

# Stay Alive Evaluation Report

June 05, 2020

Grassroots



## Executive summary

To evaluate Stay Alive's impact to-date from an economic, health and social perspective, a qualitative survey as well as an opportunity cost health economic model have been produced. The evaluation has measured any improvements the application either contributed to or realised since its launch in 2014 and the previous evaluation in 2016. Specifically, findings from a renewed survey has assessed, from a qualitative perspective, the application's reach and engagement as well as any patient and pathway outcome improvements. The opportunity cost model highlighted societal and indirect benefits Stay Alive could be a factor for e.g. hospital re-admissions or counselling costs.

This report sets out the methodology and findings of both analyses alongside insights from a literature review. Discussion and limitations of the approach are examined alongside suggested recommendations considering Grassroots' expected developments.

## Key findings

### App reach and engagement

A significant increase of 48% was captured in the number of active users from 2018 to 2019. Engagement rates are average with a 10-week retention rate of 4%. Research shows that over a shorter period of 5 weeks, the average retention rate across applications is 6% (Haslam, 2019). Official statistics show that males and population groups aged 45 – 49 contribute to the current spectrum of at-risk groups. Stay Alive's user base is predominantly represented by younger demographics given the inherent nature of the solution being a digital application. The userbase is also broadly represented by a young female population (gender split 70% female and 30% male) which could be reflecting the gender split across professionals working in the caregiving sector. Survey results showed that the majority of app users were supporting someone at-risk rather than at-risk individuals themselves. This breakdown mirrors the fact that more individuals are performing a supporting role rather than experiencing thoughts of suicide. This finding fits with Grassroots' desire to not only offer support to those at-risk, but to offer help to those supporting others with thoughts of suicide.

## **Patient outcome improvements**

According to the survey results, Stay Alive has helped individuals stay safe from suicide in 76% of cases when using the app for themselves, 81% when supporting someone else (compared with 70% in 2016) and 78% when professionals were using it. This suggests a large increase in feeling the app is useful for self-management purposes when it comes to them or the person they are supporting. The Stay Alive app has successfully helped reduce stigma for more than 90% of users, per the survey, as well as improved the way users speak about suicide. Key resources and features included the “Local Crisis Support”, “National Crisis Support” as well as the ‘Safety Plan’ feature, the latter for those supporting at-risk individuals.

## **Pathway improvements**

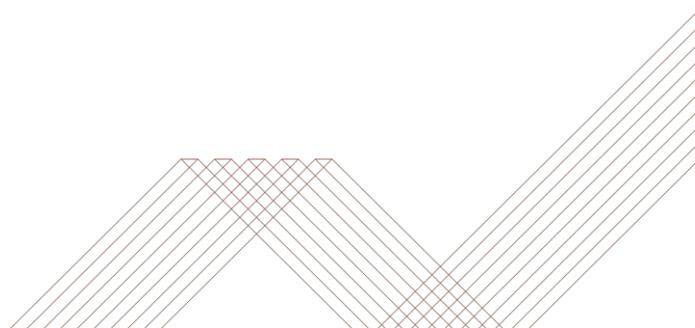
The application was considered a useful signposting tool for 78% of respondents and helped connect individuals to the right resources. This is an indicator that Stay Alive could provide better access to care by making services from the suicide prevention pathway more accessible and increasingly used.

## **Societal and indirect benefits**

As illustrated in the opportunity cost model, the current economic impact of suicide and suicide attempts in England was estimated at £22.7M per year in healthcare system costs and at £118.1 million per year once the mortality rate is accounted for. Should a suicide prevention programme be implemented across England and target 10% of the at-risk population, it is estimated that around £11.8M of potential savings could be achieved. Going forward, it will be interesting to understand the contribution Stay Alive could have to these outcomes which included hospital re-admissions, length of stay, mortality rates and counselling costs. Other indirect benefits highlighted included reduction in sick days and improvement in productivity from higher quality of life.

## **Technical improvements**

Initial review of the survey findings highlighted overall ease of navigating but there was no available data from expected focus groups at the Hertfordshire site to assess in greater detail navigability, aesthetics and application quality components.



## Limitations

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Whilst findings illustrated improvements and positive impact, there are limitations to the analyses and broader considerations to note. The survey analysis was subject to user case interpretability and lack of comparability between the 2016 and 2020 surveys. Due to lack of data obtained from the Hertfordshire pilot site, it was decided that an opportunity cost model was a more appropriate form of analysis compared to a cost-benefit model, which would have showcased the true impact of the Stay Alive intervention. Assumptions had to be based on latest available secondary data generating further inconsistencies. Other limitations were noted, specifically the need to consider the application as a complement to the pathway rather than a substitute, as well as privacy and security requirements, and risks around harmful content and digital literacy.

## Key Recommendations

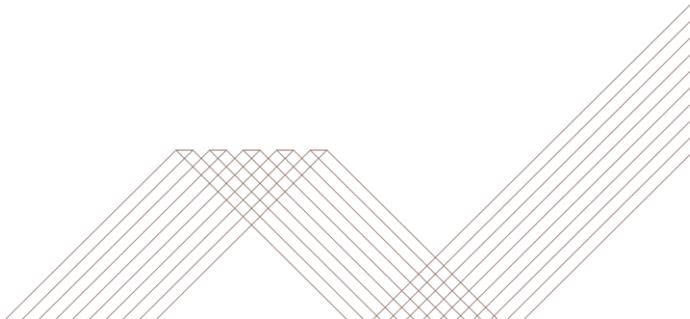
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### Evaluation

Some of the evaluation domain areas would need to be further explored due to lack of available or relevant data to-date. The opportunity cost model could be further elaborated by identifying a community or secondary care site and tracking outcomes from the existing pathway relative to the Stay Alive intervention. The technical and accessibility evaluation domains, which similarly had insufficient data to highlight any improvement, should be reviewed and tested through the expected user experience trials Grassroots will be coordinating. Surveys in the future should contain clear and distinct user profiles to make correlations to responses easier.

### Business model

In order to help Grassroots, attract and target the missing but relevant at-risk groups, and to increase engagement rates, it was suggested the organisation investigates specific user profiles' behaviours. This will assist in understanding how the application can best be tailored to them. Targeted campaigns for these groups could then be launched. Grassroots could also look to embed some features within the context of the current suicide prevention pathway. Research has shown that other settings for at-risk groups may be seen in conjunction to other factors including before or after a discharge point or linking to medication use. Finally, partnerships

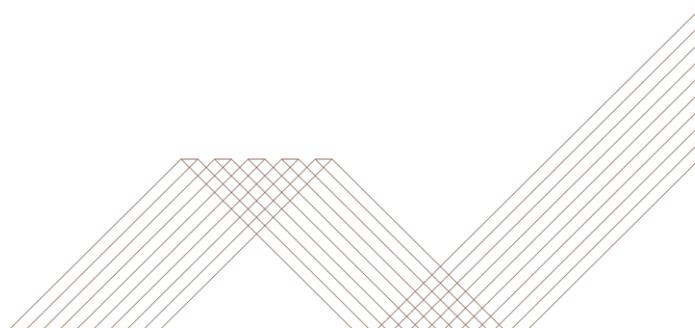


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both within the healthcare system and beyond should be considered to enhance the signposting capability e.g. veteran charities, ex-convict communities or charities for population groups with co-morbidities.

### **Technical guidance / adherence**

With the new version of the Stay Alive application launching soon, necessary precautions have been taken to ensure encryption standards are met. Going forward and because security requirements within digital continuously evolves, it will be important to ensure the application remains in line with independent bodies' assessment and guidance from the code-of-conduct for data driven health and care technologies .

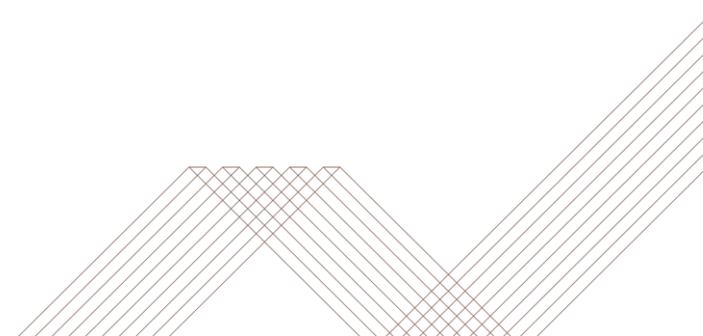


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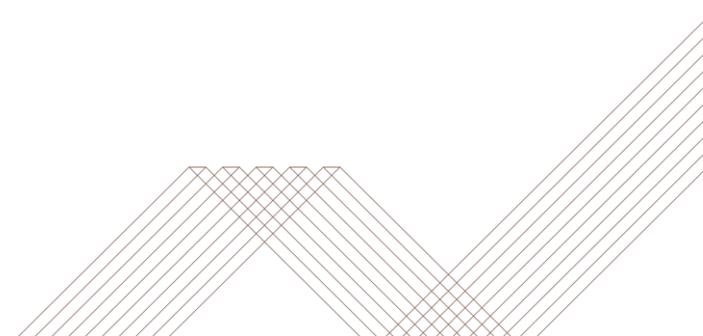
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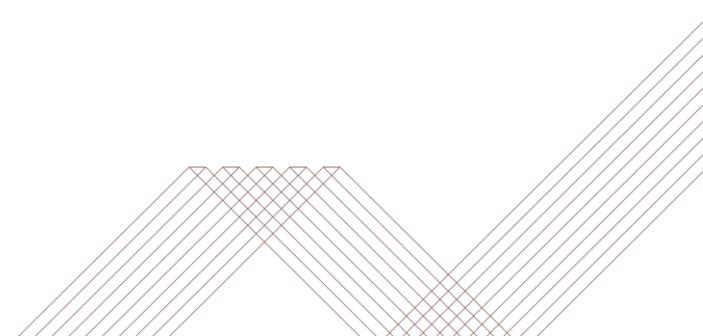
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# Introduction and purpose of report

Grassroots Suicide Prevention ('Grassroots') is a Brighton-based charity that works to prevent suicide. Grassroots aims to achieve suicide prevention by reducing stigma and helping people in the community by starting conversations and offering support to individuals around the topic of suicide. The Stay Alive application (app) is a suicide prevention resource for the UK and was launched in 2014 by Grassroots. The app aims to offer help and support both to people experiencing suicidal thoughts and to those who are concerned about someone else. It comprises useful information and tools to help you stay safe in times of crisis. These features make the app a fitting solution to Grassroots achieving their organisational goals. The app is well appraised by users and clinicians and is currently promoted across 10 different areas with approximately 22,000 active users (Google, 2018).

## Purpose of the report

The Kent Surrey Sussex Academic Health Science Network ("KSS AHSN") was commissioned to support Grassroots in assessing the economic, health and social impact, when applicable, of the Stay Alive app through survey analysis, a high-level opportunity cost economic model and literature review for further insights. This exercise follows an evaluation conducted in 2016 which showed the app had a significantly positive impact two years after its release.

Adding to the 2016 evaluation findings, this assessment will seek to inform whether the Stay Alive app was successful in:

- Showcasing improvements from the 2016 results in terms of user traffic, usage, accessibility, navigability and security.
- Evidencing patient outcome improvements from features of the app that could lead to improved awareness and knowledge, increase support or signposting, improvement in self-management and improvement in supporting gatekeepers, with an overall preventative perspective of helping at-risk population groups stay safe from suicide.
- Evidencing operational efficiency improvements generated by the app to the current pathway from indicating greater access to care and bettering communication between healthcare professional, supporters (friends and family) and individuals struggling with suicidal ideation.

In order to assess the impact of the application an evaluation framework was designed to highlight key quantitative and qualitative measures, with associated data collection methods. Derived from this evaluation framework, the following were created:

- Quantitative and qualitative analysis was used, drawing from a literature review and survey analysis to explore and detail changes in user response comparing the 2016 and 2020 surveys across a set of questions that related to the evaluation framework.
- A high-level opportunity cost was conducted to measure the costs of suicide to the English population and the impact of such in terms of mortality rate, admission, GP consultation and bed days costs associated with suicide and suicide attempts in England.

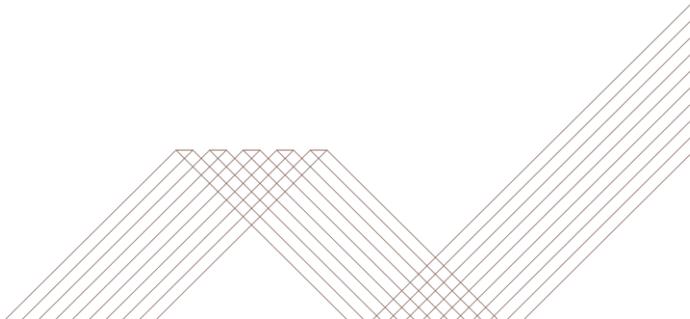
Finally, limitations and considerations will be suggested. All above elements will be framed within context of current academic literature surrounding the topic of suicide prevention through digital health technologies.

## Context around Suicide Prevention

### Figures and national context

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In 2018 there were 6,507 suicides registered in the United Kingdom (UK), which is a statistically significant increase of 11.8% since 2017. This is surprising as previous years have followed a declining trend trajectory (Mackley, 2019) (Office for National Statistics, 2019). Furthermore, the 2018 registered suicides figure is likely to be an underestimation of the suicide rate due to registration delays or even miscoding, with increasing concern for their occurrence to follow an upward trend (Mackley, 2019) (Office for National Statistics, 2019). Alterations in registered suicide trends could be due to a change in proof standard changes. In July 2018, the standard of proof used by coroners to determine whether a death was caused by suicide was lowered, resulting in an increase in the number of deaths recorded as suicide (Office for National Statistics, 2019). Therefore, the increase may not reflect a direct comparison to prior years. England accounted for 5,021 suicides registered in the UK in 2018, with men being three times more likely to die by suicide than women (Department of Health and Social Care, 2019). Suicide was recorded as the leading cause of death in men under 50, whilst it is growingly becoming a leading cause for younger age groups.

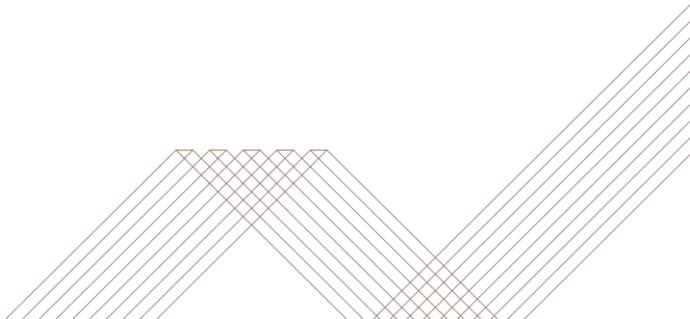


Over the past decade, various key guidance and reports have pushed towards reducing suicide rates. The *Five-Year Forward View of Mental Health* made recommendations on suicide prevention and reduction with a goal to reduce suicides by 10% in England by 2020/2021 (NHSE, 2016). Included within this framework is the goal to achieve multi-agency prevention plans targeting high-risk locations and supporting high-risk groups with their population by 2017 (NHSE, 2016) (see [Appendix A](#)).

In 2012, the National Suicide Prevention Strategy was published outlining two key objectives including, a reduction in the suicide rate and better support for those bereaved or affected by suicide (Department of Health and Social Care, 2012). Furthermore, six key areas of action were highlighted:

- Focus on reducing risk for at-risk groups
- Providing tailored approaches to improve mental health for specific groups
- Reducing access to methods for suicide
- Informing and supporting those affected by suicide
- Working and helping the media in communicating about suicide and suicidal behavioural in an adequate way
- Fostering data collection and tracking on the topic and ongoing research

Moreover, in January 2019, a cross-government suicide prevention plan was published, setting out actions for local government, the NHS and the criminal justice system (Department of Health and Social Care, 2019). The focus of this initiative lies in understanding how social media and the latest technology (including predictive analytics and artificial intelligence) can identify those at risk of suicide. The plan welcomes various actions including:

- Improving data held on causes of death, among veterans for example
  - Addressing the increase in suicide and self-harm among young people, asking social media companies to take more responsibility for harmful online content
  - Ensuring every local authority puts an effective prevention plan in place
  - Ensuring every mental health trust to have a zero-suicide ambition plan for mental health inpatients by end of 2019
- 

- Addressing the specific needs of the highest risk groups, including middle-age men with £25 million funding
- Supporting prisons to put actions in place to reduce suicides and self-harm and improve staff awareness and training
- Improving research on indirect factors affecting suicide e.g. debt or gambling

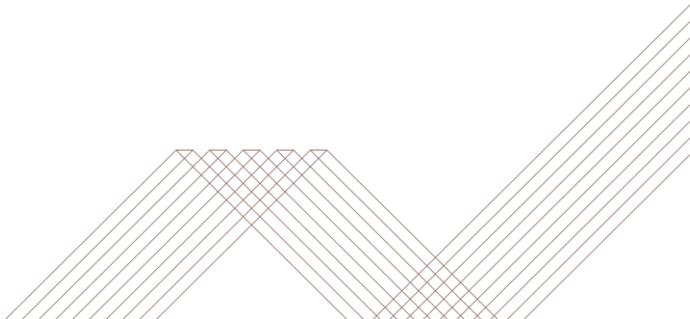
## Target population affected

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Identifying the at-risk population groups for suicide is complex because suicide represents the endpoint to an intricate series of risk factors and challenging events (Department of Health, 2012). Studies have compared various economic tools to possibly measure the at-risk population, however, conclusions have shown that these scales have failed to predict suicide (Steege, et al., 2018). The argument has been to use these scales alongside supporting clinical evidence (Steege, et al., 2018).

In order to understand the relevant target population for the purposes of this evaluation, trends and statistical understanding were first reviewed in conjunction with a general understanding of causes, risk factors and clinical evidence, where possible.

Trends, with a focus on England as available, have until now showcased the following results:

- **Prevalence of suicide for men** - Higher suicide rates for men than women with 75% of registered deaths being among men in the UK. Male suicide rates increased from 1.4% in 2017 to 1.59% in 2018 in England (Office for National Statistics, 2019) (see [Appendix B](#)).
  - **Prevalence of suicide for mid-aged population groups and increase in younger population groups** - Population groups between 45-49 years seem to be the most affected age group with the highest suicide rate (Office for National Statistics, 2019) (see [Appendix C](#)). Whilst population groups ages from 10 to 24 years and males aged 75 and above have seen an increase in their suicide rates (Office for National Statistics, 2019) (see [Appendix D](#))
  - **Prevalence of suicide in regions correlating with higher socioeconomic inequalities** - Specific regions in England are affected, in particular in the North East, Yorkshire and The Humber, South West, East and North West –
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all regions showcasing rates of 17:100,000 deaths per males (Office for National Statistics, 2019) (see [Appendix E](#)).

A few factors can potentially lead to suicide events, attempts or behaviours and put an individual at risk, these include but are not limited to:

### **Demographic factors: gender, age and genetics**

Registered suicides in males equated to 17.2 deaths per 100,000 and female deaths were recorded as 5.4 deaths per 100,000 in the UK (Office for National Statistics, 2019). These figures support findings that men can be considered higher risk than women (Department of Health, 2015) and aligns with the categorisation of at-risk population groups, per the National Strategy, which include young and older male (Department of Health and Social Care, 2019).

It is unclear why there is a greater rate of death by suicide in males when compared to females but, this could relate to help seeking behaviours in men. Men are more reluctant than women to seek help, talk about suicide or engage with healthcare professionals (Department of Health and Social Care, 2019). Some research by the Samaritans suggested that this might be due to increased family breakdown trends e.g. divorce resulting in an increased feeling of loneliness; the decline of traditionally male dominated industries or social expectations of masculinity (Office for National Statistics, 2017). Furthermore, studies show gender differences in methods of suicide attempts. One study showed that women attempt suicide more frequently than men but, men use more violent methods of suicide. Therefore, men are more likely to die by suicide (Tsirigotis, Gruszczynski, & Tsirigotis, 2011). This makes the attempt more difficult or impossible to reverse i.e. hanging is more likely to cause death by suicide than a drug overdose. The patient could phone an ambulance once they have overdosed and receive medical attention. Hanging, which is considered a violent mean of suicide (Tsirigotis, Gruszczynski, & Tsirigotis, 2011), accounted for 59.4% of all suicides in men, while it accounted for 45% in women (Office for National Statistics, 2019).

In both men and women, the most susceptible age group for suicide was 45 – 49-year olds (Office for National Statistics, 2019) and it has been estimated that the impact of suicide can be as much as £1.6 million for an individual within working age in the UK (NICE, 2018). Further inspection of data indicates that rates among under 25s have greatly increased with the highest suicide rates in females aged 10-24-years-old (Office for National Statistics, 2019). Arguably, the earlier an individual dies by suicide the greater the economic impact and loss of productivity i.e. this impact

will be greater than £1.6 million (Goeree, et al., 1999). These rates have significantly increased from 1.8 deaths per 100 000 in 2012 to 3.3 per 100 000 (83%) in 2018 in the UK (Office for National Statistics, 2019).

Genetic factors can also result in certain individuals being pre-disposed to mental disorders which can increase their chance of suicide (Goeree, et al., 1999). Additional factors can explain the increase for older age groups which include psychiatric illness, deterioration of physical health and functions as well as social factors (Office for National Statistics, 2019).

This 2020 evaluation will look to assess the relevance of the Stay Alive application's user base relative to these target population trends highlighted above.

