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**Understanding the acceptability, utilisation and  
current evidence base of mHealth and online  
interventions: A traditional and non-traditional  
approach.**



**THE UNIVERSITY  
*of* EDINBURGH**

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**July 2016**

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## **Thesis Abstract**

**Introduction:** There is an increased acceptance and demand for online and mobile health (mHealth) interventions to support physical and mental health problems. However, the uptake and engagement of these interventions is relatively low and the evidence base for these interventions requires continual updating in line with technological advances. A systematic review was conducted, focusing on anxiety and depression, to explore the existing evidence base of both physical health and mental health mobile applications. The first research paper explores the acceptability of mHealth interventions for both mental health and physical health problems. The final research paper explores use and strategies when searching for mental health information online. Additionally, perceived quality, sentiment and barriers to online health information was explored.

**Methods:** Studies were identified by searching for articles published between January 2008 and January 2016. Databases included: PsycINFO, MEDLINE, CINAHL PLUS and the Cochrane Central Register of Controlled Trials for 2016. In the research articles, 218 people completed an online survey in January 2016 exploring, online health seeking for mental health and physical health problems, and acceptability of mHealth interventions. Sentiment of online health resources was explored by extracting 432 individual tweets from Twitter.

**Results:** The systematic review revealed twenty-seven studies for inclusion; 10 with a physical health focus and 17 with a mental health focus. Targeted depression applications have the superior evidence base; however, no firm conclusions can be made regarding interventions that targeted physical health, or those measuring anxiety.

The first research paper found that face-to-face therapy would more likely meet expectations for treatment of both physical and mental health problems compared to mHealth interventions. Computerised interventions were more likely to meet expectations than mobile applications. Expectations of treatment were higher for the treatment of mental health problems than physical health problems.

The second research paper found that a large proportion of the public use the internet to search for information on mental health, with half citing it as their primary source for mental health information. The online survey found that the quality of mental health information available on the internet was rated favourably, compared to mobile applications. Overall, the sentiment towards specific online mental health resources was generally positive.

**Conclusions:** Research into online and mHealth interventions has developed considerably in recent years in line with advances in technology. These interventions have the potential to be an effective treatment of common mental health problems. The systematic review highlighted that depression applications are more established and effective than applications targeting anxiety. The first research paper suggests that mHealth interventions fall short of public expectations for treatment of health problems. The final research paper reflects that the perceived quality of online mental health information is rated favourably. However, many barriers still limit uptake. Future research could focus on continually developing and evaluating evidence based online and mHealth interventions and the outcome of this study suggests that incorporating them more widely into existing care systems, alongside face to face interventions could increase the public's confidence in these interventions.

# List of Tables

## Systematic Review

Table 1. Characteristics of included studies. -Page 13

Table 2. Methodological quality of the included studies. -Page 24

## **Journal Article- Comparing the expectations and acceptability of computerised and mHealth interventions vs face-to-face for mental health and physical health problems.**

Table 1. Evaluation dimensions for Physical and Mental Health interventions -Page 70

Table 2. Demographic characteristics of study participants (n=216) -Page 73

Table 3. Importance ratings for 12 dimensions in relation to physical health interventions in order of importance (highest on top) -Page 74

Table 4. Importance ratings for 12 dimensions in relation to mental health interventions in order of importance (highest on top) -Page 75

## **Journal Article- Using an online survey and real-time Twitter Sentiment Analysis to understand online mental health information and support-seeking activity.**

Table 1. Device use of entire sample -Page 123

Table 2. Most commonly searched mental health problems -Page 125

Table 3. Most helpful features of mental health information websites. -Page 127

Table 4. Rating of particular features available on mental health information websites and mobile applications. -Page 127

Table 5. Quality rating of attributes of Mental Health Websites. -Page 130

Table 6. Categories of positive sentiment from original tweets. -Page 131

Table 7. Categories of negative sentiment from original tweets. -Page 132

Table 8. Barriers selected for accessing mental health resources online or via smartphone- Page 133

Table 9. Likelihood of suggesting various support sources for mental health problems- Page 137

# List of Figures

## Systematic Review

Figure 1. Flow diagram of the study selection process-Page 12

## **Journal Article- Comparing the expectations and acceptability of computerised and mHealth interventions vs face-to-face for mental health and physical health problems.**

Figure 1. Importance and expectations towards different physical health treatment options. –

Page 80

Figure 2. Importance and expectations towards different mental health treatment options. -  
Page 84





# Contents

<b>D. Clin. Psychol. Declaration of own work .....</b>	<b>2</b>
<b>Acknowledgements.....</b>	<b>3</b>
<b>Thesis Abstract.....</b>	<b>4</b>
<b>List of Tables .....</b>	<b>6</b>
<b>List of Figures.....</b>	<b>7</b>
<b>Chapter 1    Systematic Review .....</b>	<b>1</b>
<b>1.1    Abstract.....</b>	<b>2</b>
<b>1.2    Introduction.....</b>	<b>4</b>
<b>1.3    Literature search.....</b>	<b>8</b>
1.3.1    Eligibility criteria .....	8
1.3.2    Information sources.....	8
1.3.3    Study selection .....	9
1.3.4    Data collection .....	9
1.3.5    Quality Assessment.....	10
<b>1.4    Results .....</b>	<b>11</b>
1.4.1    Searches .....	11
1.4.2    Quality Criteria .....	23
1.4.3    Effects of physical health mobile applications .....	25
Depression Measures .....	25
1.4.4    Interpretation of Studies.....	26
1.4.5    Physical Health Study finding.....	26
1.4.6    Effects of mental health mobile applications.....	31
1.4.7    Mental Health Studies Findings.....	32
<b>1.5    Discussion.....</b>	<b>39</b>
1.5.1    Depression.....	39
1.5.2    Anxiety.....	43
1.5.3    Considerations.....	44
1.5.4    Availability in App Stores.....	44
1.5.5    Limitations .....	45
1.5.6    Future Research.....	46
1.5.7    Implications for practice .....	47
1.5.8    Conclusions.....	48

