use the functionality if they were experiencing distress, whereas 60% of young people and 42% of supportive others and health professionals reported being likely or very likely to use it. Furthermore, only 3% of participants indicated that they would not recommend this solution to a friend or family member experiencing distress, whereas 78% of young people and 80% of supportive others and health professionals reported being likely or very likely to recommend it.

On a star rating scale of 1 to 5, the functionality achieved a median rating of 4 stars (60%). Overall, 82% of young people and 85% of supportive others and health professionals rated it as 4 or 5 stars.

Participant views on usability were measured using SUS scores, a measure of the quality of a user’s experience when using a technology. The overall mean SUS score was 84.4 (SD, 11.7) for all participants, which is considered acceptable.¹⁸ Young people’s SUS ratings (mean, 84.9; SD, 10.5) were slightly higher than those of supportive others and health professionals (mean, 83.8; SD, 12.8); however,

this difference was not significant ($t(73) = -0.5$; $P = 0.06$). The overall SUS score on usability was in the top quartile, which equates to a “B grade” and falls between objective ratings of “good” and “excellent”.

Basic qualitative coding was carried out for the open-ended question “What were your first impressions of the functionality?”. Most comments were positive (63%) and the remainder were mixed (23%), negative (10%) or deemed not applicable as feedback (4%). Illustrative positive, mixed and negative comments are presented in Supporting Information, chapter 5, box 2. Positive quotes centred around the clean and simple design, the accessibility of the functionality for young people, the layered and tailored nature of the support options provided, and the “one stop shop” of information and support. Mixed quotes often provided suggestions for additional functionalities. For example, suggestions included use of an avatar, and inclusion of additional resources such as referrals to different national and international health services, treatment, information or support. There were only nine negative comments, and these all related to the design, such as the colour scheme or a need for more visual features in the system.

Discussion

Previous reviews have highlighted the need for digital suicide prevention tools to provide an interactive experience for users.¹⁰ Similarly, in our series of co-design workshops, participants identified the need for, and then co-developed, a digital solution which provides an interactive experience. This co-design process progressed the traditionally static and information-based “need help now” functionality to an interactive tiered system of support (Service *v* Talk *v* !Help) that allows users to engage with each tier based on their self-identified level of need. This was, however, only a prototype of a digital solution. Further testing is required to understand how users navigate and interact with the functionality before it can be integrated into any online platform.

An important advantage of potentially integrating this functionality into our prototypic online platform is that the platform provides a centralised place where other evidence-based apps and e-tools can also be recommended. This empowers young people to choose from apps and e-tools that are high quality and suitable for their needs and goals. Importantly, many of the digital tools that are recommended by the platform are already available in the marketplace, so the platform does not endeavour to reinvent or compete with these products. Instead, the platform provides a pathway to established evidence-based tools, and will continue to do this as new material becomes available. Furthermore, as part of the platform’s quality assurance process, the quality of these apps and e-tools is ensured by use of tools such as the Mobile App Rating Scale.¹⁵ Such quality assurance processes are in turn important for the digital suicide prevention functionality as it is well recognised that these tools need to be high quality, reliable and free from harmful content.¹⁰

Limitations

This study had several limitations. First, our prototype was co-designed with young people, supportive others and health

3 Participants' demographic characteristics and use of technology

Item	Number (%)*
Demographics	
Sex	
Female	77 (78%)
Male	22 (22%)
Age band	
15–19 years	16 (16%)
20–24 years	27 (27%)
25–29 years	17 (17%)
30–34 years	15 (15%)
35 years and older	24 (24%)
Group	
Young person (30 years or younger)	43 (43%)
Supportive other (over 30 years)	9 (9%)
Health professional (30 years or younger)	11 (11%)
Health professional (over 30 years)	36 (36%)
Region	
Sydney (Central Eastern, Western, South Western, North)	48 (49%)
Western Australia (Perth South, Perth North, Country WA)	24 (24%)
Far West NSW and Murrumbidgee	9 (9%)
Eastern NSW and ACT (Hunter New England, Nepean Blue Mountains, North Coast, South Eastern NSW, ACT)	6 (6%)
Queensland (Central Queensland, Wide Bay, Sunshine Coast, Gold Coast, Brisbane North, Brisbane South)	5 (5%)
Victoria (North West Melbourne, South Eastern Melbourne)	4 (4%)
South Australia (Adelaide, Country SA)	3 (3%)
Technology and internet use — device(s) used	
PC	54 (54%)
Mac computer	22 (22%)
iPhone	14 (14%)
Other smartphone (Samsung, Android, Windows)	11 (11%)