### **Medical history and engagement with primary/specialised care factors**

Other high-risk groups include people with a history of self-harm (Department of Health and Social Care, 2019). Almost 50% of deaths from suicide relate to individuals with a history of self-harm. To address this, people that have attended an Emergency Department due to self-harm were provided with a psychological assessment to ensure adequate follow up. NHS England has committed to a £249 million investment to help with the roll-out of liaison mental health teams in every A&E Department by 2021 (Department of Health and Social Care, 2019). These teams will deal with presentations for self-harm and ensure that patients receive a psychological assessment to prevent them from self-harming again (Department of Health and Social Care, 2019). It is important to note that whilst one can track at-risk populations looking at medical histories of self-harm, these represent only the tip of the iceberg, as many incidences of self-harm in the community are not always presented to clinical services (see [Appendix F](#)).

It is also estimated that about 25% of people who die by suicide were in contact with secondary mental health services in the year prior to their death and that shy of 20% of suicides occur within the first three months following their hospital discharge (Department of Health and Social Care, 2014). The peak likelihood for an event happening after discharge was suggested to be within the first week. This calls for the need of effective care planning prior to discharge, with follow up appointments scheduled to reduce any adverse event from happening (Department of Health and Social Care, 2014). A primary care study also showed that 63% of individuals dying from suicide had contacted their GP in the previous year providing the NHS with an opportunity to influence such high-risk groups and signposting to useful resources such as the Stay Alive application (Department of Health and Social Care, 2014).

People in the care of mental health services are another at-risk group accounting for around 33% of all suicides in England, whilst being some of the most preventable suicides (Department of Health and Social Care, 2019). Interestingly, about 25% of mental health patients who die by suicide also have a major physical illness (Department of Health and Social Care, 2019). This could suggest that integrated care becomes a vital step to properly tackle suicide.

Research suggests that there could be an increased risk of suicidal ideation and attempts in individuals who take antidepressants to manage anxiety or depressive disorders, who are not properly monitored by a healthcare professional (Anil Nischal, 2012).

### **Socioeconomic and other factors**

Other high-risk groups include people living in deprived or from lower socio-economic background who are more likely to die from suicide (Office for National Statistics, 2017). Work occupation can be a substantial factor in characterising high at-risk population groups. The National Strategy identifies specific occupational groups, such as doctors, nurses, veterinary workers, farmers and agricultural workers as potentially high-risk groups (Department of Health and Social Care, 2019). Similarly, lower-skilled occupational jobs for the male workforce could induce potential suicide risks (Department of Health and Social Care, 2019).

Moreover, people in contact with the criminal justice systems, due to the increasing prevalence of psychoactive substance in prison, increased violence, mental health issues or substance misuse, sentence-related factors and family or isolation factors, are more likely to prematurely end their lives (Department of Health and Social Care, 2019). The period which follows an individual's release from prison could be considered high risk (Department of Health and Social Care, 2019). A few actions including the release of a Prison Safety Framework in 2018/2019 seek to support such groups to reduce suicide and self-harm (Department of Health and Social Care, 2019).

One needs to review the target population relative to the access to suicide that some individuals might have (Department of Health, 2015). For that reason, methods of suicide are important to review. The most common suicide method in the UK was hanging, suffocation or strangulation which accounted for almost 60% of all suicides for male and 45% for female, followed by poisoning (17.9% of suicides for males and 36.2% for females) (Office for National Statistics, 2019). It is also important to mention that these vary on a case-by-case basis and that it is difficult to provide with

an objective assessment in identifying correctly high at-risk groups or suicide events from occurring.

## Outcomes

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Suicide events, attempts or behaviours can have a large impact on the individual, the system and society, both directly and indirectly. Some of these outcomes can be easy to quantify whilst other have further confounding factors reducing the direct causation.

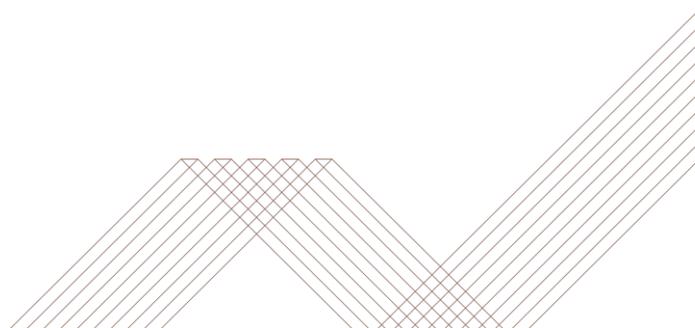
### Health and economic impact

Health system-related outcomes include hospital admissions and re-admissions, as well as inpatient bed days, due to self-harm incidents, particularly in the first six-month period. Re-admissions provides an indicator of repeated distress and need for continuous clinical care (Steeg, et al., 2018). Assessment and counselling appointments represent consequent costs to the system, along with an increase in the demand for resources provided by local and national crisis support.

Suicide and suicide behaviours severely impact the system from an economic perspective by either decreasing work productivity or increasing the number of sick days (Hamberg-van Reenen, Proper, & van den Berg, 2012). In 2015, it was estimated that mental health problems resulted in 17.6 million sick days per year, whilst 181,600 people could not join the labour force due to mental health problems (Lynch & Clarke, 2006).

### Social impact

Social outcomes include an increase in mortality rates, as seen from the suicide figures in England and the UK (Office for National Statistics, 2019). Additional consequences are represented from feelings of isolation and stigma from society, subsequently to initial suicidal behaviours, which could exacerbate an individual's feeling of helplessness leading to more severe events or ongoing deterioration of an individual's quality of life (Rost, 2005) (French, et al., 2009)



## Indirect impact

Suicide has a resounding effect on the affected individual's social circle e.g. family, friends and partners (Rost, 2005). This can lead to further health and economic impact, where family members would require days off work and counselling support and more severely, could relate to an increase in suicide from bereavement (Larsen, 2016). In 2015, an estimated cost of £5.4 billion was incurred to the UK's GDP from individuals taking time off work to care for those who had attempted suicide (Mental Health Foundation, 2020).

## Existing pathways and interventions

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NICE guidance sets out various pathways available in the short to long-term, highlighting specific programmes and resources depending on one's population group. It sets out key principles, management protocols and approaches for healthcare professionals in primary care settings, emergency departments, ambulance trusts setting, both in the immediate, transitional or long-term period (NICE, 2019). Note that support can be given at both local and national level.

### Mental health care

Across mental health care settings, successful evidence of reduction in suicides was seen in across various types of interventions. These included the provision of specialist community mental health services e.g. crisis resolution home treatment teams, assertive outreach and services for people with pre-conditioned diagnosis. Other successful services included the implementation of NICE guidance for other mental health disorders including depression and anxiety and sharing information across agencies (Department of Health and Social Care, 2019).

### Secondary care and A&E settings

Given that in 25% of cases, individuals have had contact with secondary care mental health services, there is a pathway continuation from that touchpoint (Department of Health and Social Care, 2014). Special programmes and objectives in acute settings have been set up to ensure good management of self-harm as a vital step for suicide prevention strategies. For example, an acute pathway for Adults and Older Adults was outlined as part of the Five-Year Forward View for Mental Health programme including a range of diagnoses and needs including such as psychosis, personality

disorders, bipolar affective disorders and other severe and complex mental health problems. As part of this, people who self-harm have been included in the pathway (Department of Health and Social Care, 2019).

### **Primary care settings**

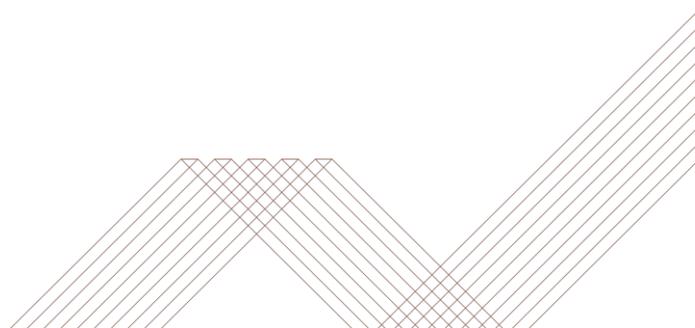
In 75% of cases, patients do not have access to solutions via secondary care, therefore, primary care presents as an opportunity to support with self-harm and suicide prevention. Clear markers to reduce suicides and suicide behaviours include frequent consultation, either via the IAPT route or other assessments (Department of Health and Social Care, 2014). Treatment of depression and anxiety through these consultations alongside proper prescription and monitoring of psychotropic drugs can improve an individual's at-risk outcomes. However, this requires individuals to seek help through primary care services and does not account for high-risk population groups who do not engage neither with primary care or secondary care mental health care settings (Department of Health and Social Care, 2019).

### **Voluntary sector, internet-based support peers and friends**

Various charity organisations have been supporting communities in keeping them safe from self-harm when in need of help. A few known organisations offering support include either helpline, counselling groups or internet-based support such as the Samaritans, CALM helpline, Papyrus, SANE mental health helpline, Childline, the MIX, the Silver Line, Switchboard, Mind.

Other carers such as family and friends tend to be a large source of support but should be viewed with caution as such events can affect the people who are supporting those in need. These individuals should also seek support on their end – initiatives such as the Suicide Bereavement Support Partnership enable these help-seeking behaviours (Department of Health and Social Care, 2019).

Digital resources to address suicide prevention have increasingly been used including self-guided digital interventions, signposting resources, meditative and breathing exercises, depression management apps including chatbots and more. A study reviewed 69 applications that are available in English and comply to six forms of clinical guidelines assessment and management, ranging from identifying at-risk population groups, tracking of mood and suicidal thoughts, supporting with the development of a safety plan, recommending activities, informing and educating, providing access to resources and counselling (Martinengo, 2019).



This evaluation will seek to review one of these applications, which is Grassroots' Stay Alive application.

## Grassroots and Stay Alive

### Overview

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Grassroots Suicide Prevention is a Brighton-based charity with the main belief that individuals should not be in a position where they contemplate suicide alone. The team provides training, signposting and innovations in the hope that these tools open-up conversations around suicide and reduce stigma associated with this topic. Courses offered by Grassroots help to better prepare and equip those supporting individuals that have difficulty with suicide, mental health and self-harm. The organisation works both locally and nationally with various stakeholders and individuals (Grassroots, 2020).

In 2014, on World Suicide Prevention Day (September 10<sup>th</sup>), the application was launched and was made available to

and iOS platforms. The Stay Alive app is a suicide prevention resource that serves as a self-help and educational tool for those experiencing suicidal thoughts and for those supporting individuals with suicidal ideation. Since 2015 the Stay Alive smartphone app has been licensed by 16 local areas, including: Avon & Wiltshire; Cheshire & Merseyside; Coventry & Warwickshire; Essex; Gloucestershire; Greater Manchester; Herefordshire; Hertfordshire; Kent & Medway; Leicester, Leicestershire & Rutland; Norfolk & Waveney; Scotland (Brothers in Arms); South West London; Suffolk; Surrey; and Sussex.

Stay Alive seeks to empower its different users in helping prevent suicide through its features, which on some occasions can be customised and made unique to each user or signpost to other useful resources. Some of Stay Alive's key features include access to UK national and local crisis support, educational and myth-busting content; an interactive safety plan, strategies for staying safe from suicide and a LifeBox for life-affirming photos. Since its launch in 2014, the app has had 106,594 downloads with 18,167 active devices using the app currently, and growing figures of downloads and maintained use (Grassroots, 2019).

Grassroots, through the Stay Alive app, attempts to address stigma and taboo around suicide by raising awareness towards suicide prevalence in society.



Secondly, it is a means to address a previously inaccessible at-risk population who would not use traditional suicide prevention resources. For example, evidence shows that men are more likely to use apps (42.9%) rather than traditional resources (26.9%) (Grassroots, 2019). Thirdly, the app acts as an intermediary between the individual affected and local, national or international support systems. Finally, Grassroots appreciates that apps are a form of interactive media that could possibly be incorporated into public prevention strategies. This solution could be a tool to help reduce immediate demand on NHS resources and could be the essential additional step in the current suicide prevention pathway.

Grassroots has developed the app engaging users and individuals who have experienced suicide across the charity's network and volunteers, trustees and staff. Including people who have been bereaved, have struggled with their own thoughts of suicide, or help others personally or professionally. This enables the application to be built using an informed and human-centric approach.

## 2016 survey and evaluation exercise

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An evaluation was conducted in 2016 drawing from a survey conducted by Grassroots. The aim of this evaluation involved gathering quantitative and qualitative insights about user's sentiment and the app's performance two years after its launch.

The report argued that the app could have contributed to preventing at least 73 suicide attempts. Nevertheless, it is important to highlight that the direct impact of the app is difficult to measure as confounding factors could have contributed to that reduction and such a measure cannot be obtained with certainty through a survey. It was shown that the app had received good feedback from users and clinicians, and appeared in several positive media stories (Flecknoe, 2016). The Stay Alive app had even been included in discharge plans from local mental health services within the Brighton area (Flecknoe, 2016).

Detailed results showed, across 135 respondents who use the application, 29.4% of them felt the Stay Alive app had helped them to stay safe from suicide, and 77.9% of respondents felt it had helped them or someone else to stay safe from suicide. Of these, respondents reported having used the app to help themselves (33.8%), a friend (28.8%), a stranger (20%) or someone that they provide a professional service to (61.3%). These answers were not mutually exclusive, with most respondents indicating that they had used the app in more than one of these contexts. Of the professions listed by respondents in the last category, doctors, nurses, counsellors,

social and educational professionals were all represented. The app is being used in many professional settings, for instance it is included on mental health patients' discharge paperwork at Brighton & Hove and Haywards Heath Accident and Emergency Departments, being promoted across 10+ NHS Trusts, and being used by Sussex Police, British Transport Police, and Network Rail. Further research and development for its use in professional settings is one aim of the proposed project.

Further data shows that the 18-24 age group accounts for 32% of users; 25-34 – 27%; 35-44 – 17%; 45-54 – 16%; 55-64 – 6%; and 65+ – 3%. This is relatively matched with smartphone usage for these age groups overall, and shows that University age students are particularly active users of the app (Google, 2018).

## Recent developments

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The application is expected to undergo a general release, with further updates to be made to its features in April 2020. This evaluation will help confirm and validate the need for some of these suggested updates and new developments.

We understand that the following feature updates are already underway (Grassroots, 2020):

- Development of searchable database of crisis resources, including local resources for the whole of the UK
- Increased functionality for the LifeBox, to include audio, video, weblinks, and text (currently only photo/images can be stored)
- Ability to share Safety Plan, Wellness Plan, Reasons for Living sections
- Addition of Progressive Web App – a website version of the app which syncs with phone/tablet app if users log in to account.

Further to the feature updates, a larger project and upgrade is expected to occur between 2020 and 2024, supported and funded by the National Lottery Digital Fund. The suggested enhancements are three-fold (Grassroots, 2020).

Firstly, Grassroot is looking to develop its user experience through testing and optimisation of the app by initially involving external support. This will be followed by in-house expertise and capacity development to conduct ongoing user-testing over the 4-year period. This would include focus groups and one-to-one sessions with users and potential users from a wide range of demographics to help fully



understand the user experience, and test iterative developments in an agile and evidence-based approach. It will help increase clarity and relevance to the user, making Stay Alive a more personalised experience. The application will also advance towards becoming a learning resource incorporating both classroom and e-learning options. An additional upgrade may consist in developing a moderated forum for users to share experiences, contribute ideas and test app developments (Grassroots, 2020).

Secondly, the charity will look to increase capacity and expertise within the staff team to enforce the in-house capability of developing and maintaining the app, with new roles or enhanced responsibilities added (Grassroots, 2020).

Thirdly, independent research and evaluation of how Stay Alive is being used in clinical and non-clinical professional settings as well as personal settings will be reviewed. This will be centred around two independent evaluations of the app over the 4 years, the first over years 1-2, and the second over years 3-4. This would be supplemented by regular surveys/user-engagement run by Grassroots through their networks (Grassroots, 2020).

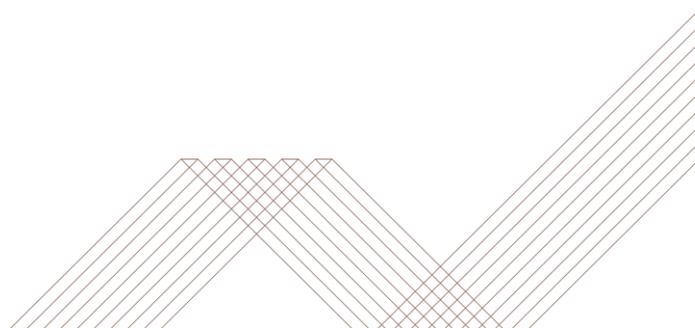
## Methodology

### Summary approach

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The study used the following approach to address the two-fold purposes of this evaluation: 1) assessing the potential impact Stay Alive has had to-date in England and to the wider system and 2) highlighting improvements of the application relative to its assessment in 2016.

The first step included the design of a tailored validation framework which considered the complexity of gathering available data that would evidence the effectiveness of a preventative mental health digital solution. Understandably so, most of the application's health, social and economic outcomes tend to be indirect to the system. For example, the application might reduce mortality by averting a suicide from occurring through one of its features, but there may be many more confounding factors preventing this event from happening with little knowledge on the impact Stay Alive, independently has had. To address this, the framework outlined various evaluation domains to understand how the app, as an intervention, positions relative to these domains. Three key exercises were examined to assess the application relative to that framework:



- Conducting a quantitative and qualitative review of key metrics from the evaluation framework through analysing data collected from 2016 and 2020 surveys and using the application user tracking tool, Firebase – specific questions of the survey were attributed to components of the framework and, where possible, changes and improvement from the 2016 survey were highlighted.
- Building and interpreting a high-level opportunity cost model to help value and understand the existing cost of suicide and suicide attempts to the healthcare system in England. Such a model, rather than a typical cost-benefit model, was generated due to the lack of available quantitative data around health and economic outcomes from the application. Nonetheless, the model built still helped understand the overall economy of suicide prevention, with the assumption that if Stay Alive could reduce suicide attempts or suicide even by a small portion, this could equate to a certain monetary figure.
- More broadly, a detailed literature review was conducted around existing evaluations of digital health solutions for suicide prevention and, more broadly, the effects of suicide to complement the first two exercises and further our insight in a holistic and academic fashion.

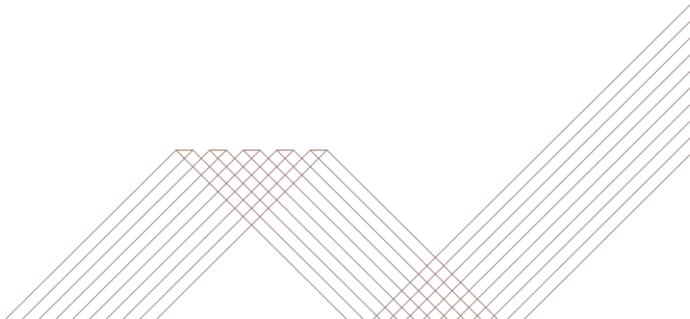
## Sources

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This study produced a to-date current and an ex-ante appraisal of the prospective and potential impact of Stay Alive, which was estimated using:

- Best available project data from the 2016 evaluation and survey
- Data and results as presented by Grassroots' Firebase platform
- Survey results from the 2020 survey, where 2020 results were compared to results obtained in 2016
- Emerging academic research and other literature papers
- Statistics from relevant public-sector bodies such as Office for National Statistics (Office for National Statistics, 2019) and the World Health Organisation (WHO, 2014)

The project is assessed in line with the standard HM Treasury guidance. This guidance, as outlined in the 'The Green Book' (HM Treasury, 2018) applies throughout the public sector to ensure consistent estimation of costs and benefits in cost-benefit appraisals. In recent years this has been supplemented by several



departmental or sectorial 'supplementary guidance' documents. This study attempts to retain consistency with this landscape, except where the supplementary guidance documents contradict each other. In such cases, the study takes a 'first principles' approach to identifying an appropriate methodology based on economic fundamentals.

The supplementary guidance documents of most relevance are:

- Evidence Standards Framework for Digital Health Technologies (NICE, 2019)
- Technology Appraisal in Health (NICE, 2017)
- Public Service Transformation (HM Treasury, 2018)
- Risk (HM Treasury, 2018)
- Policy appraisal and Health (Department of Health and Social Care, 2004)
- Code-of-Conduct for data driven health and care technology (Department of Health and Social Care, 2019)

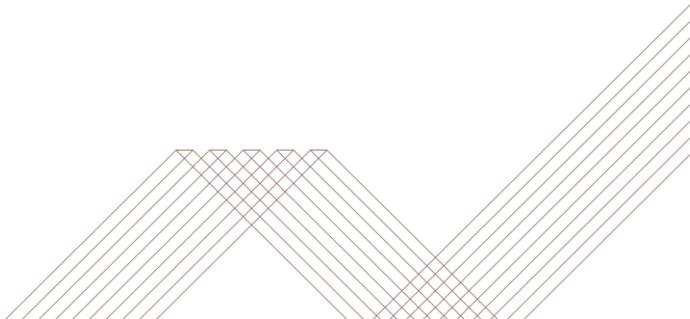
## Evaluation Framework

### Approach

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As discussed in the 'General Methodology' section, the evaluation framework sought to review the application from a more qualitative angle given the lack of data available and the confounding factor issue stemming from the difficulty of appraising a preventative mental health application.