1.6	Abbreviations .....	50
1.7	References .....	51
<b>Chapter 2</b>	<b>Journal Article .....</b>	<b>61</b>
2.1	Abstract.....	62
2.2	Introduction.....	64
2.3	Methods.....	67
2.3.1	Sample and Recruitment .....	67
2.3.2	Online Survey .....	68
2.3.3	Statistical analysis .....	71
2.3.4	Power .....	71
2.4	Results .....	72
2.4.1	Demographic.....	72
2.4.2	Expectations towards physical health interventions .....	74
2.4.3	Expectations towards mental health interventions.....	75
2.4.4	Comparisons of importance .....	76
2.4.5	Physical Health Interventions .....	76
2.4.6	Mental Health Interventions .....	81
2.4.7	Comparisons of different interventions .....	85
2.5	Discussion.....	86
2.5.1	Principal Findings .....	86
2.5.2	Future directions .....	90
2.5.3	Strengths and Limitations .....	92
2.5.4	Conclusion .....	94
2.6	Abbreviations .....	95
2.7	References .....	96
<b>Chapter 3</b>	<b>Journal Article .....</b>	<b>105</b>
3.1	Abstract.....	106
3.2	Introduction.....	108
3.2.1	Study Aims .....	112
3.3	Methods.....	113
3.3.1	Overview.....	113
3.3.2	Sample and Recruitment .....	113
3.3.3	Ethics .....	115
3.3.4	Procedure .....	115

3.3.5	Data Sources .....	116
3.3.6	Statistical Analysis .....	119
3.3.7	Power .....	120
3.3.8	Exclusion Criteria .....	121
<b>3.4</b>	<b>Results .....</b>	<b>122</b>
3.4.1	Online Survey Demographic.....	122
3.4.2	Online Survey- Recruited sample’s internet and technology use .....	122
3.4.3	What search strategies are used when seeking information about physical and mental health problems? .....	124
3.4.4	What are the most commonly searched for mental health problems? .	125
3.4.5	What are the features and resources of mental health websites the public find most helpful? .....	126
3.4.6	What is the public’s perception of the overall quality of the mental health resources currently available? .....	129
3.4.7	What do the public report are barriers to using online mental health resources?.....	133
3.4.8	Does the sample use private or public social media to discuss problems of a personal nature? .....	134
3.4.9	What mental health supports would the public be most likely to recommend to others within their network? .....	136
<b>3.5</b>	<b>Discussion.....</b>	<b>138</b>
3.5.1	Principal Results .....	138
3.5.2	What search strategies are used when seeking information about physical and mental health problems? .....	138
3.5.3	What are the most commonly searched for mental health problems? .	139
3.5.4	What are features and resources of mental health websites the public find most helpful? .....	139
3.5.5	What is the public’s perception of the overall quality of mental health resources currently available? .....	140
3.5.6	What do the public report are barriers to using online mental health resources?.....	141
3.5.7	Does the sample use private or public social media to discuss problems of a personal nature? .....	141

3.5.8	What mental health supports would the public be most likely to recommend to others in their network? .....	142
3.5.9	Methodology Critique & Implications.....	142
3.5.10	Other Limitations .....	143
3.5.11	Study Strengths .....	144
3.5.12	Future Research .....	145
3.5.13	Conclusions.....	146
<b>3.6</b>	<b>Abbreviations .....</b>	<b>147</b>
<b>3.7</b>	<b>References.....</b>	<b>148</b>
	<b>Full References.....</b>	<b>153</b>
	<b>Appendix 1 Downs and Black Quality Criteria Checklist .....</b>	<b>172</b>
	<b>Appendix 2- Search Terms.....</b>	<b>178</b>
	<b>Appendix 3 Data Extraction Table.....</b>	<b>181</b>
	<b>Appendix 4 Online Survey .....</b>	<b>187</b>
	<b>Appendix 5- Ethical Approval.....</b>	<b>232</b>
	<b>Appendix 6- Journal Guidelines .....</b>	<b>233</b>
	<b>Appendix 7- Additional Table of tweet sentiment assignment.....</b>	<b>239</b>





## **Chapter 1 Systematic Review**

**Do guided psychological or health and wellbeing mobile applications improve symptoms of anxiety or depression? A Systematic Review**



## 1.1 Abstract

**Background:** Health related mobile phone applications are routinely being downloaded and used within the general population. The literature on mobile applications and their impact on health behaviours is expanding rapidly.

**Objective:** Focusing on anxiety and depression, we conducted a systematic review to explore the existing evidence base of both physical health and mental health mobile applications.

**Methods:** Studies were identified by searching several databases: PsycINFO, MEDLINE, CINAHL PLUS, Cochrane Central Register of Controlled Trials, and additional grey literature. Studies were included if they investigated psychological mobile applications or physical health and wellbeing applications, assessed anxiety or depressive symptoms using standardised outcome measures, included pre and post-test design or included a control group.

**Results:** In total, 15736 abstracts were identified. Twenty-seven articles met the inclusion criteria, of these, 22 were randomised control trials. Results showed more targeted and focused depression interventions were superior to mobile applications that promote self-care and physical activity, or those that are designed for more specific health procedures. Additionally, mobile applications for the reduction of anxiety provided evidence of a small effect, however only a limited number of studies were identified.