Percentages may not add up to 100 due to rounding. ◆

professionals in the general population who had an interest in the subject matter. Although recruitment of individuals was chiefly through mental health service channels, not all the young people who participated would have had a lived experience of suicide-related thoughts or behaviour, either personally or as a supportive other. We did not directly ask participants about these experiences at any stage of the study, which we acknowledge could have provided another level of validity to the digital suicide prevention functionality.

Second, the Phase 3 national online evaluation was only designed to assess acceptability and gather basic feedback on usability. We know the functionality was liked, but we did not

4 Participant feedback relating to acceptability and usability of the digital suicide prevention functionality*

Item	Number (%)		
	Young people	Supportive other or health professional	Total†
Number of participants	45	45	87
Do you think this functionality is useful/helpful for young people with mental health concerns?			
No	0	0	0
Maybe	2 (4%)	6 (13%)	8 (9%)
Yes	43 (96%)	39 (87%)	79 (91%)
Median	Yes	Yes	Yes
If you were experiencing distress, how likely would you be to use this functionality? (overall median = 4)			
1 — not at all	0	2 (4%)	2 (2%)
2	1 (2%)	1 (2%)	2 (2%)
3 — maybe	17 (38%)	23 (51%)	39 (45%)
4	17 (38%)	10 (22%)	26 (30%)
5 — very likely	10 (22%)	9 (20%)	18 (21%)
Median	4	3	4
And, if a friend or family member was experiencing distress, how likely would you be to refer them to this functionality? (overall median = 4)			
1 — not at all	0	0	0
2	0	2 (4%)	3 (3%)
3 — maybe	10 (22%)	7 (16%)	15 (17%)
4	14 (31%)	15 (33%)	28 (32%)
5 — very likely	21 (47%)	21 (47%)	41 (47%)
Median	4	4	4
Star rating (overall median = 4)			
1 star — one of the worst tools I've used	0	0	0
2 stars	0	0	0
3 stars — average	8 (18%)	6 (13%)	14 (16%)
4 stars	23 (51%)	31 (69%)	52 (60%)
5 stars — one of the best tools I've used	14 (31%)	7 (16%)	21 (24%)
Median	4	4	4

* Data are number (%) unless otherwise indicated. † Participants could belong to more than one group (ie, young person, supportive other or health professional). ◆

test whether any measurable changes resulted from its use. Indeed, participants only had access to the functionality for viewing and feedback purposes, so they could not directly trial its use. Larger scale studies are needed to understand more about the efficacy of the co-designed digital suicide

prevention functionality, in both community settings and mental health service settings.

Finally, the rant feature (which was co-designed by participants) was the most divisive component. It was more popular with young people than with supportive others and health professionals. Further exploration of this feature's efficacy and safety is needed before it can potentially be included as part of the digital suicide prevention functionality. While the idea would be to support the rant feature with machine learning using natural language processing and generation tools,¹⁷ another study by our research group that was focused on systematic assessment has demonstrated how the use of new and emerging technologies

employing escalation algorithms can facilitate access to mental health services for help-seeking young people presenting with suicidality.¹²

Conclusion

Ultimately, our co-designed digital suicide prevention functionality was rated as highly acceptable and usable by end users. The high acceptability demonstrates the value of involving users (in this case, young people, supportive others and health professionals) from project conception, and supports recommendations that such involvement constitutes best practice.¹⁹

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Supporting Information

Additional Supporting Information is included with the online version of this article.