The suggested evaluation framework discussed in the next section has been built using the following approach:

- Various **evaluation domains** were identified under broader categories, including improvements in application reach and engagement, patient outcomes, pathway outcomes and technical outcomes. Additional societal improvements considered important to distinguish, were also reviewed. Whilst they represent indirect benefits, which could not be assessed from surveys or focus groups, this was reviewed as part of the opportunity cost model using findings from literature papers.
- 

- For each evaluation domain, specific **measurements** were reviewed including both quantitative and qualitative. The expected positive effect of the application was highlighted for each metric e.g. increase or reduction.
- For each measurement listed, specific **data collection sources** and the relevant question or metrics derived either from surveys, Firebase platform, literature papers or potential focus groups were identified.
- For each evaluation domain, the data collection method, timeframe and source were highlighted i.e. which comparator was used, what time period was evaluated, how insights were to be gathered.

## Framework

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This section outlines the key components and measures identified for the framework, with further details around the specific sources and related survey questions to be found in [Appendix G](#).

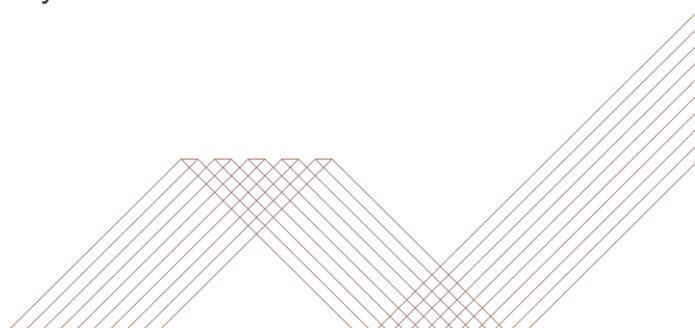
Five key evaluations domains were identified including:

- 1) App reach and engagement improvements ('Qualitative Review and Survey' Section)
- 2) Patient outcome improvements ('Qualitative Review and Survey' Section)
- 3) Pathway improvements ('Qualitative Review and Survey' Section)
- 4) Additional societal and other indirect improvements ('Opportunity Cost Model')
- 5) Technical improvements ('Qualitative Review and Survey' Section)

### App reach and engagement improvements

Derived from the 2020 Survey and Firebase insights, this section looks to review improvements in user traffic and uptake of the application. Specifically, around general traffic e.g. number of downloads and frequency of use both throughout 2019 but also since 2016. It also seeks to better understand the relevance of user population relative to the application's target population by reviewing demographic and population health factors.

Furthermore, it draws inferences between the findings from the literature review around these similar topics and those from the survey. This evaluation domain also



reviews the purpose and profile of the app's usage, looking into the features that were most used and understanding differences across three profiles; users that use the app for their own purpose, those that use it for someone they are supporting and finally, healthcare professionals' use.

In order to understand engagement improvements, accessibility and equity were reviewed when possible (given GDPR restrictions), along with the credibility and reputation of the app through public rankings e.g. ORCHA, DAQ assessment.

### **Patient outcome improvements**

This evaluation domain focused on understanding whether and how the application had increased users' knowledge around suicide, and reduced the stigma around it.

Another area reviewed was whether the app helped users feel more supported. This was qualified from assessing increased feelings of social support from adequate signposting, reduction in feelings of helplessness and distress and increased perceptions of access to care via privacy and anonymity.

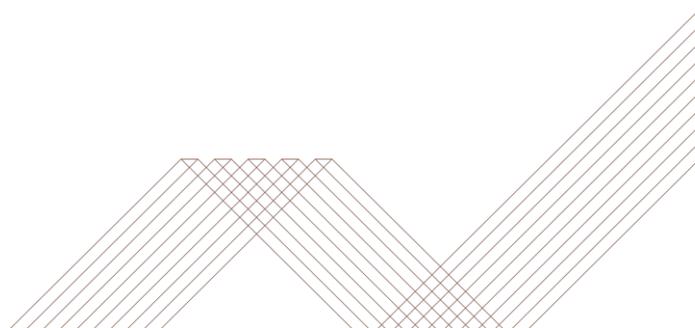
Improvements in self-management by users through improvement of emotional regulation, attitudes towards suicide and mental health treatment or even reduction in suicidal thoughts/behaviours were also appraised and addressed through the survey review.

Finally, this domain examined another user profile, those using the app to get help on how to support others. An understanding of whether the app helped them in feeling supported, increasing their awareness of tools available, and supporting them in coping in their role as caregiver, was explored.

### **Pathway improvements**

In addition to patient outcome improvements, it was noticed that the application could help link up various systems across the existing pathway. The evaluation reviewed how the app supported with better access to care via the app's signposting capability and where there may be gaps in the pathway's services.

Furthermore, another aspect of this domain involved investigating whether users felt comfortable with the information communicated and whether resources seemed credible and reliable.



### **Additional societal and other indirect improvements**

There are many indirect costs to the system stemming from at-risk population groups attempting suicide or undergoing suicide ideation. Further costs also arise from the effect such events have on friends, family, colleagues and immediate community of the affected. Whilst it is difficult to compute the impact Stay Alive might have in reducing such costs, these should still be noted as the app might contribute to their reduction. This domain seeks to list, and when possible quantify through the opportunity cost model, the overall types of costs that suicide can have on the system. These range from societal costs (such as sick days/leave, caregiving costs, reduction in work productivity and reduction in mortality), medication costs, hospital admissions or bed days following an event, consultation costs, drug/alcohol abuse or societal costs due to crimes. Some of these, from the perspective of the Stay Alive preventative intervention, could be reviewed both as a cost, e.g. increased consultations driven from the app's signposting, or a benefit, e.g. hospital admissions which could have been prevented.

### **Technical improvements**

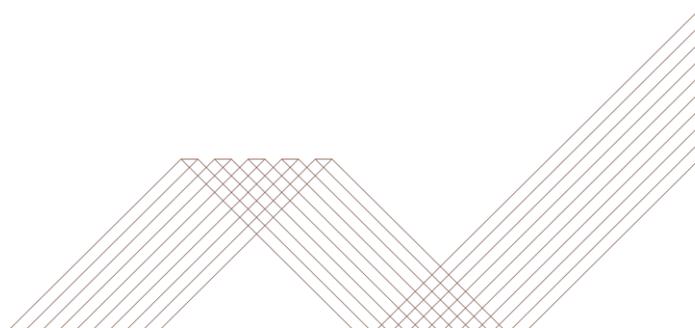
The last domain focused on the practical elements of the application's assessment. For example, easier navigability through improved clarity, changes made to the app's quality and security and aesthetics. Some of these areas were evaluated from the team's own assessment or other information available online, however we would urge for a user focus group to be organised to consider these factors in a tailored and engaged approach.

## **Qualitative Review and Survey**

### **Methodology**

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Following on from the 2016 survey and evaluation of Stay Alive (Flecknoe, 2016), a 2020 survey and evaluation was carried out to assess changes in app reach and engagement, patient and pathway outcomes. In addition to the surveys, literature papers and Firebase (which assesses Android usage) were used where appropriate.



New survey questions were attributed to quantify each of the measures from the evaluation framework. Before the survey was launched by Grassroots on the 10<sup>th</sup> of January 2020, these survey questions were discussed with the Grassroots team, finalised and inputted into Survey Monkey. Grassroots own the 2020 survey. The final 2020 survey consisted of 40 questions. Responses were collected over a four-week period. Following this period Grassroots sent anonymised survey results from their Survey Monkey account to KSS AHSN to be analysed.

A comparative survey analysis was done between the 2020 survey questions and similar 2016 questions. The 2020 survey thus builds from these findings for a fulsome picture of improvement relative to both the baseline and 2016. In some cases, only the 2020 survey questions were used as there was no appropriate corresponding 2016 question. Grassroots' Firebase account for Stay Alive was used to supplement "User traffic and Uptake" and "Accessibility and Equity". Demographics such as age, gender and global location were assessed through "Audiences". Data evaluating retention was obtained through "New User Retention". Active users were taken directly from the Firebase dashboard. Firebase allowed for information to be filtered by date with data from 2018-2020 being available to access. Survey and Firebase analysis were carried out alongside insights from the literature review findings.

The following represents some key approaches used when reviewing the 2020 survey:

- **Three survey response flows:** Survey responses for 2016 and 2020 were divided into three use cases, each reflecting a type of user profile:
  - Individuals using the app for themselves ("themselves")
  - Individuals using the app to support someone who is at-risk of suicide ("someone else")
  - Healthcare professionals using the app to support someone who is at-risk of suicide ("professional").

The analysis was split accordingly to assess how different user sub-populations would engage with the app and what features of the app were most relevant to the three different purposes of use.

- **Analysis exclusion:** Respondents were filtered according to the date the survey was completed i.e. for 2016 analysis only respondents in 2016 were included, the same applied for 2020. When performing the analysis

respondents from 2016 were included if respondents answered “Yes” to “Have you ever downloaded the Stay Alive app?”. In the 2020 survey, responses were analysed if respondents stated that they are “happy to take part in this survey” and if they answered “Yes” to “Have you ever downloaded the Stay Alive app to your phone or tablet?”.

## Key survey results

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Over the course of 4 weeks, following a launch on January 10th, 2020, the new survey attracted 202 respondents. Two surveys were excluded from analysis as one respondent stated they were “not happy to take part in the survey” and one respondent started the survey but did not provide any answers. Respondents who did not download the app (n=60) were excluded from analysis. There were 123 respondents who completed the survey, this means that there was a drop-out of 17 respondents. Comparatively, the 2016 survey attracted 235 respondents, however, 2 respondents were removed as they answered the survey outside of 2016. A further 99 respondents were removed from the analysis as they had not downloaded the app. Therefore, 155 respondents completed the 2016 with 19 respondents dropping out.

### App reach and engagement improvements

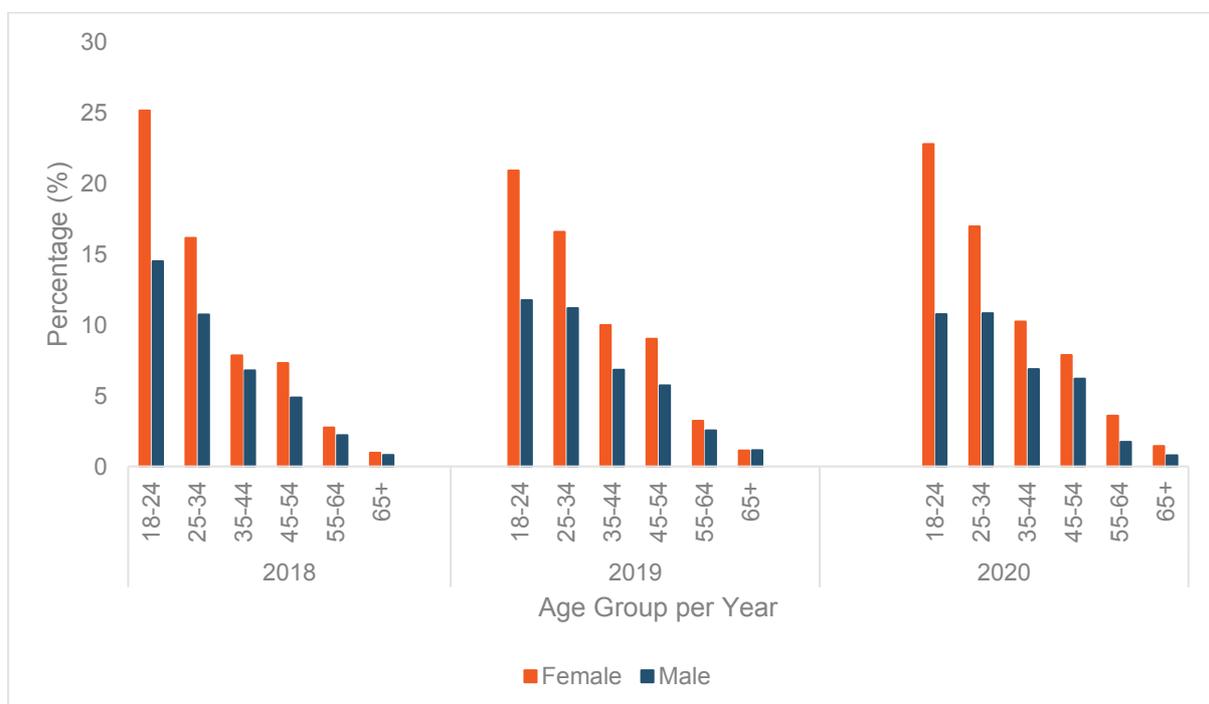
#### User traffic and uptake

In order to showcase improvements in user traffic and uptake since 2016, it is important to consider the relevance of the user population to the solution’s target population, changes in traffic and changes in the frequency of use between 2016 and 2020.

Users were investigated over various periods to assess trends in terms of age and gender demographics. In the period of 01/01/2020 – 13/02/2020 Stay Alive had 5,300 users with 3,600 active users over a 28-day period. Note that according to Firebase, users are defined as an occurrence that results in an event being triggered (Google, 2018). As this period is not a full year it would be better suited for comparative analysis to investigate earlier years.

There were 22,000 users in 2019 with 3,100 active users over a 28-day period and 7,300 users in 2018 with 2,100 active users over a 28-day period (Google, 2018). Results show an increase of 204% in users and 48% in active users between 2018

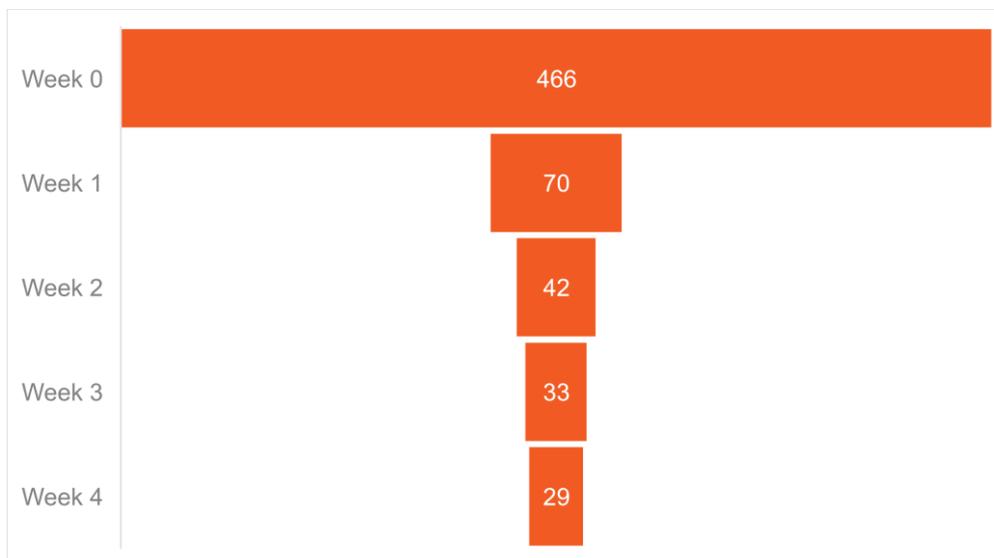
and 2019. There was a greater proportion of total female users (60%) in 2018 vs. male users (40%), with slight changes in the total proportion of female users (61%) vs. male users (39%) in 2019. The 18-24 years-old age group had the greatest number of users in 2018 (40%) and 2019 (33%) (Google, 2018). A negative relationship exists between age and users i.e. as age increased the percentage of users decrease (Figure 1). This is not surprising given that Stay Alive represents a digital intervention and may not be as accessible to all age groups given this factor. However, between 2018 and 2019 there is a slight increase in female and male users from all age groups, except the 18-24 age group which shows a decrease of 7%. The greatest increase being in the female groups 35-44 (2%) and 45-54 (2%) when comparing 2018 to 2019. No data was recorded on Firebase for 2017 and 2016 (Google, 2018).



**Figure 1.** *User demographics of Stay Alive as recorded in Firebase.* The group with the greatest number of users across all years was females aged 18-24 (25% in 2018, n=3,700, 21% in 2019, n=22,000 and 22% in the period 01/01/2020-13/02/2020, n=5,300). The group with the greatest increase between 2018 (8%) and 2019 (10%) was females aged 35-44 (increase of 2%).

Firestore 2020 user retention rates (Figure 2) are defined as the percentage of users that return every day to use the app i.e. Firestore assess retention through users that have downloaded the app and calculates the percentage of these users that make

repeated use of the app. The final average user retention rate over a 5-week period, starting on 29/12/2019 and ending 01/02/2020, is 6% or 29 average returning users.



**Figure 2. Average Firebase user retention rates.** There is a large drop (85%) in average user retention from initially using the app in week 0 (100% of users) to the return of average users in week 1 (15% of users). Week 0=100% retention, n=466, week 1= 15% retention, n=70, week 2= 9% retention, n=42, week 3=7% retention, n=33 and week 4= 6% retention, n=29.

App retention, or keeping the app on the device, increased by 4% from 2016 (84%) to 2020 (88%), according to survey responses.

Modal class for frequency, i.e. the highest class of frequency, of use in 2016 was every 2-3 months (27%) which was closely followed by monthly (26%). Other (25%) was the modal class in 2020. Comparatively, every 2 months (12%) and monthly (18%) was a less selected frequency in 2020. Open-ended responses from the 2020 survey show that the app is used either for demonstration purposes / training or it is used by respondents when they feel they need to use it.

## Use

To investigate the app's usage, analysis was separated into three branches or use cases with questions that were relevant to the respondent if they are using the app for themselves, someone else or in a professional setting.

In 2016, of those who answered the question of usage, n=86, 47% of respondents used the app to support someone else, 59% in a professional capacity, whilst for 34% of cases it was to support themselves. Note that these will sum greater than

100%, as several respondents used the app for multiple purposes (e.g. to support themselves, and someone else). Of those downloading the app to support themselves, 93% (27) of respondents indicated that they have felt suicidal (Figure 3).

In 2020, of 135 respondents, 31% said they downloaded the app to support someone else, a decrease of 16% from 2016. 47% downloaded the app to support someone within a professional capacity, a decrease of 12% from 2016. 34% of respondents used the app to support themselves, remaining constant when compared to 2016. Of the latter, 98% of the 2020 respondents indicated that they have felt suicidal. As in 2016, these will sum greater than 100%, as several respondents used the app for multiple purposes (e.g. to support themselves, and someone else).

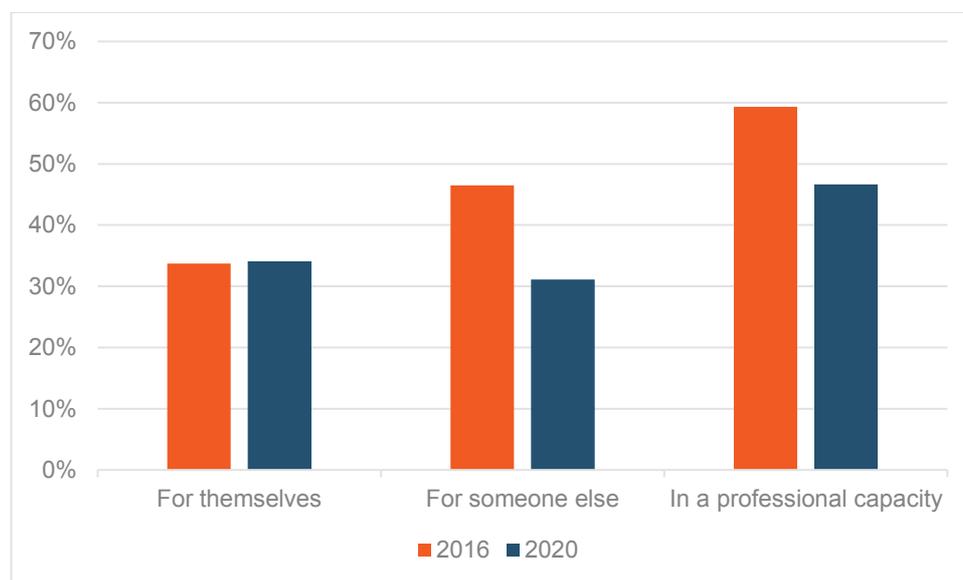


Figure 3. Usage from survey respondents categorised into three use-cases.

To further investigate Stay Alive’s usage, features most used by each use-case were assessed. The resource individuals that downloaded the app in 2016 for themselves have used most is “Strategies for staying safe” (76%). Similarly, the resource most used when supporting someone was “Strategies for staying safe” (59%), followed by “How to help a person thinking about suicide” (56%).

The most useful resources to 2020 respondents that downloaded the app for themselves was “Local Crisis Support” (50%), followed by “National Crisis Support” (43%). Resources most useful when supporting someone else were the “Safety Plan” (55%), which was followed by “Local Crisis Support” (43%). Finally, resources most useful when supporting someone within a professional capacity were “Local Crisis Support” (60%), followed by “National Crisis Support” (56%). Apart from the

“Safety Plan”, a feature associated with the app itself rather than NHS resources, features most used or recommended to others and by respondents acting in a professional capacity in 2020 were NHS resources or resources outside of the app e.g. Local and National Crisis Support. Additionally, 0% of professionals selected that none of the resources were useful i.e. professionals felt that all resources within the application were useful. Open-ended responses indicate that professionals felt the resources could be useful at different times to patients.

### Accessibility and Equity

Assessing geographic location, sexual identity and religions allow insight into the accessibility and equity of the Stay Alive app. Firebase data recorded in 2018, 2019 and 2020 indicate that the app was largely used in the UK (Figure 4). Some international users accessed the Stay Alive app.

Year	Country/Region	% Total
2018	UK	62
	United States	10
	Germany	2
2019	UK	76
	United States	7
	Germany	1
2020	UK	76
	United States	7
	Canada	1

Figure 4. *Location and percentage of sessions from each top country.* Other countries that have used the app include Australia, Philippines, India, Canada, Brazil and other European countries (Norway, Poland and France).