**Conclusion:** This systematic review provided support for the evidence that mobile applications may be effective in reducing symptoms of anxiety or depression. The review suggested that applications that target depression appear to have the superior

evidence base and have more evidence based applications available to the public. However, no firm conclusions can be made regarding interventions that target physical health, or those measuring anxiety.

### **Registration**

The systematic review was registered with PROSPERO database, University of York, Centre for Reviews and Dissemination. Registration No. CRD42015020188

## 1.2 Introduction

Mobile Health (mHealth) is a common term used to describe the practice of public health and medicine reinforced by mobile devices [1]. The practice usually consists of using a tablet computer or mobile phone for health and wellbeing services or for information [2]. In recent years, the use of mHealth interventions in healthcare has been increasing, however incorporation of mHealth into healthcare professionals' routine care is still thought to be well below its potential [3]. MHealth is still in its infancy within healthcare settings, with the app store, rather than healthcare providers, the main distributor of Health related mobile applications. There is increasing optimism among developers of health related mobile applications that doctors and hospitals will become the main distributor of healthcare applications, but this has yet to materialise; nevertheless, it is thought the provision of health related mobile applications are likely to be incorporated into the majority of healthcare practices in the future [4]. Such mobile applications could aid health behaviour change, increase adherence to treatment, offering immediate support, both physical and psychological, facilitate self-monitoring and potentially reduce psychological distress. Smartphone applications have the capacity to facilitate such behaviour change [5]. Thus, it is important to consider the way health mobile applications are currently developing within the UK, the standards used to develop the content of such applications and how effectively current health applications meet the needs of the population served.

As of November 2015, there were 103,000 unique health mobile applications across multiple mobile platforms and an estimated 3 billion downloads of health applications worldwide [4]. Google Play or Apple App Store accounted for 70% of applications, found within the categories Health & Fitness and Medical. Public consensus suggests

that there is an increased acceptance and demand for health applications to change behaviour [6]. There is clearly an appetite and competition to develop and utilise health mobile applications. However, there appears to be little information of the clinical effectiveness of the available health applications for consumers and health professionals to consider. Commercial opportunities are no doubt clear, however app developers may be less well placed to offer theoretically driven, and evidence based interventions.

A recent review [7] stated that the majority of mental health applications lack scientific evidence about their efficacy with limited understanding about whether such applications could improve psychological wellbeing. Also, the public would have difficulty identifying the applications with an evidence base [7]. The lack of evidence based mental health applications was further highlighted by the World Health Organisation (WHO), who explored the mobile applications available for the most prevalent health conditions, finding there were 1536 applications for depression, but only 32 published studies were found to evaluate the evidence for their efficacy [8]. Additionally, health care practitioners may be reluctant to incorporate health related mobile applications, due to lack of clarity about the clinical effectiveness of such interventions versus more established treatments. However, to improve the public awareness of evidence based resources, practitioners could introduce mobile applications in line with the patients' therapeutic objectives [9]. Interventions developed for smartphones have been associated with greater effectiveness if they include features such as goal-setting, performance measurement, self-monitoring, feedback and goal reviewing, core components to most psychological therapeutic approaches of behaviour change [5]. Such a move could also reduce the demand on

psychological and health based services. Health related mobile applications could potentially be embedded into stepped care approaches, reducing the burden on an overstretched health care service. The primary systematic review that explores the effectiveness of mental health mobile applications [7] focused primarily on mental health focused mobile applications for improving psychological wellbeing. At the time of writing, the review highlighted that there was only a small number of papers (n=8) contributing to the evidence base for mental health mobile applications but that interventions appear to potentially be effective. Additional systematic reviews [10, 11, 12] focus on the features and content of mental health mobile applications available on Android and Apple marketplaces. Given the developing nature of the field of health related mobile applications, the current review provides an update of the current literature around how psychological wellbeing might be improved by mental health focused mobile applications, while also being more inclusive of the mobile applications considered for review. Some general health mobile applications include components that will improve psychological wellbeing and therefore should be considered within this context even if this is not the primary objective of the application. With the limited availability of mental health mobile applications, and the increasing availability of health mobile applications, it is important to consider whether, health related applications could improve psychological wellbeing and their comparable effectiveness to mental health mobile applications. Well-designed mobile applications for exercise, use common psychological techniques to improve adherence to treatment programs such as modelling, graded components, feedback on performance, goal setting and social support [13]. Therefore, health focused mobile applications could have considerable psychological benefits in engaging patients in treatment, improving adherence and maintaining treatment gains [14]. A recent

systematic review highlighted that health related mobile applications also have the potential to increase retention in health behaviour interventions [6]. The review cited a number of factors of acceptability with the application that could potentially boost retention; feedback from the app, the display on the smartphone, ease of use, prompting notifications, convenience, continually reviewing progress, coaching, discreteness of the app and fast interactions with the application [6].

The potential limitations of previous reviews are, they either focus on all evidence based mental health mobile applications [7], or the content and features of those available commercially [10,11,12]. The primary aim of this review was to qualitatively review studies that include a mobile application as part of treatment. The studies could focus on either the treatment of a physical health problem or for the treatment of a mental health problem. Both types of intervention were included because the mobile applications could contain components of health behaviour change that could improve psychological wellbeing, within either population. The changes in wellbeing would be by measuring changes in anxiety and depression. Anxiety and depression were chosen because they represent the most common mental health disorders in Britain, with approximately 18% of the population meeting criteria for diagnosis of an anxiety disorder and approximately 9% for a mood disorder [15]. Additionally, standardised psychological measures of anxiety and depression are relatively common in the literature, and it was hypothesised that such measures would feature in articles where mental health was not the primary feature of the intervention, therefore incorporating more physical health based intervention studies for comparison. The review aimed to be inclusive of all articles that utilised smartphone or tablet applications as part of the intervention. This was irrespective of whether the intervention only focused on health,

the setting, or population targeted by the intervention. The inclusion criteria were purposely diverse to encapsulate as much of the literature as possible.