2016 respondents mainly identified as heterosexual (72%) with some respondents identifying as gay/lesbian (11%), bisexual (7%), prefer not to say (5%), pansexual (3%), asexual, queer, and other (each 1%). Some respondents indicated the presence of a disability (21%). Additionally, 58% of respondents indicated that they had no religion, 29% indicated that they are Christian and 10% indicated another religion, with 2% giving no response. This finding is contradictory to literature that suggests at-risk populations of suicide include men aged 45-59 (NICE, 2018) and vulnerable groups that experience discrimination such as gay/lesbian, bisexual, queer, asexual and people with disabilities (WHO, 2014). Questions of this nature were not repeated in the 2020 survey due to concerns around GDPR. In the latest GDPR regulations it is not appropriate to ask for personally identifiable information.

### Credibility and Reputation

To assess credibility and reputation of the app, external ratings were considered. ORCHA has recently reviewed Stay Alive based on 260 criteria and received a score of 82% on both Android and iOS (ORCHA, 2020). ORCHA is the trusted source for health app advice. It helps consumers and NHS professional to find safe, secure and clinically assured apps. Google Play reviews have scored the app as 3.6/5 (Google Play, 2020) and the app has scored 4/5 based on reviews in the Apple Store (App Store, 2019).

Positive feedback was received by professionals who have used the app. Responses such as, “Excellent, very comprehensive tool that I will use both at work and for myself to help manage others'/my mental wellbeing and be more resilient at times of severe depression.” add to app credibility and reputation. Some negative comments from users include, “In reality it is of sub-optimal use to sufferers of suicidal ideation.” This could indicate that the app is a starting point for users but, when users are experiencing severe issues around suicide attempts and suicidal ideation a more direct approach or intervention needs to be accessed i.e. patients talking to a counsellor rather than using features within the app such as the “Safety plan” etc.

### Patient outcome improvements

#### Improved awareness / knowledge / attitudes towards suicide

Several components could be assessed to conclude patient outcome improvements. Improved awareness, knowledge and attitudes towards suicide was reviewed by

examining propensity of respondents to notify others of their condition and reduction in stigma around suicide.

Almost three quarters (71%) of 2020 survey respondents that downloaded the app for their own use indicated that the Stay Alive app has helped them to talk more openly about suicide to someone else when they were struggling with suicidal ideation. Two thirds of these individuals (63%) stated that they were able to talk to healthcare professional about suicide. Furthermore, 90% of respondents supporting someone else (not in a professional capacity) have stated that the app has helped them to speak about suicide to individuals they were concerned about and 89% of healthcare professionals indicated that patients using the app better articulate around the topic of suicide. Across all the use cases, 93% of respondents feel that the Stay Alive application has helped reduce the stigma of suicide through improved awareness.

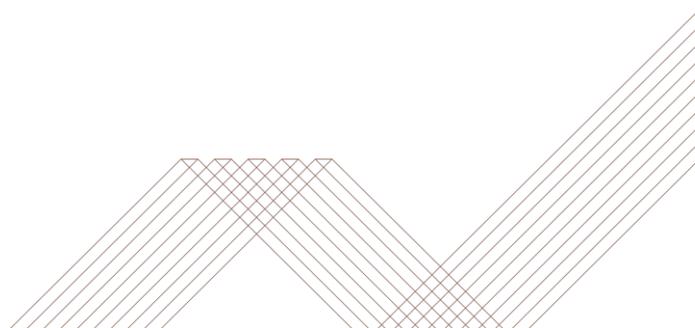
### Increased support (signposting)

Increased support was demonstrated from an increase in social support, decrease in feeling helplessness and distress and an increased privacy and anonymity when accessing care. The majority of 2020 respondents (89%) indicated the app provided them with further support when using the app for themselves. Many healthcare professionals chose to increase social support by signposting the “Safety Plan” (62%) feature. Resources such as Local Crisis Support (59%) and National Crisis Support (54%) were highly recommended. This is interesting as features intrinsic to the app (“Safety Plan”) were more signposted than the resources (Local and National Crisis Support), but when professionals recommended resources to patients they recommended more drastic resources that are accessed through the NHS i.e. recommending that patients go directly to resources where an interaction with healthcare professionals occurs. The nature of the “Safety Plan” is anonymous.

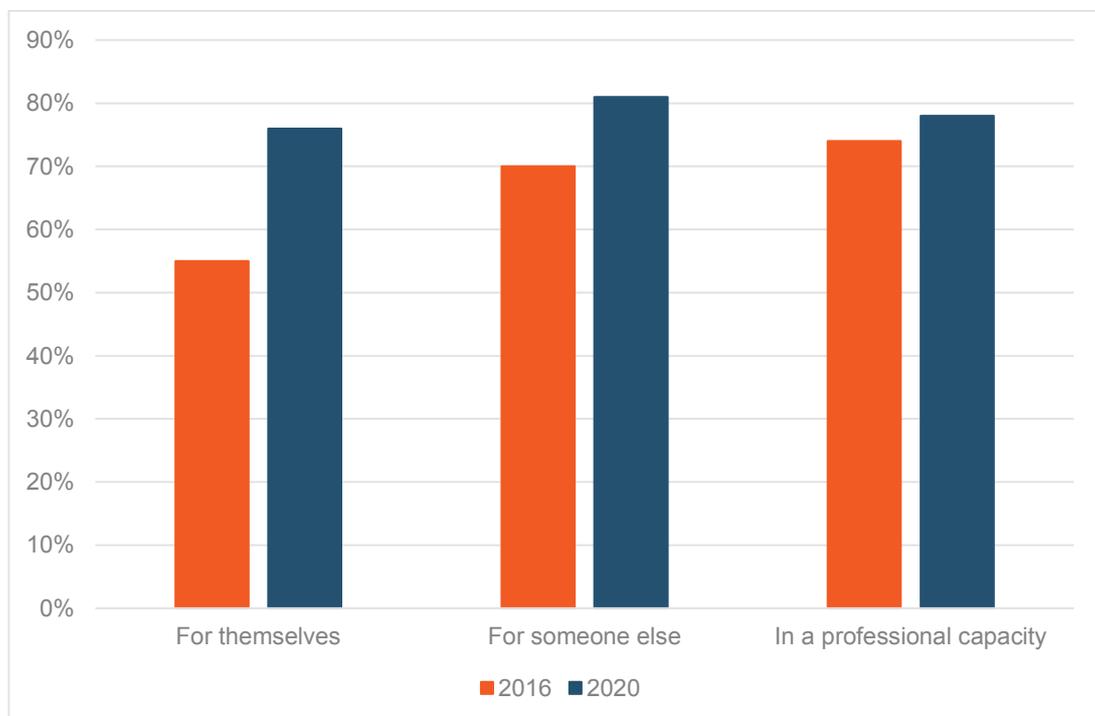
Open-ended responses such as, “It has helped me understand how much crisis support happens outside of statutory services, which are so overstretched as it is (and likely to become more so). Thank you for what you do - in my opinion statutory services would not function as safely without you.” indicate that some respondents felt a decrease in helplessness and distress when using the app.

### Improvement in self-management

Improved patient outcomes can be evaluated by assessing the emotional regulation of respondents. The 2016 survey indicates 55% of participants that have



downloaded the app for themselves feel the app helped them stay safe from suicide. When investigating respondents that downloaded the app exclusively to support someone else, 70% of respondents feel that the app has helped someone else stay safe from suicide. Additionally, when assessing respondents that downloaded the app exclusively to use within a professional capacity, 74% of respondents feel that the app has helped their patients stay safe from suicide (Figure 5). Comparatively, the 2020 survey indicated the app helped the relevant individuals stay safe from suicide in 76% of cases when using the app for themselves, 81% when supporting someone else and 78% when professionals were using it (Figure 5), which suggests a large increase in feeling the app is useful for self-management purposes when it comes to them/the person they are supporting.



**Figure 5.** *Percentage of respondents that stayed safe from suicide.* “For themselves” shows an increase in 21% between surveys, n 2016=29 and n 2020=46. “For someone else” shows an increase in 11% between surveys, n 2016= 20 and n 2020=42. “In a professional capacity” shows an increase of 4%, n 2016 = 31 and n 2020= 63, between surveys.

Utilizing resources for one’s own support could increase self-management. Participants in 2016 used more than one feature for their own support. The feature used the most was “Strategies for staying safe” (76%). The features used the least were “Suicide bereavement resources” and “Other” (3%). The 2020 survey contrasts

findings to 2016 as Local (50%) and National (43%) Crisis Support was the favoured feature of respondents. Comparatively, respondents from the 2016 survey made less use of Local (34%) and National (31%) Crisis Support resources.

Reduction in suicidal behaviours could be evaluated by assessing the app's ability to better enable coping mechanisms. When supporting someone else (not in a professional capacity), a large proportion of respondents (95%) indicated that the app helped themselves and/or others to develop better coping mechanisms. Professionals felt that the "Safety Plan" (68%) was the best feature in enabling their patients with better coping mechanisms.

Open-ended responses such as, "It's doing [great] work. My friend, who I shared the app with, was considering suicide. Partly due to the help and info on the app my mate is still alive. Thank you for my friend's life." indicate that the app could increase improvement in self-management and overall patient outcomes.

### Improvement in supporting gatekeepers, friends and family

Survey analysis indicated 95% of 2020 respondents agreed the app was effective in highlighting resources that could be used to support someone else. Additionally, 78% of respondents who were supporting someone else indicated that these resources were useful.

## Pathway improvements

### Access to care/signposting

It is important to discuss which health and social care resources could be impacted by individuals, following use of the Stay Alive app, and how that might affect the current suicide prevention pathway. The top three resources most heavily recommended when supporting someone else was National (64%), Local (55%) Crisis Support and Online Support (31%). It could be fair to assume that recommending these current pathway resources would increase demand for NHS resources.

### Communication

For pathway improvement, it is important that the quality of information provided by the app is well processed. This avoids harmful content. A large proportion (95%) of 2020 respondents were happy with how the information was worded and provided in

the app, 98% of respondents were happy with how the app managed their personal data and 93% felt that the resources were up-to-date, relevant and accessible. ORCHA, an independent digital app assessor, provided Stay Alive with a score of 82% but did note some issues with the app which, according to the company, could impact communication, quality and navigation. It pointed out that the app did not state that Grassroots would not share the user's data without user consent. Even though the "Disclaimer" section of the app does clearly state that "the app is fully compliant with GDPR" it is best practice under GDPR regulation, to clearly ask for user consent, explaining how any user information may be used, processed or stored. Furthermore, it was stated that the app does not allow users to share information within the app with other apps, organisations or systems (ORCHA, 2020). With regards to data security, ORCHA highlighted that the app does not encrypt information that is collected by the app to ensure it is safe from other people as it is transferred from the app or retained by the developer (ORCHA, 2020). With the version of the application at the time of the assessment, this was a null point as the app did not transfer data to other apps, organisations or systems. In turn, the new version being launched in a few weeks will encrypt data as it will then be sharing data between the PWA and phone apps. Our understanding from discussion with Grassroots is that for the new version of the app, communication between the app and the website (API) will be encrypted. When data will be stored in the database (i.e. website/api/cloud), it will be "encrypted at rest", meaning that data will be unreadable in the event of a data breach.

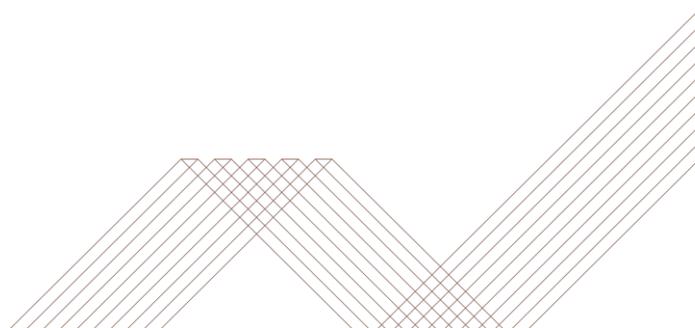
## Technical improvements

### Navigability

Some respondents thanked the Grassroots team for the development of the app and have commented on its ease of navigation such as, "Found the App easy to navigate, which would help someone in a distressed state". Additionally, a response such as "The Wellness Plan takes some searching to find" could impact upon the navigability of the app.

### App quality

Other comments indicated a technical glitch in the app which could affect the quality of the app, "For some reason all my photos in my Lifebox keep going so please can you look into this".



## Aesthetics

No information was provided in the 2020 survey around the applications user-friendliness and aesthetics.

# Opportunity Cost Economic Model

## Methodology

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### Choice of analysis

For the purposes of this evaluation, a high-level opportunity cost analysis was used to evaluate the possible cost of suicide in England at a national level. Although this method uses the same principles as a cost benefit analysis, it differs as it aims at estimating and quantifying the potential savings that could be realised by addressing an unmet need. It does not determine the economic impact of an intervention against the counterfactual e.g. the current pathway or services available. Instead it highlights the opportunities and costs associated with a future improvement programme.

This approach was chosen over a classic cost-benefit analysis as appraising the intervention within the agreed timeframes presented the following limitations:

- At the incept of the evaluation project, it was expected that data from the Hertfordshire Mental Health Trust would help understand the potential impact the Stay Alive app had on individuals in a Trust and community setting. Specifically, measures including reduction hospital admissions, enhancing counselling when required, reduction in adverse events and mortality rates had initially were hoped to be reviewed. Nevertheless, due to delays with the study, no data came through in time to be used for the cost-benefit model.
- The data collection was thus only centred around the 2020 survey and although it provided interesting insights regarding the app usage and the users' acceptability and satisfaction, it was not sufficient to draw quantifiable and monetizable inferences on the potential effect of the Stay Alive application in regard to admission or mortality rates. Indeed, whilst correlation between the use of Stay Alive and the reduction in adverse outcomes could be established, demonstrating causality would require an extended data collection and potentially an RCT methodology.

Therefore, this study focused on the existing cost nationally, to explain the potential effect, Stay Alive could have in a preventative way. Early intervention and preventions approaches aim to support people's health and wellbeing by acting before health problems worsen, or by preventing health problems from occurring in the first place. Their value is increasingly recognised as exemplified by their prominent place in the NHS Long Term Plan – chapter 2 (NHS, 2019). A NICE (National Institute for Health and Care Excellence) review of the cost effectiveness of 200 interventions also found that 30 (15%) were cost saving and 141 (70.5%) were cost effective (BMA, 2017).

The opportunity cost model estimates potential savings from the healthcare system's perspective and considers costs and benefits to the system as well as social outcomes. The costs and benefits are discounted to account for the rate of inflation in healthcare (e.g. the fluctuation in the cost of healthcare and for the time value of money (net present value). For the purposes of this report we have computed the net present values (NPV) with a five-year view (Figure 6).

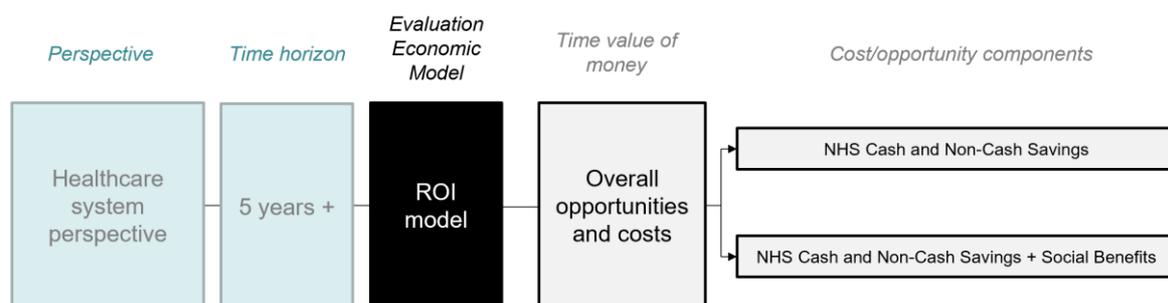


Figure 6. Health economic analysis spectrum

## Literature Review

A targeted literature review was conducted to understand whether any applicable data could be used for the purposes of building the high-level economic model and to populate indicative formulas and identify the best evidence and mechanism for estimating benefits. The databases reviewed spanned across a select range of journals which are outlined under the reference section.

## Standard frameworks

The project is assessed in line with the standard HM Treasury guidance. This guidance, 'The Green Book' (HM Treasury, 2018) applies throughout the public sector to ensure consistent estimation of costs and benefits in cost opportunity appraisals. In recent years this has been supplemented by several departmental or sectorial 'supplementary guidance' documents. This study attempts to retain consistency with this landscape, except where the supplementary guidance documents contradict each other. In these cases, the study takes a 'first principles' approach to identifying an appropriate methodology based on economic fundamentals.

The supplementary guidance documents of most relevance are:

- Policy appraisal and Health (Department of Health and Social Care, 2004)
- Public Service Transformation (HM Treasury, 2018)
- Risk (HM Treasury, 2018)
- Technology Appraisal in Health (NICE, 2017)

In addition to this supplementary guidance, there is also relevant technical research we have drawn upon, specifically in relation to the value of a preventable fatality (Deloitte, 2009) (Woolf & Orr, 2009).

## Standardised data sources

In addition to the framework described above, HM Government has also looked to enable quicker and more efficient delivery of cost benefit appraisals, particularly by local government, through the funding and development of three sets of standardised unit cost databases, from which we will look to draw data as standard. These are:

- Department for Transport's WebTAG data book
- PSSRU's 'Unit Costs of Health and Social Care 2019' and (PSSRU, 2020)
- Greater Manchester Combined Authority 'Unit Cost Database' (2019) which divides costs into financial costs and economic costs. These terms broadly equate to 'public sector delivery costs' and 'all other socio-economic costs' (GMCA, 2019).

These sources present an effective mechanism for identifying values for many costs and outcome benefits. They are broadly consistent with one another but where they are not, we will look to identify the original source data where possible to identify the most relevant source.

### Optimism bias

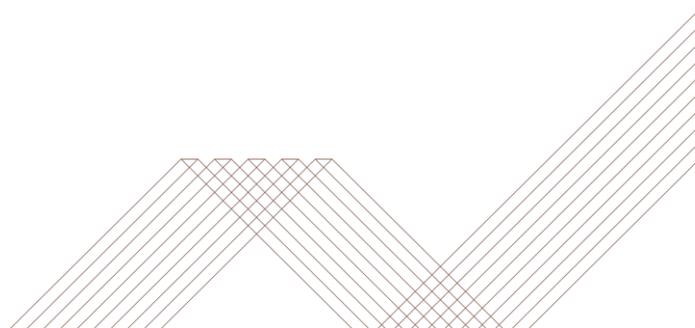
It has previously been reported that commissioners and practitioners are often overly optimistic about the outcomes that will be achieved by the project or programme and the amount of money that will be needed to deliver these outcomes (New Economy, 2015). It seems reasonable to assume that the degree of over optimism will be greater when the data and evidence upon which the cost effectiveness model is based are uneven, old or incomplete. Therefore, the model applies optimism bias correction factors in response to the level of uncertainty in the data or assumptions used. The optimism bias approach used is based on the confidence grade definitions (Appendix H). The confidence grade which the model applies to the data is determined by the lowest assessment in any of the descriptive columns. The optimism bias correction factor for the data is then determined based on the lowest confidence grade found in relation to each individual outcome and costs are increased by the corresponding percentage factor (shown in the table above). Data in the spreadsheet are colour-coded to enable a quick visual assessment of the quality of the cost data inputs.

### Applying a discount to future costs and benefits

In order to determine the present value of the costs and opportunity streams, the values of future costs and opportunities are discounted to current prices. The discount rate is used to convert all costs and opportunities to 'present values', so that they can be compared. The model uses a standard discount factor of 3.5%, following HM Treasury (2018) guidance. The discount calculation can be expressed mathematically as:

$$D_n = \frac{1}{(1+r)^n}$$

For example, a payment of £150 at the middle of year 5 has a present value at the middle of year 0 of £141.33, with the following working:



$$£ 150 * \frac{1}{1.035^5} = £ 150 * 0.9422 = £ 141.33$$

### Other key assumptions

The base year in the model - e.g. the reference year for constructing an index (enabling to make comparison from this point) – is 2019 as it is the reference year for the survey collected during the project.

Any historical costing data used will be uplifted to current estimates using an inflation rate derived from the Gross Domestic Product (GDP) deflator produced by the Treasury from data provided by the Office for National Statistics (ONS) and the Office for Budget Responsibility (OBR).

### Key Inputs

To build an opportunity cost economic model, various inputs are required for calculation purposes and computation of desired outputs. Various inputs are listed below in a structured approach as used in the model.

### Population

There is no internationally agreed-upon set of terms, definitions, or classifications for the range of thoughts, communications and behaviours that are related to self-injurious behaviours, with or without the intent to die. Nor is there an agreed taxonomy that encompasses the full spectrum of what is clinically defined as suicide-related behaviours (Silverman, 2016). The suicide literature remains replete with confusing (and sometimes derogatory or pejorative) terms, definitions, descriptors, and classifications that make it difficult, if not impossible, to compare and contrast different research studies, clinical reports or epidemiological surveys, or to make comparisons, generalisations or extrapolations. Therefore, capturing the number of individuals at-risk of suicide comes with its own set of challenges.

The 5,300 Stay Alive application users (number of active users reported between 01/01/2020 and 13/02/2020) reported different motivation for using it, some respondents used the app for themselves and others to support someone else. Thus, this study did not utilise the number of users for the population input as the breakdown of at-risk users and concerned relatives/friends was hard to establish at a national scale.

Instead the number of suicides in England was used as a proxy measure for the at-risk population. The actual size of the at-risk population is likely to be larger than the number of deaths by suicide but as there is no consensus around the methodology to estimate this population, this study favors a low yet prudent estimate.

In 2018, a total of 5,021 deaths were recorded (rate of 10.3 deaths per 100,000) according to the Office for National Statistics (Office for National Statistics, 2019). That population was used for the benefit stream linked to the reduction in mortality.

For the reduction in healthcare resources and in number of bed days, this study looked at the number of people attempting suicide. According to the World Health Organisation (WHO) there are indications that for each adult who died of suicide there may have been more than 20 others attempting suicide (WHO, 2014). Consequently, we considered the number of deaths by suicide times 20 is the number of people attempting suicide. After application of the optimism bias on the multiplier factor (40% optimism bias applied to the figure from the WHO report), the people of attempting suicide in England could be close to 60,250.

### Uptake

As the model focuses on the opportunity and cost, the retention rates of the app were not considered in the benefits and costs calculations. Instead, the average population growth was used to determine at-risk population in England between 2020-2025.

### Outcome Streams

To convert outcomes into financial benefits, each stream should be monetised.

How benefits are realised depends on the *cash ability* of the saving. Cash ability refers to the way a change in an outcome will result in a reduction of fiscal expenditure. The ability to cash depends on the type of benefit, scale, timing and the leadership in place to realise the savings. This report takes a prudent approach to identify benefits and separates the fiscal savings into the following benefit streams:

- **NHS related non-cash releasing benefits:** These benefits are important to reducing demand and strain on services, but a fiscal value cannot be realised without decommissioning of services. Benefits which can be described as non-cash releasing include reduced bed days and reduced readmissions.

- **Social benefits:** Social benefits relate to the overall benefit to the public, including, but not limited to, improved health and wellbeing such as reduction in mortality rate.
- **Other benefits:** Although the health economic model is primarily concerned with the fiscal benefits associated with Stay Alive, it is important to acknowledge other benefits that might not have an accurate value and may be attributed through qualitative review e.g. improvement in awareness and knowledge around suicide, reduction in stigma, improvement in self-management and improved signposting to care access.

## Benefits calculations

### 1. Mortality cost

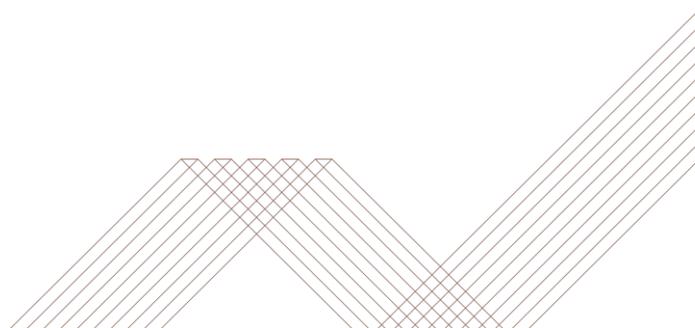
As a suicide prevention intervention, Stay Alive has the potential to prevent deaths in vulnerable members of society. As highlighted the Samaritans Suicide Statistics Report 2018, suicides can be prevented or reduced by the implementation of timely and targeted public health policies (Samaritans, 2019).

A key element of understanding these benefits is the approach the model takes in calculating quality of life changes. Quality of life related benefits use a Quality Adjusted Life Year (QALY) calculation. The basic construction of a QALY valuation for a particular health state is the number of years of life spent in that state multiplied by a health state utility-based weighting (Williams, 1985). So, for example, a health state which lasts 10 years and is valued at 0.9 in terms of health state utility would give 9 QALYs. The QALY provides a single index allowing a measurement of the effects of health interventions on mortality and morbidity.

This QALY is then given a financial value using the willingness to pay threshold value used by NICE on behalf of the NHS. NICE methods guides refer to a threshold of £20 000-£30 000 per QALY. A sensitivity range is used to reflect the range within which this threshold is applied, with the lower value (£20,000) taken as the modal value.

The opportunity stream was calculated using the number of reported suicides multiplied by the value of QALY.

Applied to the population, the model suggests the following benefit opportunity (Table 1).



	2019/2020	2020/2021	2021/2022	2022/2023	2023/2024
<b>Cash releasing benefit</b>	£ 0.0	£ 0.0	£ 0.0	£ 0.0	£ 0.0
<b>Non-cash releasing benefit</b>	£ 0.0	£ 0.0	£ 0.0	£ 0.0	£ 0.0
<b>Social benefit</b>	£ 95,399.0	£ 95,399.0	£ 95,399.0	£ 85,859.1	£ 76,319.2
<b>Total benefits</b>	£ 95,399.0	£ 95,399.0	£ 95,399.0	£ 85,859.1	£ 76,319.2

**Table 1.** *Breakdown for reduction of the mortality rate (£,000, net present value, 2019 values)*

## 2. Non-admissions costs

A prevention initiative is likely to positively impact the number of hospital admissions for self-harm presentations. In Australia, a randomized controlled trial (RCT) investigated using SMS text messaging to reduce self-harm and suicide attempts and found brief contact intervention, like SMS, effective to reduce the rate of deliberate self-harm re-presentation (Stevens, et al., 2019). Similarly, another study looked at the effectiveness of a brief psychological intervention (VHS) to reduce repeat self-harm in the 6-month following a suicide attempt (O'Connor, et al., 2017). Although there were no significant differences between the intervention and the control group, post-hoc analyses suggest VHS might be effective in reducing the number of self-harm repetitions following a suicide attempt in people who complete the help sheet and who have been previously admitted to hospital with self-harm.

To understand the impact of suicidal behaviours on healthcare resources, this report studied the body of researches available. Whilst many studies have focused on assessing potential risk factors (O'Connor, et al., 2017) (Randall, Roos, Lix, Katz, & Bolton, 2017), few estimates have been made of the hospital costs of assessing and treating self-harm. Therefore, estimated hospital resource use and care costs for all presentations for self-harm to the John Radcliffe Hospital (Oxford, UK), between April 1, 2013, and March 31, 2014 were used when assessing these costs (Tsiachristas, et al., 2017). In their analysis, they determined that the cost associated with non-admitted care for self-harm is of £258 (includes self-poisoning alone, self-injury alone as well as both self-poisoning and self-injury combined). Out of the 1647 self-harm presentations 78% were admitted to hospital (emergency assessment unit; other bed or ward) whilst 22% were not admitted to hospital (this information was not known for <1% of the patients) (Tsiachristas, et al., 2017).

This benefit stream is therefore calculated by multiplying the population that attempts suicide by the percentage of not admitted care and its associated cost. It focused on the costs occurring in secondary services but does not capture the potential costs generated in the community as discussed further in the “Opportunity cost economic model limitations” section.

*Cost across healthcare resources*

$$= \text{Attempted suicide} \times (\% \text{ not admitted patients} \\ \times \text{not admitted costs})$$

Applied to the population, the model suggests the following benefit opportunity (Table 2).

	2019/2020	2020/2021	2021/2022	2022/2023	2023/2024
Cash releasing benefit	£ 0.0	£ 0.0	£ 0.0	£ 0.0	£ 0.0
Non-cash releasing benefit	£ 3,171.9	£ 3,218.3	£ 3,266.7	£ 2,982.0	£ 2,688.8
Social benefit	£ 0.0	£ 0.0	£ 0.0	£ 0.0	£ 0.0
Total benefits	£ 3,171.9	£ 3,218.3	£ 3,266.7	£ 2,982.0	£ 2,688.8

**Table 2.** Breakdown for reduction of non-admission cost (£,000, net present value, 2019 values)

### 3. Admission costs

Out of the 78% of self-harm presentations who were admitted to hospital, 2% received critical care, for an estimated cost of £6,180, and 98% were treated by the emergency assessment unit (or were admitted to other wards) for an estimated cost of £436 (Tsiachristas, et al., 2017). The latter cost is taken from the Unit Cost Database developed by the Greater Manchester Combined Authority (GMCA, 2019), previously New Economy, and not from the study as for the previous costs. The study used an average length of stay of 1.1 day for the admitted patients (Tsiachristas, et al., 2017).

Therefore, this benefit stream is calculated by multiplying the population that attempts suicide by the percentage of admitted patients and by the prevalence and cost of both critical and non-critical care and the average length of stay.

*Cost of bed days*

$$\begin{aligned}
 &= \text{Attempted suicide} \times \% \text{ admitted patients} \\
 &\times [(\text{bed day costs} \times \text{average length of stay}) \\
 &+ (\text{critical bed day costs} \times \text{average length of stay})]
 \end{aligned}$$

Applied to the population, the model suggests the following benefit opportunity (Table 3).

	2019/2020	2020/2021	2021/2022	2022/2023	2023/2024
Cash releasing benefit	£ 0.0	£ 0.0	£ 0.0	£ 0.0	£ 0.0
Non-cash releasing benefit	£ 19,559.5	£ 19,845.5	£ 20,143.8	£ 18,388.5	£ 16,580.1
Social benefit	£ 0.0	£ 0.0	£ 0.0	£ 0.0	£ 0.0
Total benefits	£ 19,559.5	£ 19,845.5	£ 20,143.8	£ 18,388.5	£ 16,580.1

**Table 3.** Breakdown for reduction of admission cost (£,000, net present value, 2019 values)

### Costs calculations

An improvement in prevention of suicide cannot be implemented without generating some up-front and running costs. Should the Stay Alive be rolled-out across England the costs of its spread would encompass various elements such as the licensing fee for the app, a potential increase in medication as well as treating costs. In order to illustrate this, we have used the cost associated with an increase in usage of counselling services as an example to the study.

By signposting health care professionals and suicide prevention services, the Stay Alive mobile application is likely to impact the usage of the relevant services such as counselling. Counselling is a talking therapy that involves a trained therapist listening to you and helping you find ways to deal with emotional issues.

In our model, the population who attempts suicide is multiplied by the cost of psychological counselling sessions of £450. The figure was obtained using the Unit Cost Database (GMCA, 2019), it is cost of a course of CBT delivered as part of a suicide prevention package, at around £450 per person. The costs have been projected to the 5 years of the modelling timeline (Table 4).

	2019/2020	2020/2021	2021/2022	2022/2023	2023/2024
<b>Cost of counselling services</b>	£ 26,858.1	£ 27,261.8	£ 27,651.3	£ 28,048.4	£ 28,457.3

**Table 4.** *Cost of counselling services (£,000, net present value, 2019 values)*

## Key findings

The opportunity cost model assesses the potential financial impact of the implementation of a suicide prevention programme such as Stay Alive across England.

For this high-level modelling, 3 opportunity streams were monetised, should they have been part of a classic cost benefit analysis, they would be classified as non-cash releasing healthcare system savings and societal benefits. Below they are designed as “non-cash releasing opportunity” and “social opportunity” (Table 5).

	2019/2020	2020/2021	2021/2022	2022/2023	2023/2024
<b>Cash releasing opportunity</b>	£ 0.0	£ 0.0	£ 0.0	£ 0.0	£ 0.0
<b>Non-cash releasing opportunity</b>	£ 22,731.4	£ 23,063.8	£ 23,410.5	£ 21,370.5	£ 19,268.8
<b>Social opportunity</b>	£ 95,399.0	£ 95,399.0	£ 95,399.0	£ 85,859.1	£ 76,319.2
<b>Total opportunity streams</b>	£ 118,130.4	£ 118,462.8	£ 118,809.5	£ 107,229.6	£ 95,588.0

**Table 5.** *Overall opportunity streams (£,000, net present value, 2019 values)*

The modelling of the costs was restricted to the cost of counselling services for the population who attempts suicide (Table 6).

	2019/2020	2020/2021	2021/2022	2022/2023	2023/2024
<b>Cost of counselling services</b>	£ 26,858.1	£ 27,261.8	£ 27,651.3	£ 28,048.4	£ 28,457.3

**Table 6.** Cost of counselling services (£,000, net present value, 2019 values)

In addition to the opportunity streams monetised in this model, the implementation and national spread of a suicide prevention programme could have the potential to produce some additional social and indirect positive effects. Similarly, although they were not included in the model, some additional investment and running costs could have been articulated.

#### Other societal opportunity:

In 2015, common mental health problems (e.g. anxiety, depression and stress) and more serious mental health problems were the third most important cause of sick leave and mental-health-related issues were found to lead to approximately 17.6 million days' sick leave, or 12.7% of the total sick days taken in the UK (Mental Health Foundation, 2016). Therefore, a suicide prevention programme has the potential to reduce the number of sick days taken and to the subsequent loss of productivity for the UK economy.

#### Development costs

According to Grassroots, the development of the app costed £55 000 (Flecknoe, 2016). This upfront cost has been paid for and will not fall onto the healthcare system, however the cost of maintenance and upgrade for the app of £35,000 over 4 years (supported by the digital fund according to the business planning of Grassroots) may have an impact on the pricing of the license fee.

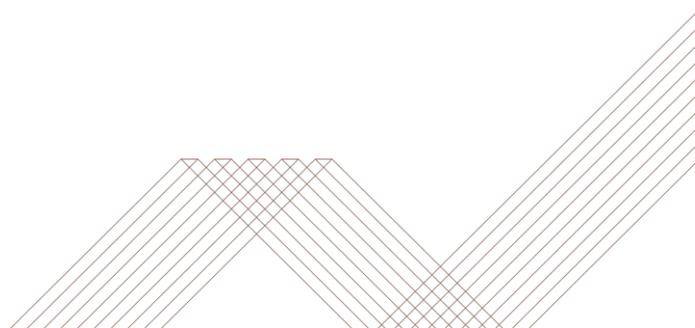
## Discussion

### App reach and engagement improvements

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#### **User traffic and engagement**

*Growing userbase:* Findings have showed remarkable increases in the number of users over the past year, with an increase of 204% in users between 2018 and 2019, with a 48% increase in active users. Engagement rates are average with a 10-week retention rate of 4%. Research shows that over a shorter period of 5 weeks, the average retention rate across applications is 6% (Haslam, 2019).



*Relevance to at-risk population groups:* It appears that the Stay Alive application attracts some of the at-risk population groups as suggested from national statistics trends. Specifically, it seems to address the increasing trend of younger users attempting suicide or having suicidal thoughts, with almost 50% of the application's users being under the age of 34. Nevertheless, some other at-risk population groups seem to be less represented across the application's userbase. For example, Stay Alive's female to male ratio is 6:4 whilst the death by suicide ratio is closer to 2:8. This means that the male population group, which is the most vulnerable, seems to be less engaged with the application. The difference in the gender split could be representative of the professionals working in the caregiving sector (Grassroots, 2020). Previously, those receiving suicide prevention training from Grassroots was approximately 70% females and 30% males. However, these recent figures show an improvement in the balance of the gender split to 60% females and 40% males. Furthermore, and according to national statistics, the population groups between the age of 45 to 49 are the most at-risk of suicide, yet they only represent under 15% of Stay Alive's userbase (45 – 54-year age group is 15%) (Google, 2018). Relevance of the application to the at-risk national population is important to ensure the application appeals to the right target groups. This difference could be due to the technological nature of the app, where younger users might feel more comfortable engaging with this solution in comparison to older users or to different campaign engagements.

*Engagement Rates:* There are two ways to assess engagement success. The first reflects satisfaction in ensuring the features/resources are deemed useful, to which survey results have exhibited large satisfaction rates from respondents (See 'Qualitative Review and Analysis - Key Results'). The second is the level of user retention from users depicted from data coming from Firebase, with an average 5-week retention rate of 6% and 10-week retention rate of 4% over a 6-month period (July – Dec 2019). A good balance of both elements is essential to keeping an application relevant to user needs.

*App user profiles:* Approximately a third of users use the app to support someone else, which is lower than 2016 survey results, with approximately half using it to support in a professional capacity. Interestingly, the percentage of respondents using the app to support themselves in 2016 and 2020 remain the same (34%). Out of the latter use case, 98% indicated that they have felt suicidal. This is a noteworthy outcome, suggesting that whilst that profile prevalence might be lower relative to others, it does appear to be the most relevant for the purposes of the app and should be further targeted.

*App usage and useful features:* Most useful features as listed in the 2020 survey were NHS resources (local and national crisis support). This highlights that effective signposting could result in more patients getting the help they need, but also might put a strain of the NHS system, should such services not be available. One could argue that optimal utilisation of these NHS signposted resources would enable to increase allocative efficiency across the suicide prevention pathway. Self-management was best supported through the ‘Safety Plan’, and often signposted by healthcare professionals. In spite of literature review highlighting that suicide bereavement could be a factor that could contribute to an individual being at risk of suicidal attempts (Larsen, 2016), the “Suicide bereavement resources” had little appeal with only 2.5% of survey respondents finding it useful.

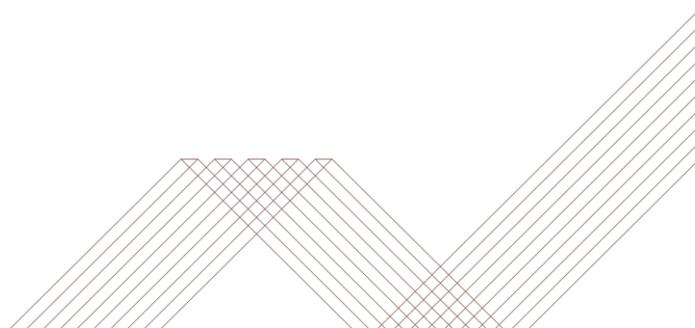
### **Accessibility and equity**

Given the digital and cost-free nature of the application to the user, it can be accessed by a large proportion of the population. However, it is important to note that there will be age groups that are more digitally literate than others, or individuals in difficult socioeconomic situations who may not have the same means to access a smartphone. Furthermore, for some users, English might not be their first language, or they may have learning disabilities. It will therefore be important to make the application accessible to all such population groups. Data has shown that currently, the application is in majority accessed by younger population groups. Due to GDPR concerns with the survey, little information was gathered around the diversity of the userbase, and whether the application was equitable to all potential users. This should be further reviewed through their user engagement activities as part of the recent grant received from the Digital Fund e.g. focus groups.

Acknowledging the local and national nature of resources, it would be interesting to better understand the spread of the application across the various regions in the UK. Furthermore, and noting from the national statistics trends, some regions are at higher risks than others and in particularly in isolated regions, Stay Alive could be a useful tool to ensure high-risk individuals stay supported and informed.

### **Credibility and reputation**

Results suggest that the app has been well received and that the users have scored the app positively.



There has been discussion and doubts worldwide around the usefulness of digital interventions to prevent suicidal ideation or attempts. This was raised in a number of research papers, which looked to determine whether suicide and depression prevention applications, adhered to six evidence-based suicide prevention strategies (Martinengo, 2019) (Torok, 2019):

- Tracking of mood and suicidal thoughts
- Development of a safety plan
- Recommendation of activities
- Information and education
- Access to support networks

In the research paper, Stay Alive was rated as one of the six applications which adhered to these guidelines, showcasing the application's credibility and reliability (Martinengo, 2019).

## Patient outcome improvements

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### Improved awareness/knowledge/attitudes towards suicide

*Reducing Stigma:* It has been noted that stigma is one of the biggest barriers to suicide prevention, with evidence suggesting it greatly interferes with help-seeking (Keller, 2019). As a suicide prevention application, one of Stay Alive's first steps is to ensure prevention is feasible by reducing stigma and increasing awareness relative to suicide. Findings from the survey showcase that the application has successfully done so, with 92.7% of respondents feeling that the Stay Alive application has helped reduce the stigma of suicide.

*Open Communication:* The next step in suicide prevention tends to be around transparency and talking openly about suicide, once fear of judgment has been removed. Findings have shown that the application is helping on that front, with almost three quarters of respondents feeling more comfortable to openly speak about their suicidal thoughts and experience to their family, friends and professionals. The largest positive effect has been seen from the perspective of people supporting others and healthcare professionals; 90% of respondents supporting someone else have stated that the app has helped them to speak about

suicide to individuals they were concerned about, and 89% of healthcare professionals indicated that patients using the app better articulate around the topic of suicide.

### **Increased support (signposting)**

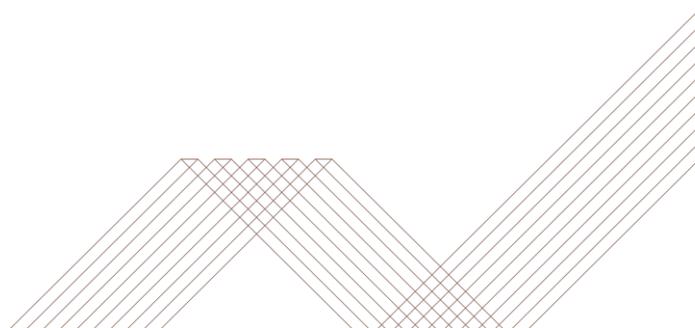
Responses from the 2020 survey indicate that the app has been effective in signposting resources with 89% of respondents believing the app has helped them find further support and 78% finding signposting resources useful. This positions Stay Alive in a favourable position relative to the best practice guideline of providing 'Access to support networks'. It also demonstrates that the tool can be used alongside professional support, both in staying up to date relative to resources, but to also ensure their patients have access to the latest advice and help. One should still acknowledge, that whilst the app provides with further support (educates at-risk individuals and their close ones, generates self-awareness and highlights additional resources), it could also overload an individual with information on the matter. Ensuring an appropriate flow is followed throughout the application's user journey is therefore key.