## **1.3 Literature search**

### **1.3.1 Eligibility criteria**

A systematic literature search was conducted in January 2016. Studies were included if they (1) investigated psychological mobile applications or physical health and wellbeing applications, (2) assessed anxiety or depressive symptoms using standardised outcome measures, (3) used pre and post-test design or included a control group.

Studies were excluded if they (1) were not published in English, (2) did not include a standardised measure of anxiety or depression and (3) did not using an interactive smart device application.

### **1.3.2 Information sources**

Studies were identified by searching several database including: PsycINFO Jan 2008 to January 2016, MEDLINE Jan 2008 to January 2016, CINAHL PLUS Jan 2008 to January 2016, Cochrane Central Register of Controlled Trials for 2016. Meta-Analysis and Systematic Reviews identified during the abstract stage of the database search were hand searched for relevant articles. We also reviewed some of the grey literature using the first 500 articles identified by Google Scholar and Proquest Dissertations and Theses. Inclusion and exclusion criteria were specified a-priori. Search terms,

Mesh Headings and Truncations varied across databases (see appendix 2). Search terms included a combination of psychological and physical wellbeing terms including; ‘anxiety or anxiety disorders’, ‘depression’, ‘stress or psychological stress’, ‘mood’ ‘wellbeing’, ‘happiness’, ‘psychological wellbeing’, ‘health promotion’, quality of life, exercise, physical health, sleep and sleep disturbance, and a combination of mobile applications, smartphone, android, apple and mobile health. The review articles identified in the database were searched for further relevant articles. The reference lists of the final retained articles were also scanned for any additional publications. All results were limited to articles published from 2008, coinciding with the development of the first publicly available smartphone application.

### **1.3.3 Study selection**

The first author screened titles and abstracts from the database search, and after exclusion of those not meeting the inclusion criteria the remaining full text articles were screened for eligibility by the first author and 50% by the fifth authors. Any disagreements were resolved through discussion with the second author.

### **1.3.4 Data collection**

The data were entered into a data extraction sheet by the first author and independently reviewed by the fifth author. Information extracted from the studies included (1) trial characteristics (including first author, publication year, and number of participants) (2) control group characteristics (including active or passive control) means and



standard deviations for the intervention and control for outcome measures of anxiety and depression. Where information was not available, the reviewer contacted the corresponding authors for additional information. Where effect sizes were not reported, these were calculated.

### **1.3.5 Quality Assessment**

Quality assessments of the studies were evaluated using the Downs and Black's Study Quality Appraisal Checklist [16] see appendix 1. Downs and Black's [16] 27-item checklist was chosen as it was developed and designed to assess the quality of both randomised and non-randomised studies. A considerable proportion of the questions (n=23) could be asked of any analytical study which investigates a health care intervention [16] which fitted well with the likely diverse nature of the studies in this review. The checklist measures the quality of studies in terms of reporting (11 points), internal validity (13 points) which is split into confounding (selection bias) (6 points) and bias (7 points), external validity (3 points) and power (1 point) resulting in a maximum of 28 points on the Quality Index (QI). Each of the 27 items is either given a score of 1 or 0, with the exception of question 5, which has a maximum score of 2. The power question was simplified, in line with previous review articles [17], to assess whether a study, simply includes a statistical power calculation, rather than if it has sufficient power. For the purpose of this review, the studies were categorised as good quality 75-100% (>21), moderate quality 50-75% (>14) and poor quality <50% (<14) based on the percentage of the total score achieved.

Two reviewers independently assessed a randomised subset of 4 studies to check for inter-rater reliability. All studies were randomised to the reviewers using [www.random.org](http://www.random.org) list randomiser. Where there were discrepancies between the reviewers, the studies were jointly reviewed to reach a unanimous decision. If differences remained a third reviewer had the ultimate decision. Overall the inter reviewer concordance was  $Kappa = 0.850$ , suggesting excellent agreement [18].

## **1.4 Results**

### **1.4.1 Searches**

The systematic literature search strategy across the 4 databases and grey literature produced 15,736 potential papers once duplicates had been removed. Titles and abstracts were screened, leaving 97 papers to be screened using full text. Figure 1. shows a flow chart of the study selection procedure. 70 papers in total were excluded, with the reasons outlined in Figure 1. Overall, 27 papers were included in the final review. The characteristics of the included studies are found in Table 1.