Finally, open ended comments highlighted an immense amount of gratitude towards the application for supporting them at a time they needed. A sentiment analysis showed that out of the 27 open end questions, 14 respondents thanked the team for making this tool available.

### **Improvement in self-management**

Due to fear of hospitalisation, lack of time and finances, it is progressively common for individuals to rely on self-management to address mental health concerns (Hom, 2015). Whilst the latter method is not a perfect substitute to mental health services, it should be accepted that its prevalence is increasing. To address this trend, self-management tools should therefore closely follow clinical guidelines. To-date Stay Alive has successfully followed these guidelines. The application was considered effective by respondents in supporting with self-management helping many, as discussed in the 'Key Survey Results', staying safe from suicide.

In addition to enabling self-management through reduction of stigma and open communication, along with useful signposting, some key features of the application seemed to have helped, including national and local resources, as well as the 'Safety Plan' feature.



## Improvement in supporting gatekeepers, friends and family

A significant number of Stay Alive's users, as has been clearly evidenced across the 2016 and 2020 surveys, are people using the app to support someone else. In conjunction with evidence that users have found features useful, and that 81% of users in 2020 suggested the application has helped their loved one stay safe from suicide, demonstrates ongoing and useful support towards gatekeepers, friends and family.

Nonetheless, there seems to be little appeal towards bereavement features of the application (only 2.5% of users finding it useful), which could insinuate Stay Alive might not be tailored enough either attract or address the needs of individuals suffering from bereavement. This is in line with literature papers that suggest that whilst bereavement is a wide-spread issue, it is rarely addressed.

## Pathway improvements

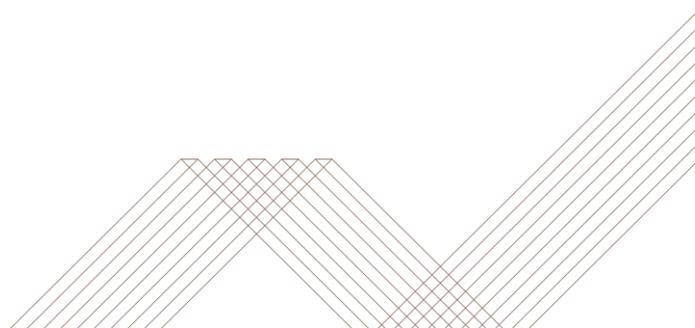
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### Access to care

Stay Alive has proven to be useful to signpost healthcare resources, as noted by individuals supporting others at-risk or professionals. This means that the application plays an important role in connecting at-risk individuals with relevant resources including national and local helplines or counselling. Through that, the suicide prevention pathway can be delineated to a greater degree, and services may become more accessible and used. There is a counterargument to this, in that it could potentially put a strain to the services' capacity as they are increasingly being used, without following the regular patient flow such services are used to. Furthermore, it creates a strong impetus to ensure that these resources are the most up to date and relevant to avoid adverse events. Finally, as Stay Alive represents a broker between services and individuals, there is a risk for the application to represent a triage tool, or substitute to triaging which might not be favourable.

### Communication

It is important to link the appropriate target group of the application to the relevant content and information. The application may therefore be more relevant to users that support at-risk population groups rather than the actual at-risk population groups themselves. Should at-risk population groups be included, advice would warrant for



the information to carefully be curated from any harmful content so that they can still manage themselves appropriately.

## Societal and indirect improvements

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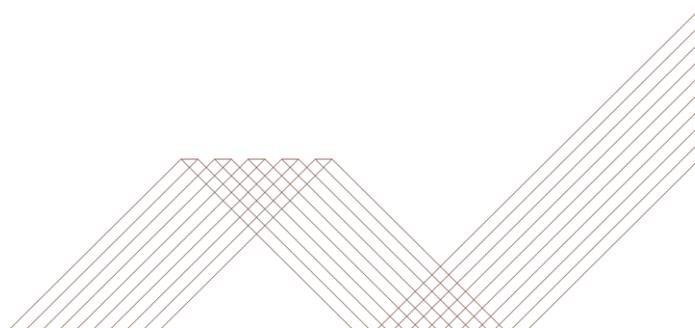
### Opportunity cost model

The purpose of the opportunity cost model was to understand the impact a suicide prevention programme would have from a health system and societal perspective, based on the costs generated in the current care pathway. This was done to understand indirect health and social benefits and costs Stay Alive may be contributing to. The economic analysis conducted was designed to determine whether robust estimates of the potential health and social economic impact of Stay Alive could be generated via a desk-based study, augmented by standardised data and published sources. It focussed on three key opportunity streams: the potential reduction in mortality rates, reduction in hospital re-admissions and bed days. It also highlighted initial costs to the system that Stay Alive could be contributing e.g. increased amount of counselling appointment costs from signposting.

Some indicative values were generated to estimate the economic impact of suicide and suicide attempts. Nonetheless, KSS AHSN does recommend some caution in the application of the results as the exercise of translating the opportunity and cost streams into traditional CBA indicators such as Net Present Values (NPV) or Cost Benefit Ratio (CBR) would be fundamentally flawed. Further discussion around gaps were highlighted in the 'Opportunity cost model limitations' section.

The current economic impact of suicide and suicide attempts in England was estimated at £22.7 million per year in healthcare system costs and at £118.1 million per year once the mortality rate is accounted for. This is based on cautious and prudent adjustments for optimism bias applied to both the benefits and the costs.

Although these figures are significant, they only represent a small fraction of the cost of suicide, suicide attempts and suicidal thoughts. The cost of a suicide is estimated at £1.7 million once cost to public services (including health, social care, and criminal justice), lost employment, and greatly diminished quality of life for the patient and their family have been accounted for (Knapp, McDaid, & Parsonage, 2011).



Should a suicide prevention programme be implemented across England and impact 10% of the at-risk population identified by current reporting mechanisms, the potential savings could be estimated at around £11.8 million.

This model presented compelling arguments in favour of the implementation of suicide prevention programmes such as Stay Alive as well as a plea for the collection of carefully selected metrics in community and acute settings to evidence more extensive health economic evaluations. As highlighted throughout the study, the outputs of the opportunity cost model must be interpreted considering the caveats and limitations of the project. The development of a clear methodology to include unreported suicides and suicidal behaviours would enable future assessment to give a more faithful representation of the burden of suicide for individuals and for the economy.

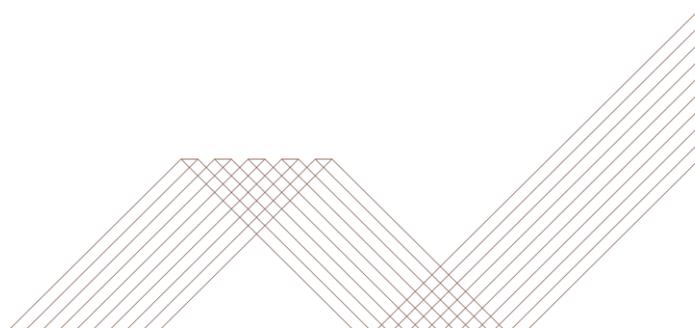
### **Other potential indirect improvements**

A few other outcomes were highlighted which could be further explored. Reductions in sick days and improvement in productivity stemming from a suicide prevention intervention such as Stay Alive. This would not only be applicable to at-risk individuals but also carers, families and friends who have been affected by a suicide incident and would therefore hold a much higher monetary value.

## **Technical improvements**

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Navigability, app quality and aesthetics were measures reviewed as part of this evaluation domain. Nonetheless, throughout the evaluation there was little interaction directly with users, aside from the survey. Initial understanding suggested that focus groups would have been conducted at the Hertfordshire sites, which would have enabled for these measures to be tested. Whilst some of the open-ended comments in the survey noted easy navigability across the application, this should be further substantiated. As part of the ongoing user engagement activities Grassroot will be conducting over the next few years, it would be worth exploring improvements or gaps relative to these measures.



# Limitations

## Survey analysis limitations

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### Use case interpretability

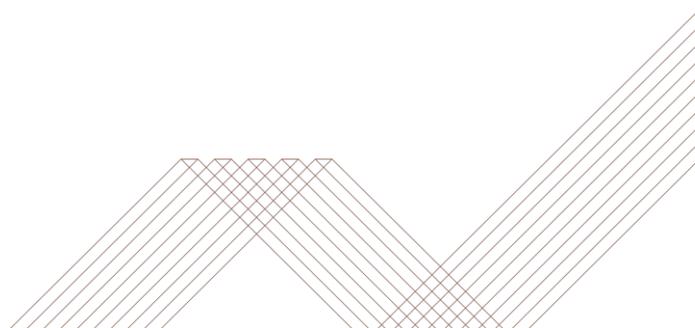
It was difficult to clearly distinguish the different use cases (“myself”, “someone else” and “professional”) across the 2016 and the 2020 survey. Choices in the 2016 survey were not restricted to a single option; meaning that respondents could pick more than one reason for an app download. Additionally, the “professional” branch was not clearly defined in the 2016 survey. When analysing the data, analytical steps had to be taken to refine these answers to make the use cases clearer which could lead to interpretation differences compared to the 2016 report (Flecknoe, 2016).

The 2020 survey better defined the branches; however, exclusivity remained an issue. This lack of exclusivity was especially an issue when investigating improvement in self-management. Furthermore, the lack of exclusivity could lead to interpretation issues. Due to the flow of the 2020 survey, the question, “Did you download the app to support someone else?”, n=87, is before the question, “Did you download the app for professional use?”, n=17. However, professionals answering the survey could have interpreted their use of the app to be to support someone else as they have not yet seen there is a question branch specifically related to professionals.

### 2016 to 2020 comparability

Questions were compared from 2020 to 2016 surveys, where possible. Some issues around this comparison included:

- Similarities in questions but differences in response options e.g. under “Use” when exploring features used in each branch Q17 in the 2016 survey did not have the same options as its corresponding 2020 question.
- Other 2020 questions were not comparable to 2016 ones as these were not included in the latter i.e. questions relating to the section of ‘improved awareness/knowledge/attitudes towards suicide’ and ‘access to care’.



- Lastly, questions under “Accessibility and equity” could only be taken from the 2016 survey as repeating these questions in 2020 created EU GDPR concerns as they would have represented personal identifiable data (Data Protection, 2018).

### **Demographic and uptake analysis**

Analysis within Firebase did not allow age group demographics to be reviewed separately. This meant that responses and uptake data relating to groups at a higher risk of suicide, such as males aged 45-49 (Office for National Statistics, 2019), could not be analysed in isolation. Secondly, Firebase data was only collected on Android users. This does not allow analysis for iOS demographics.

### **Statistical Methods**

This qualitative review was based on calculating proportions and differences between 2016 and 2020 surveys. There was an initial attempt to include statistical analysis to the review such as a Chi-Square test.

A Chi-Square test is a statistical test used to examine the statistical relationship between categorical variables. The latter checks if an association between two variables exists. This is achieved by comparing observed patterns of responses in cells to the expected pattern if variables are truly independent. This comparison is done by calculating the Chi-Square statistic and comparing it against a critical value from the Chi-Squared distribution (Statistic Solutions, 2020). This could be acceptable for testing if there was a significant difference in the app keeping users safe from suicide in 2016 vs. 2020.

In this case, the Chi-Square test would assume an expected figure from a previous evaluation rather than calculating the expected value from an academic probability (Flecknoe, 2016). However, the expected value carries many assumptions and is therefore limited. This expected figure has not been adjusted for 2020 and the 2016 figure was used. Additionally, the test was not performed for each use-case, but rather the statistical difference was based on total suicides prevented within each year, 2016 vs. 2020. Examining statistical significance within each use-case or between features or resources could add to understanding the app’s relevance to the specific sub-population i.e. the analysis would be more granular. The sample of respondents answering the survey was not random and would naturally include respondents with mental health issues, suicidal ideation or include respondents that

would possess factors that make them at-risk of suicide. Given these limitations, it was decided that additional statistical analysis would not be applicable for this dataset but could be considered for the next iteration of the survey.

### **Other survey challenges**

Collection of user and engagement data (user demographics, retention etc.) did not include all users of the app. As this data was collected through Firebase, only Android users were recorded (omitting iOS users). In addition, there are general disadvantages associated with the use of a survey. These disadvantages include (1) dishonest answers, (2) hidden agenda, (3) accessibility issues, (4) survey fatigue and (5) interpretation issues (Debois, 2019). However, when designing the 2020 survey these factors were considered and effort was made to ensure survey flow was optimised to avoid questions repetition which could reduce misinterpretation and fatigue.

## **Opportunity cost economic model limitations**

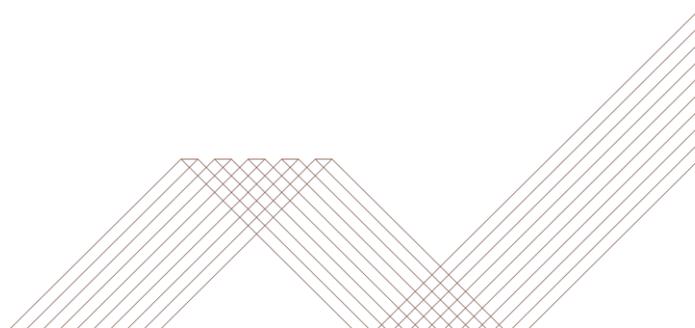
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### **Limited and unavailable data for this model**

The authors encountered several limitations. The need to rely on academic sources for some of the benefits often resulted in the need to apply higher optimism bias correction, reducing the benefit within the model. Should the data collection be designed for health economic evaluation and performed before and after the introduction of Stay Alive, localised data could be used to evidence the impact of future roll-out.

As well as reflecting better the implementation of this intervention, with reduced need for higher optimism bias correction, the benefits may well be higher. Utilising an informatics partner (such as the KSS AHSN) to assist in the definition, collection and analysis of data to monitor and evaluate the project as it is rolled out further would significantly improve uncertainty associated with less evidence-based assumptions.

Several of the opportunity streams identified used information from older research studies. As such there is little means to verify that benefits identified within these studies remain applicable to the present-day value attributed. To guard against overestimating on this basis, prudent application of a variable optimism bias attempted to control for this effect.



Economic modelling is not an exact science and its outputs should be a guide to decision-making and not a substitute for experienced local knowledge. There will always be some need for assumptions or reliance on secondary data, which limits the ability to generalise and draw broad policy lessons from an individual project or programme review. As further evidence is made available, particularly from the current implementation or a regional roll-out, the model should be reviewed and amended accordingly. This will act to further enhance the accuracy of the model and the ability to draw wider conclusions. In future evaluations which would collect some data of the project to build a cost benefit model, the outputs from the model should be subjected to a range of risk and sensitivity tests to understand more about the degree of confidence with which the outputs from our model should be treated.

### **Hospital re-admissions**

Moreover, should the evaluation be extended or replicated further, the authors would recommend factoring the cost associated to multiple hospital episodes following a suicide attempt into the model. A study has shown that the episode-based 6-month repetition rate was 30% out of 483 episodes of self-harm (Quinlivan, 2017). Similarly, in the UK, the risk of suicide has been reported to be approximately 50 times greater for patients in the year after a self-harm episode compared with the general population (Hawton, et al., 2015). Therefore, a future model should include a further reduction in mortality linked to the number of suicide attempts avoided as a result of Stay Alive.

### **Primary care costs**

Furthermore, the authors felt that there would be value in widening the scope of the evaluation. Whilst our study accounts for the costs falling upon the secondary services, it does not take a holistic view to preventing and treating suicide and suicide attempts. For instance, continuation of care and out-of-hospital care, such as Cognitive Behavioural Therapy (CBT) sessions are estimated at £296 (PSSRU, 2020) and could impact an initiative like Stay Alive. Similarly, costs to GP and other allied health care professionals should be integrated into a more in-depth evaluation.

### **Lack of scenario testing to account for suicide method and population groups**

Besides, a more extensive health economics evaluation would gain insights from having more granularity when calculating the costs associated with the method of

attempted suicide. In this study, no distinction was made between the self-poisoning alone, self-injury alone and self-poisoning and self-injury combined, however, Tsiachristas et al. (2017) showed that after adjusting for hospital use variables and age, self-poisoning alone was £120 more costly than self-injury alone and the combination of self-poisoning and self-injury was £74 more costly. Likewise, suicide attempts by violent methods (cutting, jumping from heights, hanging, shooting, etc.) resulted in longer hospital stays and longer intensive care unit stay (Persett, Grimholt, Ekeberg, Jacobsen, & Myhren, 2018).

Accounting for differences in outcomes in different age groups as well as gender-linked disparity is recommended by the authors in future health economic models, in addition to evaluations as highlighted earlier. Imbalance in suicide trends is repeatedly observed: men remain around three times more likely to take their own lives than women and suicide rates have increased in women aged 45-49 years in the UK (Samaritans, 2019). Furthermore, the in-app data collected by Grassroots could enable the evaluation to assess how Stay Alive impacts the different sub-population groups.

### **Beyond the health economic model**

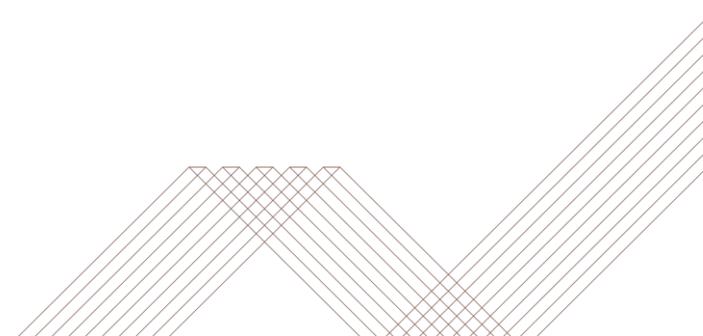
When partners commission and evaluate interventions, they should be advised to consider more than just the benefit-cost ratio of the project. They should consider interventions from a range of perspectives, including the qualitative analysis, strategic contribution and capacity to deliver, alongside the Net Present Value or Cost Benefit Ratio, and the range of potential results revealed through the sensitivity risk, which demonstrates negative return on slightly more than a third of the draws of the sensitivity analysis.

## **Broader limitations and risks**

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### **Stay Alive as a complement rather than a substitute**

As noted in the discussion section, Stay Alive demonstrated adherence to prevention strategies via its features and could therefore be a useful tool for real-time monitoring of at-risk groups or access to support (Martinengo, 2019). Nonetheless, one should always view digital interventions as complementary tools to an ongoing patient-provider/professional relationship and never a replacement (Martinengo, 2019). It is



difficult through the app to understand at which stage an at-risk individual may find themselves and how they might interpret or use information from the application. This is why digital interventions should position themselves as connectors between at-risk individuals and appropriate mental health care services, rather than substitutes (Hom, 2015). It is of particular importance to do so as individuals increasingly prefer self-management rather than using mental health services due to fear of hospitalisation and other structural factors including time and finances (Hom, 2015). Striking the right balance in supporting at-risk individuals with accurate information and access to further resources is therefore essential. Further research supported this point concluding that digital interventions have been associated with reductions for suicidal ideation scores post-intervention, but without any evidence of a treatment effect for self-harm or attempted suicide. This shows that on their own and without the continuity of the mental healthcare pathway, digital interventions for suicide prevention are not efficient enough to prevent suicides/suicide attempts.

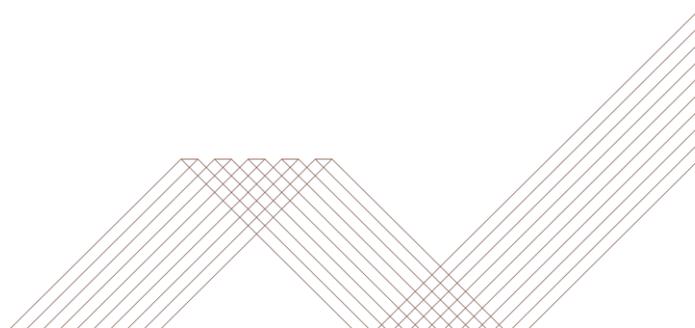
### **General difficulties of data availability and quality**

It has come to our understanding that there is a lack of both relevant and accurate data sources in the field of mental health and more specifically suicide prevention. This is demonstrated by the continuous advocacy and policy recommendation to improve data quality, consistency and timeliness to enable rapid responses to suspected suicides and identify clusters in an attempt to prevent additional suicides (Mackley, 2019).

### **Privacy and security requirements**

While the use of technology can overcome many obstacles, it can also introduce new caveats. These can in turn be difficult to measure and monetise.

New technologies could lead to privacy breaches and compromise patient confidentiality (Luxton, June, & Chalker, 2015). Growing standards and regulation around data driven health and social care solutions, such as GDPR and other ICO requirements, have started putting pressures on companies to ensure their data are of good quality and reliable. Failure to do so could incur legal costs and possibly negative patient outcomes due to harmful or incorrect information content.



### **Harmful content and social media**

More importantly, studies have shown that harmful content on apps (describing or facilitating access to lethal means) could lead to individuals ending their life prematurely (Larsen, 2016).

Some studies have even argued that suicide has been portrayed as fashionable or appealing on social media, which in turn desensitises the issue and can lead to the creation of further stigma (Rost, 2005).

### **Digital literacy**

Apps are not accessible to all individuals within a population. Be that due to a lack of resources or a lack of technological knowledge e.g. no access to a smartphone or an inability for older populations to engage with the technology and the app (Flecknoe, 2016). This should be considered when reviewing relevant at-risk target population groups for Stay Alive and creating engagement campaigns.