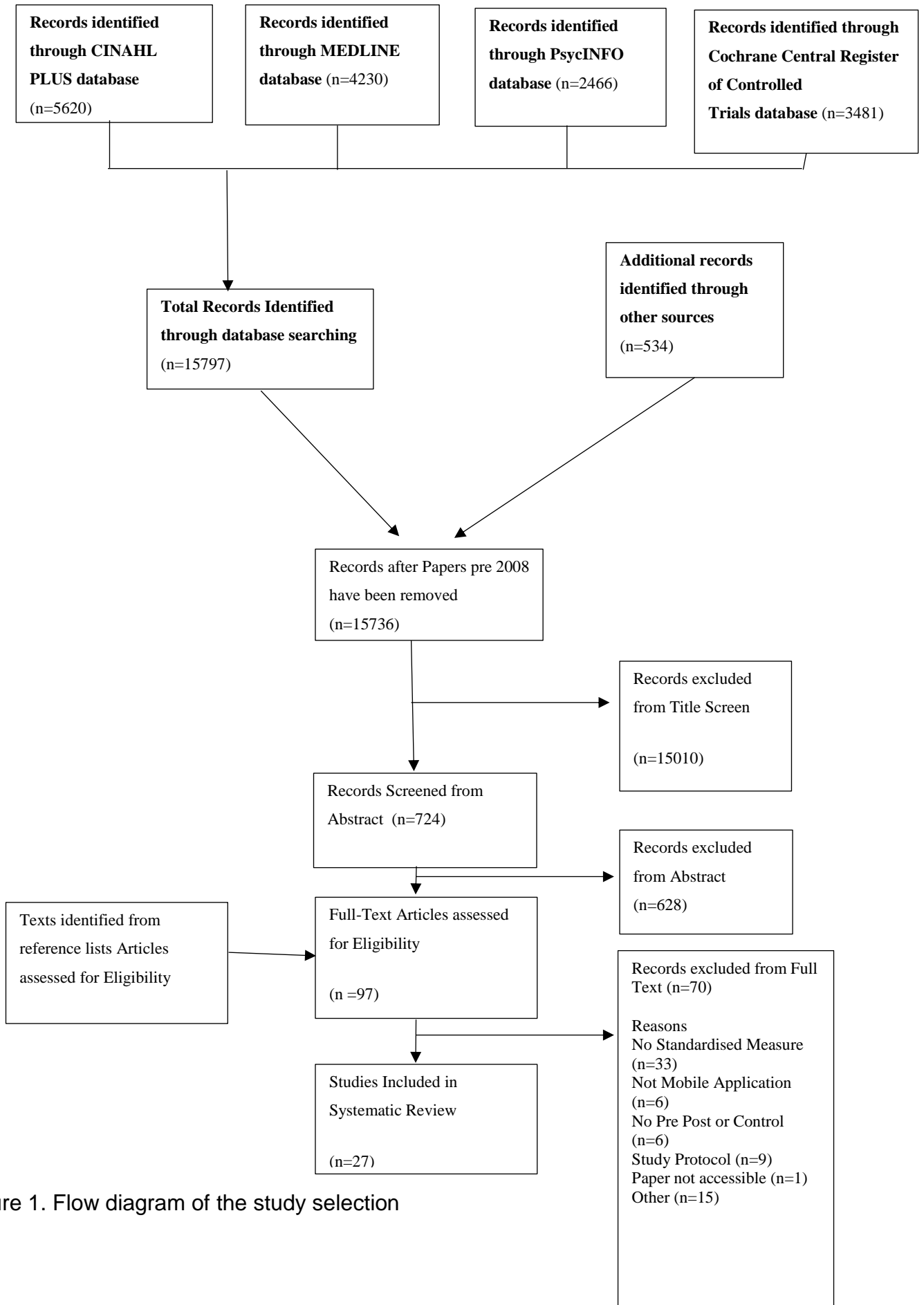


Figure 1. Flow diagram of the study selection

Table 1. Characteristics of included studies

Author	Focus of Study	Study	Participants	Sample size	Gender; mean age	Mobile Application	Intervention	Outcomes	Findings; effect size
	Physical or Mental Health	Design; setting; country	Inclusion			Availability	Intervention type; differences between groups	Anxiety and Depression Measures	Cohen's d Hedge g
Ahmedani, B. K., et al. (2015). [19]	Mental Health	Pre-Post Feasibility Study, Spine Clinic, Michigan	Over 18 Chronic Pain >5 on PHQ 9	N <sub>inter</sub> 75	Male 32.8% NR	Name of application not reported	Tablet, web-based intervention, with animated narration and interactive tailored feedback. Psycho education, MI and CBT foundations, used in hospital setting.	PHQ 9 [46] $\alpha=0.89$	Intervention group significantly less depressive symptoms two weeks post intervention. Improved treatment seeking behaviours. Within-Group Pre-Post= $d=0.39$
Baron, J. S., et al. (2016). [20]	Physical Health	RCT; Clinic, United Kingdom	Over 18 with poorly controlled type 1 or type 2 diabetes	N <sub>inter</sub> 45 N <sub>control</sub> 36	Male 57%; 57 years	Name of application not reported	Mobile-phone software with feedback. Stores and transmits diabetes-related data, monitors physical exercise, from various sensors.	CESD-10 [47] $\alpha=0.85$ STAI-6 [48] $\alpha=0.82$	Intervention group at 3months Depression, CESD-10, Between-Group Hedges $g=0.38$ , Within-Group Hedges $g=0.15$ Anxiety STAI-6, Between-Group Hedges $g=0.2$ , Within-Group Hedges $g=0.03$
Birney, A. J., et al. (2016). [21]	Mental Health	RCT, Several Business Organisations, USA	Over 18, mild to moderate depressive symptoms	N <sub>inter</sub> 150 N <sub>control</sub> 150	23% males 41 years	Moodhacker, Only available to registered users. Not offered to consumer market.	Intervention- mobile Web app was designed to educate users about depression and the benefits of CBT-based strategies to improve mood self-management  Control-Vetted Mental Health Websites	PHQ-9 [46] $\alpha=0.89$ BADS [49] $\alpha=0.87$	Depression, PHQ-9, BADS Between-Group PHQ-9, $d=0.14$ BADS, $d=0.19$ Within-Group PHQ-9, $d=0.93$ BADS, $d=0.7$

Burns et al. (2011) [22]	Mental Health	Pre-Post, NR, USA	Diagnosis of Major Depressive Disorder	N <sub>Inter</sub> 7	13% male 37 years	Mobilize.  Not available	Smartphone sensors, to link with self-reports about, mood, social context, activity and location.  No Control	PHQ-9 [46] $\alpha=0.89$  GAD-7 [50] $\alpha=0.92$	Depression-PHQ-9 Within-group PHQ-9, d=3.43  Anxiety, GAD-7 Within-group GAD-7, d=2.58
Carissoli, C., et al. (2015) [23]	Mental Health	RCT, Businesses in Milan, Italy	Over 18, employed, NR	N <sub>Inter</sub> 20 N <sub>control</sub> 18 N <sub>waiting list</sub> 18	Male 43% 38 years	It's time to relax  Not available	Intervention-3 week mindfulness delivered by an Android application for smartphone. Control- Music & Waiting List	MSP [51] $\alpha=0.95$	No Difference between Mobile and Music group post intervention Between-Group-MSP Depressive, anxiety MSP, d= 0.12 Within-group NR
Choi, J., et al. (2015). [24]	Physical Health	Pilot RCT, Pre Natal Clinics, San Francisco	18-40 years of age 10-20 weeks gestation and physically inactive	N <sub>Inter</sub> 15 N <sub>control</sub> 15	Female 100% 34 years	App name not disclosed  Linking with Fitbit	Intervention (mobile phone app plus Fitbit) or a control (Fitbit) group. Mobile phone activity diary with automated feedback and self-monitoring systems.	CES-D [52] $\alpha=0.85$	Intervention group had a reduction at 12 weeks in depressive symptoms. Depression-CES-D Between-group CES-D, d=0.43 Within-group CES-D, d=0.2
Dagöö, J., et al. (2014). [25]	Mental Health	RCT, NR, Sweden	Over 18, < 25 on the Montgomery Asberg Depression Rating Scale, DSM IV Criteria for SAD	N <sub>ipt Inter</sub> 25 N <sub>CBT inter</sub> 27	Male 48% 37 years	Name of application not reported	Guided self-help treatment, mCBT and mIPT available on Tablet, Smartphone for 9 weeks	LSAS-SR [53] $\alpha=0.96$  MADRS-S [54] $\alpha=0.84$  BAI [55] $\alpha=0.92$	<b>mCBT</b>  <b>Anxiety- LSAS,SR, BAI</b> Between Groups LSAS-SR, d=0.64 BAI, d=0.46  Within-Group LSAS-SR, d=0.99 BAI, d=0.25  <b>Depression, MADRS</b> Between-Group MADRS-S, d=0.88  Within-Group MADRS-S, d=0.26  <b>mIPT</b>

									<b>Anxiety- LSAS,SR, BAI</b>  Within-Group LSAS-SR, d=0.43 BAI, d=0.02  <b>Depression, MADRS</b>  Within-Group MADRS-S, d=0.1
Dennis, T. A. and L. O'Toole (2014). [26]	Mental Health	RCT, University Undergraduates, NY	Highly trait-anxious participants in excess of 49 on STAI	Short training N <sub>Inter</sub> 18 N <sub>control</sub> 20 Long Training N <sub>Inter</sub> 19 N <sub>control</sub> 19	Short training Males 29% 20 years Long training Males 30% 22 years	Name of application not reported	Gamified attention-bias modification training mobile application, and placebo training	STAI [56]  α=0.86	A single session of the active short training relative to the placebo training reduced subjective anxiety  <b>Short Training</b> Between-Group Vs Active Control STAI, d=0.66 Vs Placebo STAI, d=0.49  Within-Group STAI, d=0.3  <b>Long Training</b> Vs Placebo STAI, d=0  Within-Group STAI, d=0.2
Depp, C. A., et al. (2015). [27]	Mental Health	RCT, Community, San Diego	Bipolar Disorder I or II. No substance use disorder or excessive mania or depressive symptoms	N <sub>Inter</sub> 41 N <sub>control</sub> 41	42% males 48 years	Name of application not reported	Mobile device delivered interactive intervention linking patient-reported mood states with personalised self-management strategies vs paper-and-pencil mood monitoring.	MADRS-S [54]  α=0.84	Mobile intervention condition showed greater reductions in depressive symptoms at 6 weeks. Depression, MADRS  Between-Group MADRS-S, d=0.17  Within-Group MADRS-S, d=0.37

Dicianno, B. E., et al. (2015). [28]	Physical Health	RCT, Spina Bifida Clinic and Community, NR	18-40 years Primary Diagnosis myelomeningocele with hydrocephalus.	N <sub>Inter</sub> 13 N <sub>control</sub> 10	57% males 30 years	App not available	iMHere -6 Android smartphone self-management modules, a web-based clinician portal and a 2-way communication system. Can set reminders of medication.	BDI II [57] $\alpha=0.91$	<b>Depression, BDI-II</b> Between-Group BDI-II, d=0.39  Within-Group BDI-II, d=0.28
Faurholt-Jepsen, M., et al. (2015). [29]	Mental Health	RCT, Clinic for affective disorders	18-60 years Inclusion-Newly diagnosed or treatment resistant bipolar disorder. Not invited to psychoeducation groups in clinic until after trial	N <sub>Inter</sub> 33 N <sub>control</sub> 34	33% males 29 years	MONARCH App not available	Smartphone with daily self-monitoring and reminders with clinician and patient feedback	HAMD-17 [58] $\alpha=0.83$	No significant effects of daily self-monitoring difference between intervention and control, at any time point. Not enough information provided to report effect sizes
Glynn, L., et al. (2014). [30]	Physical Health	RCT, Primary Care Centre, Ireland	Over 16 years and active Android smartphone users. Exclusions- acute psychiatric illness, pregnant and unable to do physical exercise.	N <sub>Inter</sub> 37 N <sub>control</sub> 40	36% males 44 years	Accupedo Available in iOS	Accupedo-Pro Pedometer app for smartphone apps promoting physical activity. Participant provide with fitness goal. The intervention group was provided with a smartphone app and detailed instructions on how to use it to achieve these goals. Control Group no instructions of how to use app.	HADS [59] $\alpha=0.82-0.83$	<b>Depression and Anxiety, HADS</b> Between-Group HADS, d=0.15  Within-Group HADS, d=0.67
Hansen, M. M. (2015). [31]	Physical Health	RCT, Hospital based, Iceland	18-75 years. Half general surgery patients, Half gynaecological surgery. No substance use chronic pain, major psychiatric disorders.	N <sub>ART</sub> 25 N <sub>NVAM</sub> 15 N <sub>NVA</sub> 16 N <sub>MI</sub> 51 N <sub>Control</sub> 51	20% males 46 years	Not available commercially	The participants were randomised to one of five group's pre surgical procedure. Intervention 15 mins 4 days prior. Audio relaxation technique (ART), Music intervention (MI) delivered on iPod Nature video application with music (NVAM), and Nature video application	STAI [56] $\alpha=0.86$	<b>Anxiety, STAI</b> Between-group Vs ART, STAI, d= -0.4 Vs MI, STAI, d= -0.19 Vs NVA, STAI, d=-0.26 Vs TAU, STAI d=0.39 Within-Group STAI, d=0.16