## **Key Recommendations**

### **Evaluation**

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As discussed in the discussion and limitations sections, some of the evaluation domain areas would require to be further explored due to lack of available data to-date. Specifically, two key domain areas should be reassessed: the technical as well as societal and indirect improvements. Moreover, suggestions and learnings from the survey exercise were highlighted.

#### **Health economic model**

Due to the lack of data expected from the Hertfordshire site, KSS AHSN was not able to build a cost-benefit model to assess the impact of the Stay Alive intervention relative to the existing suicide prevention pathway. Instead an opportunity cost model was created to highlight where there could be opportunity for the application to showcase their intervention as cost-effective. Should this be an area Grassroots would like to investigate, KSS AHSN would recommend identifying one pilot site in a community or secondary care setting. In such setting, the individuals' or professionals' use of the application would be monitored and correlated to broader

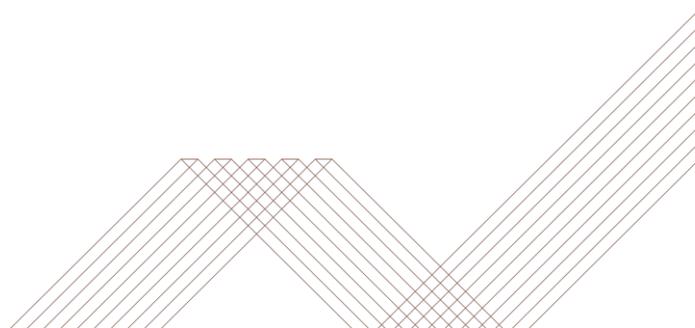
benefit streams as identified at the relevant setting e.g. reduction in re-admission, reduction in mortality rates, reduction in bed days, or increase in counselling costs. It is still important to note that all such possible benefits are highly indirect, with multiple confounding factors possibly leading to the outcomes described. Furthermore, and should this exercise occur, it will be interesting to identify any further benefit or cost stream that might not have been included in the opportunity cost model, as it only focussed on the big picture of the cost of suicide. The inclusion of the health economic model should only be a complement to the qualitative evaluation.

### **Technical improvements**

KSS AHSN would urge for the technical improvement measures to be reviewed via focus groups through the user experience testing, expected to occur over the next few months. An understanding around navigability of the application would be interesting looking at different pathways or user profiles. For example, a user that falls into the 'supporting someone else' category could be asked to identify a resource that helps their loved one stay safe from suicide. The pathway taken by the user would then be mapped, including timing, ease of finding and usefulness. This will help simplify the application in a user-friendly manner. Furthermore, users could test the quality of the application from a technical perspective, including loading time and other technical issues. Finally, aesthetics could be reviewed to improve user experience. As part of the user engagement and testing, which may include a forum, it will be important to sort any information governance and liability issues. Specifically, topics such as the moderator's accountability, training and professionalism should carefully be reviewed as these could trigger severe adverse effects.

### **Survey considerations**

For future evaluation exercises, a few considerations with regards to the survey should be noted. One of the key limitations, which made some of the results difficult to interpret and categorise accordingly, was the lack of delineation across the three user profiles. Ensuring that these are clearly categorised and mutually exclusive from the beginning of the survey, would make it easier to trace answers across the specific measures.



KSS AHSN would also suggest maintaining the questions from the 2020 survey in the renewed survey for comparison purposes, whilst continuously building from it if new evaluation areas have been identified.

## **Business model**

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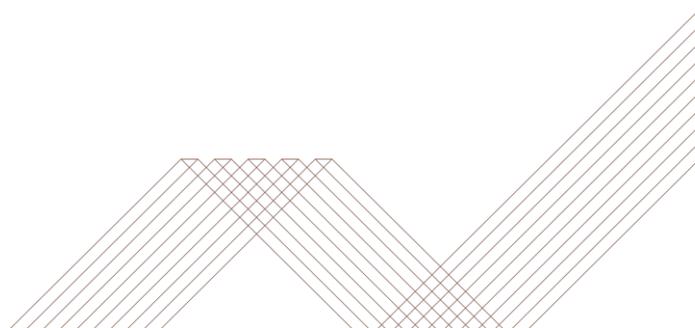
### **Use case and pathway importance**

Whilst KSS AHSN understands that Grassroots prefers not to categorise users extensively, there is interest in understanding how different user profiles behave i.e. interpret information provided in the application and react. The survey findings demonstrated differences across the three user profiles (at-risk individual, carers and professionals), in terms of resources and features that were found more useful than others. Grassroots could seek to understand such differences and potential need to review the application from a profiling perspective through the user engagement testing exercise. Considering the behavioural science COM-B framework which suggests that capability, opportunity and motivation all drive an individual's behaviour or components of the 'nudge' theory that highlights strategies to indirectly influence an individual's decision, may also be worth exploring. Supporting individuals during bereavement may be a topic worthy of further investigation.

There may also be appetite in adjusting the features, not only relative to the profiles suggested, but also to the point-in-time that different resources may be needed. For example, prior to a counselling session, the 'Safety Plan' might be convenient to complete in order to gather thoughts; or following a counselling session, the functionality of a journal may help showcase improvements in mental health state. Reflecting and mapping the suicide prevention pathway within the application may help guide the user towards an appropriate feature.

### **Targeted campaigns to increase use by all demographics**

One of the key findings from the qualitative review was that the existing Stay Alive users are not inclusive of the totality of at-risk population groups of suicide, specifically men or individuals in the 45 – 59-year-olds category were underrepresented in the application's user review. This represents a big opportunity for Grassroots to increase the number of relevant users who could find the application useful.



This hypothesis could be tested via the user experience testing exercises, ensuring the groups are well-represented in these focus groups. By doing so, Grassroots will be able to identify where the app might have dissuaded that user category in engaging with Stay Alive.

Once Grassroots has established the relevance of the application's content to that userbase, targeted campaigns may be necessary to increase app accessibility amongst these groups.

A similar activity could be undertaken with regards to regional trends where clusters of at-risk groups have been identified e.g. isolated areas such as Yorkshire, and where Stay Alive could have a positive impact.

### **Exploring other at-risk groups**

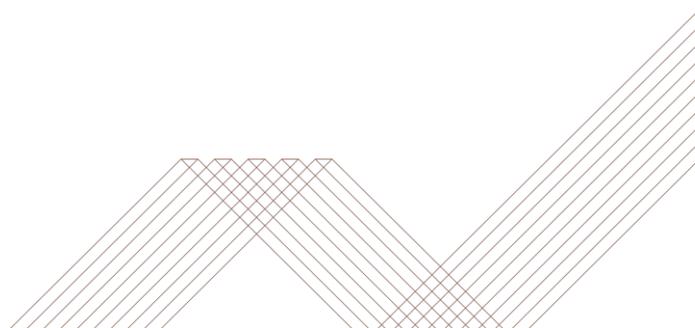
The evaluation did not study other at-risk groups such as individuals that are at-higher risk of suicide attempt following a discharge, either from a hospital or prison setting. This area could be assessed and considered for additional resources or features. Moreover, campaigns or pilot sites could be adjusted to include these groups.

A few correlations between factors leading to an individual being at-risk could also be explored including the link between medication use e.g. anti-depressants and suicide attempts.

### **Partnerships**

Grassroots should evaluate partnering with other charities that seek to support specific groups e.g. ex-convicts, veterans or individuals with co-morbidities. This would enhance the signposting capability of the application whilst making it accessible across a wide range of users.

Investigating where best the Stay Alive application positions across the suicide prevention pathway, with multiple options being feasible e.g. after discharge or prior to any event occurring, would help the organisation identify preferred partnership channels across the health system.



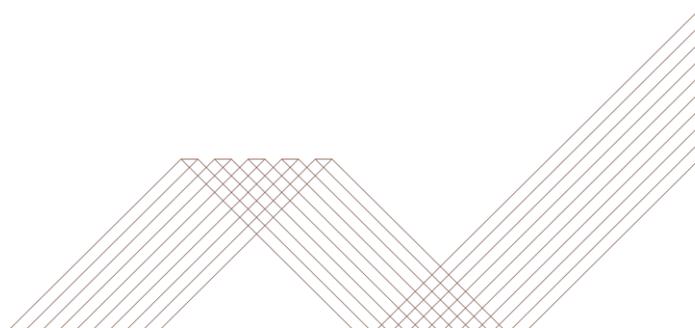
## Technical guidance / adherence

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There is ongoing scrutiny around compliance to GDPR regulations and other data requirements across digital health applications. As discussed, ORCHA pointed out potential issues Stay Alive has with regards to Grassroots' data use, consent and encryption policies. Addressing this should be made a first priority.

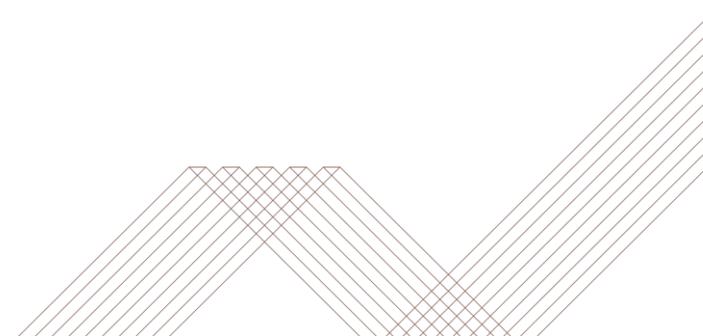
KSS AHSN would suggest reviewing the following guidance from the Department of Health and Social Care as well as NHS digital, to ensure the application is fully compliant with any requirements deemed appropriate. The code-of-conduct for data driven health and care technologies suggests a few key toolkit to help companies guarantee the security becomes an integral part of their solution (Department of Health and Social Care, 2019). Principal 9 from the code discusses the Data Security and Protection Toolkit which is an online self-assessment tool which provides organisations the opportunity to measure their performance against the National Data Guardian's 10 data security standards (NHS Digital, 2019). This is not mandatory as the organisation does not manipulate NHS data, but it is a good set of rules to try to emulate, where feasible. The code also mentions the OWASP Application Security Verification Standard (ASVS) which gives a basis for testing web application technical security controls and also provides developers with a list of requirements for secure development (OWASP, 2019). Th

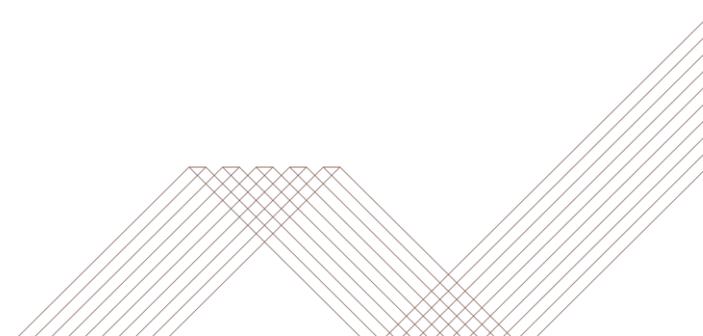
is could be of interest as Grassroots looks to transfer all the developing activities in-house.

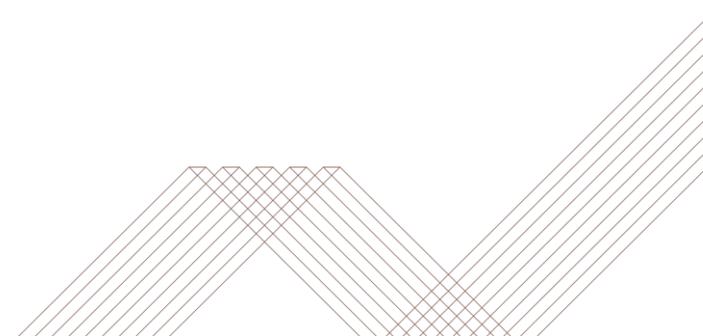


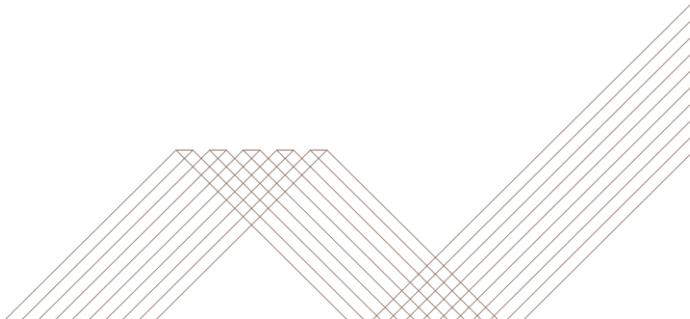
## References

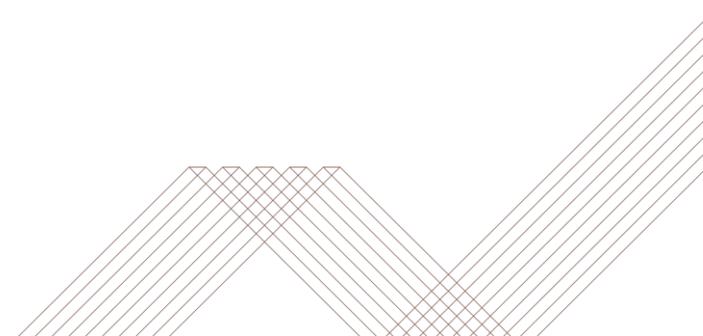
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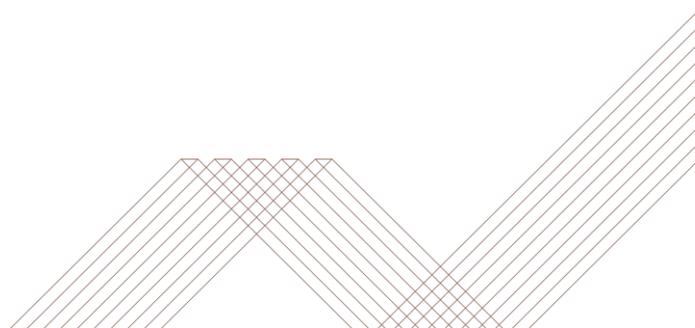
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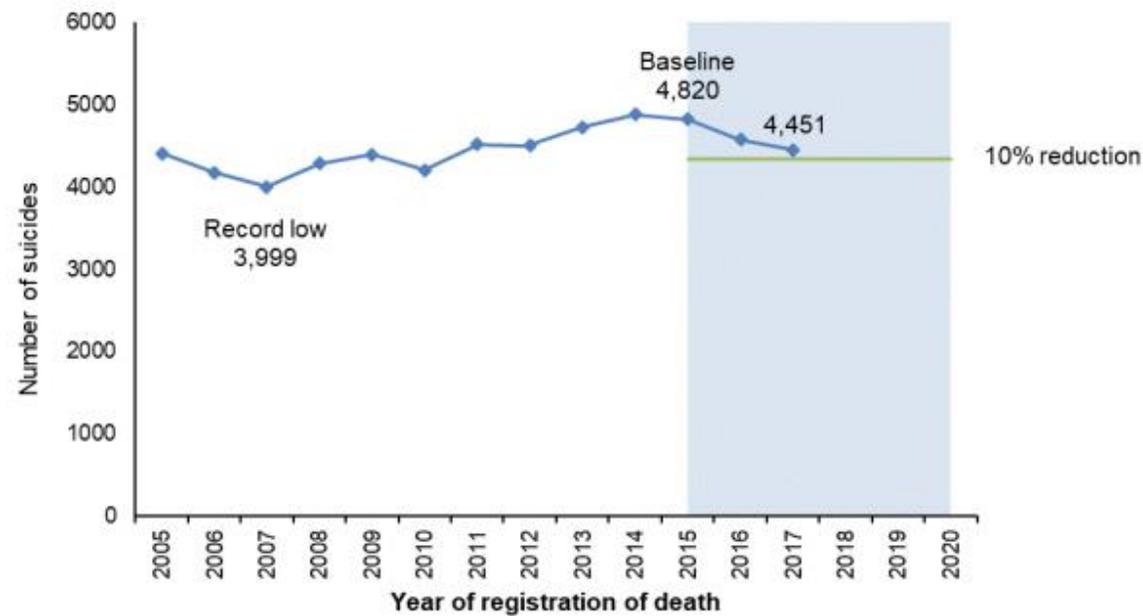
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# Appendix

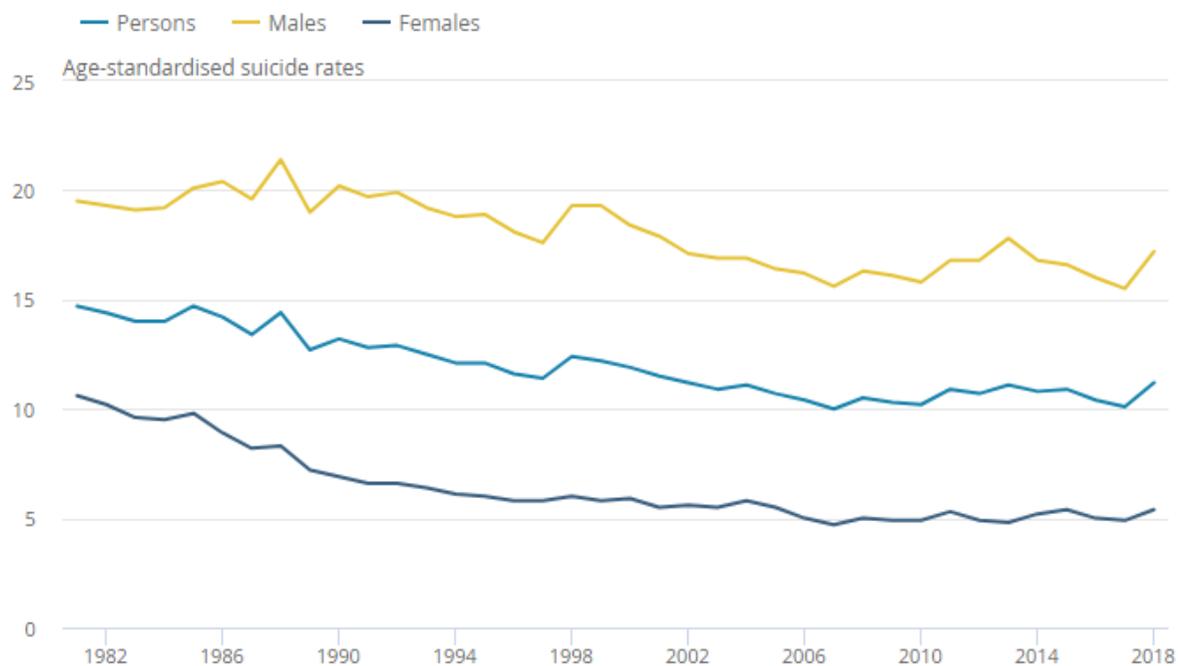
## Appendix A: Monitoring progress towards a 10% reduction in suicides



Source: (Department of Health and Social Care, 2019)

## Appendix B: Significant increase in suicide rates for all persons and males in 2018

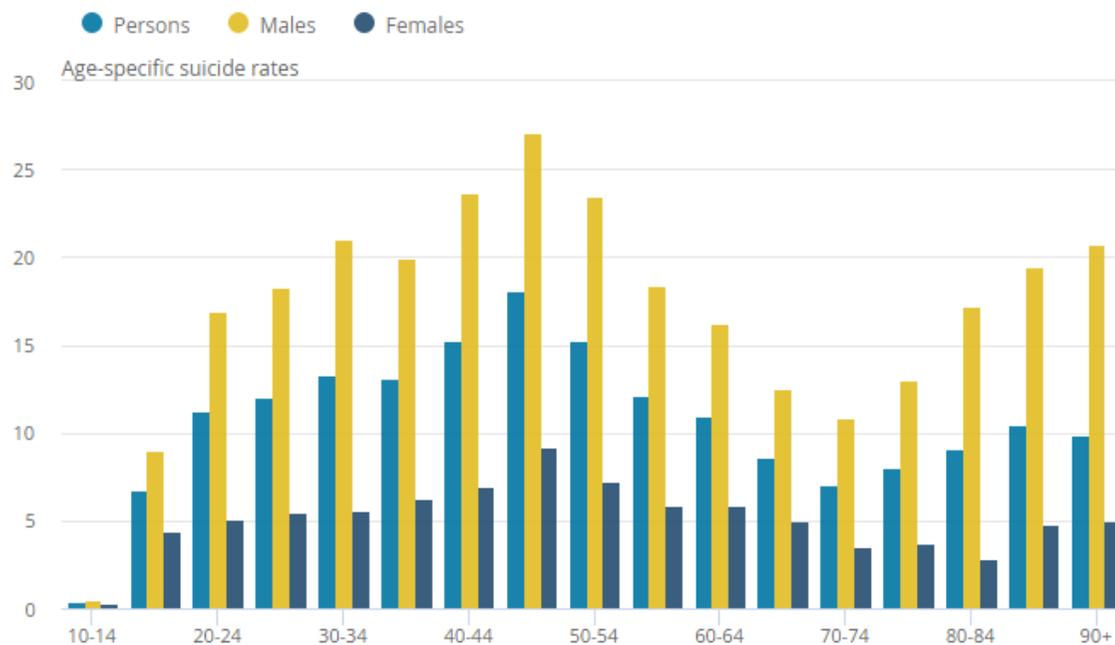
Age-standardised suicide rates by sex, UK, registered between 1981 and 2018



Source: (Office for National Statistics, 2019)