							(NVA), without music delivered on iPad or a control group.		
Howells, A., et al. (2014). [32]	Mental Health	RCT, Community, 11 countries	Over 18, access to smartphone	N <sub>Intervention</sub> 57 N <sub>Control</sub> 64	13% males 41 years	Headspace available on iOS	Headspace On-The-Go is a smartphone application delivering simple daily activities based on mindfulness practice. Control-unrelated list-making application called Catch Notes.	CES-D [52] $\alpha=0.85$	Depression-CES-D Between-group CES-D, d=0.36 Within-group CES-D, d=0.39
Ji, L., et al. (2016). [33]	Physical Health	RCT, Surgery, China	Children between 4-12 years scheduled for a tonsillectomy or strabismus. Any general anaesthesia in previous 6 months excluded.	N <sub>Intervention</sub> 51 N <sub>Control</sub> 51	50% males 6 years	Not commercially available	drawMD app is a personalised the drawing of operations for the patient. Using and iPad to explain a procedure or condition to parents and children.	STAI [56] $\alpha=0.86$ APAIS [60] $\alpha=0.86$ M-YPAS [61] $\alpha=0.92$	<b>Parental Anxiety</b> Between-Group, APAIS, d= 0.85 SAI, d= 0.56 TAI, d= 0.30  <b>Children Anxiety</b> Between-Group m-YPAS, d= 0.22
Johnson, N., et al. (2014). [34]	Physical Health	Pilot RCT, tertiary care children's health system, USA	Children with ASD, and a parent, with the child undertaking imaging procedure	N <sub>Intervention</sub> 16 N <sub>Control</sub> 16	83% males 10 years	Not Available on App stores	iPad application interactive social script intervention for children with autism spectrum disorder	STAI-6 [48] $\alpha=0.82$	Parental Anxiety Between-group STAI, d=0.33 Within-Group STAI, d=0.03
Lappalainen, P., et al. (2013). [35]	Mental Health	RCT, Community, Finland	Males aged between 25-45 years with exhaustion, stress, or sleeping problems	N <sub>Intervention</sub> 11 N <sub>Control</sub> 12	100% males 43 years	Some applications commercially available	P4Well combines modern psychotherapy (ACT and CBT) with personal health technologies through group meetings, Internet/Web portal, mobile phone applications, and personal monitoring devices.	BDI [62] $\alpha=0.81$	<b>Depression, BDI</b> Between-Group BDI, d=0.57  Within-Group BDI, d=1.11



Ly, K., et al. (2015). [36]	Mental Health	RCT, Three Clinics, Sweden	Over 18, >5 PHQ No severe co-morbid psychiatric condition	N <sub>Intervention</sub> 46 N <sub>Control</sub> 47	30% male 31 years	Name of application not reported	Blended Treatment 4 face to face sessions and a smartphone application.  Control-Full behavioural activation, 10 sessions face to face.	PHQ=9 [46] $\alpha=0.89$  BDI II [57] $\alpha=0.91$  BAI [55] $\alpha=0.92$	Depression, BDI-II, PHQ-9 Anxiety, BAI  Between-Group  BDI-II, d=0.13 PHQ-9, d = -0.01 BAI, d=-0.36  Within-Group  BDI-II, d=1.40 PHQ-9, d=1.58 BAI, d=0.72
Ly, K., et al. (2014). [37]	Mental Health	RCT, Online, Sweden	Over 18, >5 PHQ No severe co-morbid psychiatric condition	N <sub>BA Inter</sub> 40 N <sub>Mind Inter</sub> 40	30% male 36 years	Smartphone app available commercially but no details in paper	BA: An 8-week long behaviour programme administered via a smartphone, containing psychoeducation, and behavioural programme. Mindfulness: An 8-week long mindfulness practice programme and psychoeducation administered via a smartphone	PHQ=9 [46] $\alpha=0.88$  BDI II [57] $\alpha=0.91$  BAI [55] $\alpha=0.92$	Depression, BDI-II, PHQ-9 Anxiety, BAI  Between-Group  BDI-II, d=0.25 PHQ-9, d = 0.28 BAI, d=-0.06  Behavioural Activation Within-Group  BDI-II, d=1.83 PHQ-9, d=1.63 BAI, d=0.76  Mindfulness App Within-Group  BDI-II, d=1.21 PHQ-9, d=1.15 BAI, d=0.51