## Appendix C: Highest suicide rates seen among those aged 45-49 for males and females

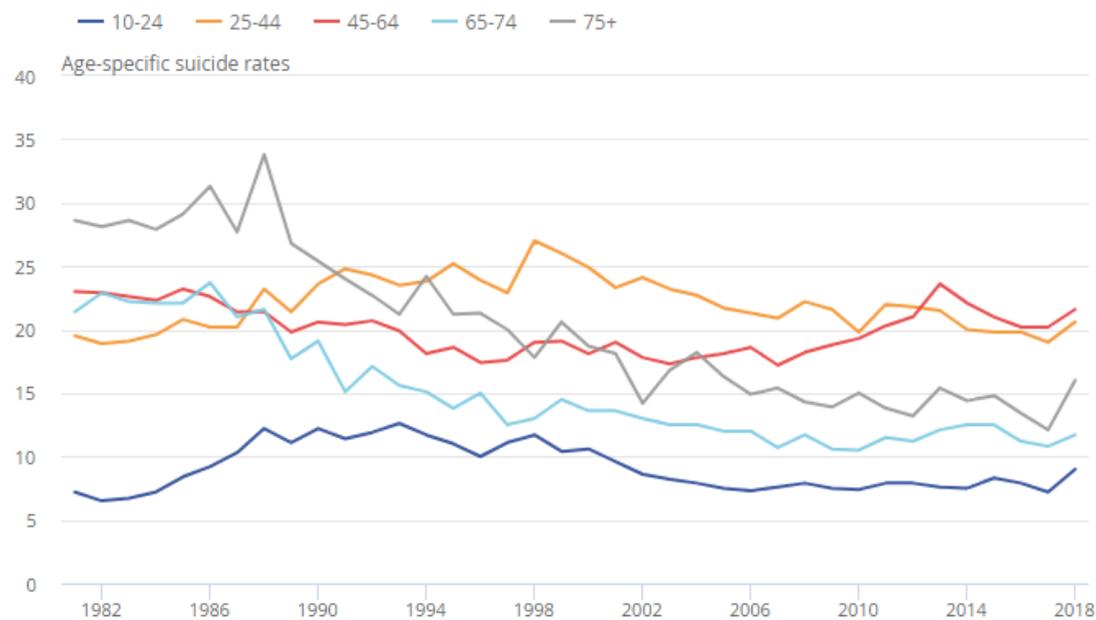
Age-specific suicide rates by sex and five-year age groups, UK, registered in 2018



Source: (Office for National Statistics, 2019)

## Appendix D: Compared with the previous year, there were significant increases in suicide rates among males aged 10 to 24 years and males aged 75 years and over

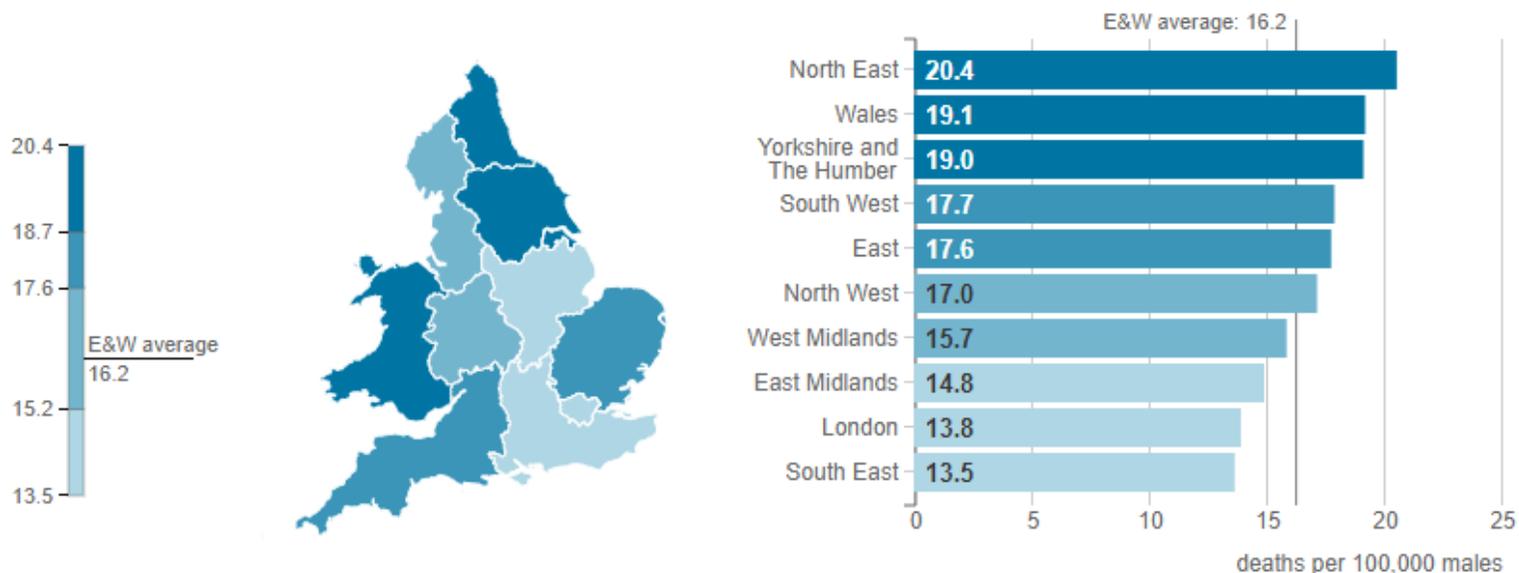
Age-specific suicide rates by broad age groups, males, UK, registered between 1981 and 2018



Source: (Office for National Statistics, 2019)

## Appendix E: The North East had the highest suicide rate for males in 2018

Age-standardised suicide rates for English regions and Wales, males, deaths registered in 2018



Source: (Office for National Statistics, 2019)

## Appendix F: Iceberg model of self-harm and suicide in young people



Source: (Department of Health and Social Care, 2019)

## Appendix G: Evaluation framework

Evaluation domains	Measurements / Assumptions	Sources of Data Collection and Questions / Metrics	Methodology
<b>App reach and engagement improvements</b>			
User traffic and uptake	<ul style="list-style-type: none"> <li>- Relevance of user population to solution’s target population i.e. what is user traffic trend in terms of demographic</li> <li>- Increase in traffic i.e. number of downloads, recurrent activity</li> <li>- Increase in frequency, if applicable</li> </ul>	<ul style="list-style-type: none"> <li>- Survey                             <ul style="list-style-type: none"> <li>o Have you ever downloaded the Stay Alive app? (Q1)</li> <li>o Do you still have the app on your device? (Q4)</li> <li>o If you uninstalled the app, please tell us why. (Q5)</li> <li>o If you have kept the app on your device, how often do you refer to it? (Q15)</li> </ul> </li> <li>- Literature papers / other documents from client                             <ul style="list-style-type: none"> <li>o Digital Fund document</li> <li>o Daniel Flecknoe document (2016 survey)</li> </ul> </li> <li>- Firebase                             <ul style="list-style-type: none"> <li>o What is your age group? <i>Note: use Firebase instead of survey (Q6)</i></li> <li>o How would you describe your gender identity? <i>Note: use Firebase instead of survey (Q7)</i></li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- Compare 2016 to renewed 2020 survey, if possible (Surveys)</li> <li>- 12-month and 24-month wherever relevant (Firebase)</li> </ul>
Use	<ul style="list-style-type: none"> <li>- Which features are the most used?</li> <li>- What’s the breakdown between using it for self-purposes vs. for someone</li> </ul>	<ul style="list-style-type: none"> <li>- Firebase For key feature use through Firebase i.e. signposting, self-management (including Lifebox), use for others, knowledge / awareness                             <ul style="list-style-type: none"> <li>o Number of users / unique users</li> <li>o Total user engagement</li> <li>o Average time (secs)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- 12-month and 24-month wherever relevant (Firebase)</li> <li>- Compare 2016 to renewed 2020</li> </ul>

Evaluation domains	Measurements / Assumptions	Sources of Data Collection and Questions / Metrics	Methodology
	<ul style="list-style-type: none"> <li>one supports vs. healthcare professional (note questions to be slightly different for the latter section)</li> </ul>	<ul style="list-style-type: none"> <li>For breakdown, specific ‘worried about someone else’ pages with:                             <ul style="list-style-type: none"> <li>○ Number of users / unique users</li> <li>○ Total user engagement</li> <li>○ Average time (secs)</li> </ul> </li> <li>– Survey                             <ul style="list-style-type: none"> <li>○ For what purpose did you download the app? (Q3)</li> <li>○ Do you feel that the app has helped you to stay safe from suicide or someone else to stay safe from suicide (Q18)?</li> <li>○ What do you think is the most useful feature of the app? (Q19)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>survey, if possible (Surveys)</li> </ul>
<ul style="list-style-type: none"> <li>Accessibility and equity</li> </ul>	<ul style="list-style-type: none"> <li>– Increase access across geographies, sexual, religious, age and gender diversities</li> </ul>	<ul style="list-style-type: none"> <li>– Firebase                             <ul style="list-style-type: none"> <li>○ What is your age group? <i>Note: use Firebase instead of survey (Q6)</i></li> <li>○ How would you describe your gender identity? <i>Note: use Firebase instead of survey (Q7)</i></li> </ul> </li> <li>– Survey                             <ul style="list-style-type: none"> <li>○ How would you describe your sexual identity? (potential issues with GDPR) (Q8)</li> <li>○ Do you consider yourself to have a disability? (potential issues with GDPR) (Q9)</li> <li>○ What is your religion? (potential issues with GDPR) (Q10)</li> <li>○ Where do you normally live? (potential issues with GDPR) (Q11)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>– 12-month and 24-month wherever relevant (Firebase)</li> <li>– Compare 2016 to renewed 2020 survey, if possible (Surveys)</li> <li>– Provide further insights as</li> </ul>

Evaluation domains	Measurements / Assumptions	Sources of Data Collection and Questions / Metrics	Methodology
		<ul style="list-style-type: none"> <li>- Literature papers               <ul style="list-style-type: none"> <li>o (HM Government, 2015)</li> <li>o (Department of Health, 2016)</li> <li>o (Steeg et al., 2018)</li> <li>o (Zalsman et al., 2018)</li> <li>o (Quinlivan et al., 2017)</li> <li>o (Kennard et al., 2018)</li> </ul> </li> </ul>	highlighted (literature papers)
Credibility and reputation	<ul style="list-style-type: none"> <li>- Rankings</li> <li>- ORCHA assessment</li> <li>- DAQ – NHS library</li> </ul>	<ul style="list-style-type: none"> <li>- Orcha ranking</li> <li>- Google Playstore ranking</li> <li>- Apple store ranking</li> </ul>	- Highlight existing ranking and areas for improvement
<b>Patient outcome improvements</b>			
Improved awareness / knowledge / attitudes towards suicide	<ul style="list-style-type: none"> <li>- Increase in knowledge about self-harm and suicide</li> <li>- Reduction in suicide myths through better knowledge</li> <li>- Reduction of stigma by making peers aware</li> </ul>	<ul style="list-style-type: none"> <li>- Survey               <ul style="list-style-type: none"> <li>o Has the application improved your ability to communicate around suicide?</li> <li>o Do you feel the application could help reduce stigma through improved awareness?</li> </ul> </li> <li>- Literature papers               <ul style="list-style-type: none"> <li>o (David et al., 2011)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- Compare 2016 to renewed 2020 survey, if possible (Surveys)</li> <li>- Provide further insights as highlighted (literature papers)</li> </ul>

Evaluation domains	Measurements / Assumptions	Sources of Data Collection and Questions / Metrics	Methodology
Increased support (signposting)	<ul style="list-style-type: none"> <li>– Increase in social support</li> <li>– Reduction in stigma</li> <li>– Decrease in feeling of helplessness and distress</li> <li>– Increase access to care via privacy and anonymity</li> </ul>	<ul style="list-style-type: none"> <li>– Survey               <ul style="list-style-type: none"> <li>○ Has the app highlighted where you can find further support?</li> <li>○ Which resources, as signposted from the app, did you use?</li> <li>○ Were these resources helpful?</li> <li>○ Do you feel these resources equipped you / the person you were supporting with better coping mechanisms?</li> </ul> </li> <li>– Literature papers               <ul style="list-style-type: none"> <li>○ (Larsen et al., 2016)</li> <li>○ (Luxton et al., 2011)</li> <li>○ (Luxton et al., 2015)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>– Compare 2016 to renewed 2020 survey, if possible (Surveys)</li> <li>– Provide further insights as highlighted (literature papers)</li> </ul>
Improvement in self-management	<ul style="list-style-type: none"> <li>– Improvement of emotional regulation</li> <li>– Improvement of attitudes towards suicide and mental health treatment</li> <li>– Reduction in suicidal behaviours/ thoughts/ attempts</li> </ul>	<ul style="list-style-type: none"> <li>– Survey               <ul style="list-style-type: none"> <li>○ Have you ever felt suicidal? If yes, during that time / those times did you seek support and/or information from... (Q12a and Q12b)</li> <li>○ What features of the app have you used for your own support? (Q16)</li> <li>○ Did you find these tools helpful? (yes/no)</li> <li>○ Do you feel these tools can equip you / someone you support with better coping mechanisms?</li> </ul> </li> <li>– Literature papers               <ul style="list-style-type: none"> <li>○ (HM Government, 2015)</li> <li>○ (Betsy et al., 2018)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>– Compare 2016 to renewed 2018 survey, if possible (Surveys)</li> <li>– Provide further insights as highlighted (literature papers)</li> </ul>

Evaluation domains	Measurements / Assumptions	Sources of Data Collection and Questions / Metrics	Methodology
Improvement in supporting gatekeepers, friends and family	<ul style="list-style-type: none"> <li>- Increase in feeling supported</li> <li>- Increase in awareness of tools available</li> <li>- Increase ability to cope with friend feeling suicidal</li> </ul>	<ul style="list-style-type: none"> <li>- Survey                             <ul style="list-style-type: none"> <li>o Have you ever known / suspected that a friend or family member was feeling suicidal? (Q13).                                     <ul style="list-style-type: none"> <li>▪ If yes, during that time / those times did you seek support and/or information for them from... (Q13b)</li> <li>▪ If yes, during that time / those times did you seek support and/or information for yourself from...(Q13c)</li> </ul> </li> <li>o What features of the app have you used to support someone else? (Q17)</li> <li>o Do you feel these tools can equip you / someone you support with better coping mechanisms?</li> </ul> </li> <li>- Literature paper                             <ul style="list-style-type: none"> <li>o (Betsy et al., 2018)</li> <li>o (Larsen et al., 2016)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- Compare 2016 to renewed 2020 survey, if possible (Surveys)</li> <li>- Provide further insights as highlighted (literature papers)</li> </ul>
<b>Pathway improvements</b>			
Access to care / signposting	<ul style="list-style-type: none"> <li>- Where does the application fit within the suicide prevention pathway?</li> <li>- Is the tool enabling further signposting and</li> </ul>	<ul style="list-style-type: none"> <li>- Survey                             <ul style="list-style-type: none"> <li>o How did you first hear about the app? (Q2)</li> <li>o <i>For self-management when having suicidal thoughts</i> - If yes, during that time / those times did you seek support and/or information from... (Q12b) <i>(repeat of question)</i></li> <li>o <i>For loved ones or yourself when supporting loved ones through a difficult phase</i> - During that time /</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- Compare 2016 to renewed 2020 survey, if possible (Surveys)</li> <li>- Provide further</li> </ul>

Evaluation domains	Measurements / Assumptions	Sources of Data Collection and Questions / Metrics	Methodology
	<p>referrals and is it considered to be working? i.e. increase in relevant GP visits / counselling</p> <ul style="list-style-type: none"> <li>- Can the application support with identification of barriers or gaps in the pathway / identifying users at potential high risk of suicide ideation/ attempt?</li> </ul>	<p>those times did you seek support and/or information from... (Q14b) (<i>repeat of question</i>)</p> <ul style="list-style-type: none"> <li>o Has the app helped you or someone you support to better understand and access available services?</li> <li>- Literature paper <ul style="list-style-type: none"> <li>o (HM Government, 2015)</li> <li>o (Lynch et al., 2006)</li> <li>o (Rost et al., 2005)</li> <li>o Digital Fund</li> </ul> </li> </ul>	<p>insights as highlighted (literature papers)</p>
<p>Communication, quality and navigation</p>	<ul style="list-style-type: none"> <li>- Address the hypothesis that cost-effectiveness is a double edge sword with quality of</li> </ul>	<ul style="list-style-type: none"> <li>- Survey <ul style="list-style-type: none"> <li>o Do you feel comfortable with the information provided and worded?</li> <li>o Do you feel comfortable with the management of your data inputted?</li> <li>o Did you find the resources credible and reliable?</li> </ul> </li> <li>- Focus groups when possible with similar questions</li> </ul>	<ul style="list-style-type: none"> <li>- Compare 2016 to renewed 2020 survey, if possible (Surveys)</li> </ul>

Evaluation domains	Measurements / Assumptions	Sources of Data Collection and Questions / Metrics	Methodology
	<ul style="list-style-type: none"> <li>information needing to be well processed</li> <li>– Ensure there is no harmful content</li> </ul>	<ul style="list-style-type: none"> <li>– Literature papers               <ul style="list-style-type: none"> <li>○ (Larsen et al., 2016)</li> <li>○ (Luxton et al., 2011)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>– Test assumptions through focus groups (Focus Groups)</li> <li>– Provide further insights as highlighted (literature papers)</li> </ul>
<b>Additional societal and other indirect improvements</b>			
Indirect improvement of societal benefits	<ul style="list-style-type: none"> <li>– Reduction in family / individuals taking time off work / school (sick days/leave)</li> <li>– Reduction in caregiving costs</li> <li>– Improvement in work productivity</li> <li>– Reduction in mortality</li> </ul>	<ul style="list-style-type: none"> <li>– Literature papers               <ul style="list-style-type: none"> <li>○ (Hamberg-van Reenen et al., 2017)</li> <li>○ Mental health statistics: economic and social costs. Retrieved from <a href="https://www.mentalhealth.org.uk/statistics/mental-health-statistics-economic-and-social-costs">https://www.mentalhealth.org.uk/statistics/mental-health-statistics-economic-and-social-costs</a></li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>– Provide further insights as highlighted (literature papers)</li> </ul>

Evaluation domains	Measurements / Assumptions	Sources of Data Collection and Questions / Metrics	Methodology
Indirect reduction in medication costs or access and adverse events from poor use of medication	<ul style="list-style-type: none"> <li>– Poor use of medication</li> <li>– Need for treatment optimisation e.g. CBT</li> <li>– Deterioration of patient outcomes due to poor care</li> </ul>	<ul style="list-style-type: none"> <li>– Literature papers               <ul style="list-style-type: none"> <li>○ (Lynch et al., 2006)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>– Provide further insights as highlighted (literature papers)</li> </ul>
Indirect reduction in drug/ alcohol abuse or criminal records	<ul style="list-style-type: none"> <li>– Reduction in reliance on substances driving further deterioration in patient outcomes</li> <li>– Reduction in criminal record from abuse of drugs or lack of care</li> </ul>	<ul style="list-style-type: none"> <li>– Literature papers               <ul style="list-style-type: none"> <li>○ (Quinlivan et al., 2017)</li> <li>○ (Lynch et al., 2006)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>– Provide further insights as highlighted (literature papers)</li> </ul>
<b>Technical improvements</b>			
Navigability	<ul style="list-style-type: none"> <li>– Improved clarity</li> </ul>	<ul style="list-style-type: none"> <li>– Focus group questions e.g. Are all the features clear? Are all the resources easy to get to? Is the target user clear? Did you manage to successfully find the information you were looking for?</li> </ul>	<ul style="list-style-type: none"> <li>– Test assumptions through focus groups</li> </ul>

Evaluation domains	Measurements / Assumptions	Sources of Data Collection and Questions / Metrics	Methodology
App quality	<ul style="list-style-type: none"> <li>- Improvement in data collection, use, security</li> </ul>	<ul style="list-style-type: none"> <li>- Focus group questions e.g. is the content considered as not harmful? Are users comfortable with the way their data is processed?</li> <li>- Literature papers               <ul style="list-style-type: none"> <li>o (Larsen et al., 2016)</li> <li>o (Luxton et al., 2011)</li> </ul> </li> <li>- App ranking (Orcha)</li> </ul>	<p>(Focus Groups)</p> <ul style="list-style-type: none"> <li>- Test assumptions through focus groups (Focus Groups)</li> <li>- Provide further insights as highlighted (literature papers)</li> <li>- Review of ranking relative to app quality (platforms)</li> </ul>
Aesthetics	<ul style="list-style-type: none"> <li>- Improved use of colour / images / videos / text</li> </ul>	<ul style="list-style-type: none"> <li>- Focus group questions e.g. what are the attractive layout/design features of the application? Does it entice you to click on the various features? What most drew your attention to the application?</li> </ul>	<ul style="list-style-type: none"> <li>- Test assumptions through focus groups (Focus Groups)</li> </ul>

## Appendix H: Optimism bias grading

Confidence grade	Colour coding in model	Data Source	Age of data	Known data error	Optimism bias correction
1	Green	Formal service delivery contract costs	1-2 years old	+/- 5%	5%
		Figures derived from local stats / RCT trials			
2	Yellow	Practitioner monitored costs	2-3 years old	+/- 10%	10%
		Figures based on national analysis in similar areas			
3	Orange	Costs developed from ready reckoners	3-4 years old	+/- 15	15%
		Figures based on generic national analysis			
4	Light Blue	Costs from similar interventions elsewhere	4-5 years old	+/-20%	25%
		Figures based on international analysis			
5	Red	Cost from uncorroborated expert judgement	>5 years old	+-25%	40%
		Benefit from uncorroborated expert judgement			