Ly, K. H., et al. (2012). [38]	Mental Health	Pre-Post test, No control, non clinical population, NR	Inclusion-Over 18 with access to iPhone Exclusion,-no major psychiatric condition.	N=11	64%male 30 years	Viary Only available to registered users.  Not offered to consumer market.	Smartphone application with centring on ACT, Psychoeducation and diary functions.	DASS 21 [63]  $\alpha=0.88$	No significant differences found on depressive and anxious symptoms.  Depression, DASS-D Anxiety, ASS-A  Within-Group DASS-D, $d=0.38$ ASS-A, 0.27
Possemato, K., et al. (2016). [39]	Mental Health	RCT, Veteran Affairs primary care, USA	Veterans, significant PTSD symptoms from military related trauma.	N <sup>CS Inter</sup> 10 N <sup>SM Inter</sup> 10	95% male 42 years	PTSD Coach Available iOS	PTSD Coach mobile application in primary care: Self-Managed PTSD Coach and Clinician-Supported PTSD Coach. Psychoeducation on PTSD symptoms and treatment, symptom monitoring, coping skills.	PHQ-9 [46]  $\alpha=0.89$	Depression, PHQ-9  Between-Group PHQ-9, $d=.09$  <b>Self-Managed PTSD Coach</b>  Within Group PHQ-9, $d=0.27$  <b>Clinician supported</b> Within Group PHQ-9, $d=0.33$
Quinn, C., et al. (2011). [40]	Physical Health	RCT, Primary care practice, Maryland	Physician diagnosis of type 2 diabetes for 6 months; Glycated hemoglobin >7.5% within 3 months; Age 18–64 years.	N <sup>Inter and portal</sup> 22 N <sup>Inter + decision support</sup> 62 N <sup>coach only</sup> 23 N <sup>control</sup> 56	49% male 53 years	Name of application not reported	Mobile- and web-based self-management patient coaching system. Patients received automated, real-time educational and behavioural messaging in response to individually analysed blood glucose values, and lifestyle behaviours.	PHQ-9 [46]  $\alpha=0.89$	Depression, PHQ-9  <b>Mobile only</b>  Between-group vs TAU PHQ-9, $d=0.5$  Within-Group PHQ-9, $d=1.09$  <b>Mobile linking to care provider</b>  Between-group vs TAU PHQ-9, $d=0.35$  Within-Group PHQ-9, $d=0.68$

									<p><b>Mobile data to standards of care and evidence base</b></p> <p>Between-group vs TAU PHQ-9, d=0.34</p> <p>Within-Group PHQ-9, d=1.04</p>
Rizvi, S, et al (2011). [41]	Mental Health	Pre-Post pilot, Clinic, Pacific Northwest	Inclusion- Met criteria for Borderline Personality Disorder and Substance Use Disorder. Been in DBT for 2 months prior to intervention. Over 18	N 22	18% males 34 years	DBT Diary card and skills coach available on iOS	Smartphone application designed to enhance generalisation of a specific DBT skill.	BDI [62] $\alpha=0.81$	Average scores of depressive symptoms decreased post intervention. Depression, BDI Within-group BDI, d= 0.55
Roepke, A. M., et al. (2015). [42]	Mental Health	RCT, Online Recruitment, NR	Inclusion-Over 18 >16 CES-D	N <sub>inter</sub> 93 N <sub>active control</sub> 97 N <sub>waitlist</sub> 93	33% males 40 years	Superbetter Available iOS	Game mechanics based Smartphone application. Superbetter CBT-Positive Psychotherapy, vs General Superbetter vs Waitlist.	CES-D [52] $\alpha=0.85$ GAD-7 [50] $\alpha=0.92$	<p>Depression, CES-D Anxiety, GAD-7</p> <p><b>CBT Superbetter</b> Between Group Vs SB CES-D, d= -0.37 GAD-7, d= -0.25</p> <p>Between Group Vs WL CES-D, d= 0.31 GAD-7, d= 0.29 Within-Group CES-D, d=0.93 GAD-7, d=0.79</p> <p><b>General SuperBetter</b> Between Group Vs WL CES-D, d=0.79 GAD-7, d=0.61 Within-Group CES-D, d=1.46 GAD-7, d=0.89</p>

Varnfield, M., et al. (2014). [43]	Physical Health	RCT, Cardiac Rehabilitation Centres, Australia	Inclusion- Anyone with Myocardial Infarctions able to participate in self-care.	N <sub>inter</sub> 48 N <sub>control</sub> 28	87% male 55 years	Name of application not reported NR	The CAP-CR platform used a smartphone for health and exercise monitoring, and delivery of motivational and educational materials to participants via text messages and pre-installed audio and video files.	DASS-21 [63] $\alpha=0.88$	CAP-CR was effective in significantly reducing DASS-depression scores, as well as DASS-anxiety scores. Unable to calculate ES
Watts, S., et al. (2013). [44]	Mental Health	Pilot RCT, Online Community. Australia	Over 18, self-report mild to moderate depression. Exclusion, -no major psychiatric condition.	N <sub>inter</sub> 15 N <sub>active control</sub> 20	20% males 41 years	The Get Happy Program  Not available	Stand-alone mobile app on mobile phone and iPad. CBT based 6 modules over 8 weeks	PHQ 9 [46] $\alpha=0.89$  BDI-II [57] $\alpha=0.91$	Depression, BDI-II, PHQ-9 Between-Group BDI-II, d= -0.37 PHQ-9, d = -0.47  Within-Group BDI-II, d=1.79 PHQ-9, d = 1.41
Worthen-Chaudhari et al. (2015). [45]	Physical Health	Control trial, NR, Ohio	Unresolved symptoms on concussion 3+ weeks post-concussion. 13-18 years	N <sub>inter</sub> 10 N <sub>active control</sub> 6	31% males	Superbetter smartphone application	Game mechanics based Smartphone application.	CED-DC [64] $\alpha=0.80$	Depression-CES-DC Between-group CES-DC, d=0.14 Within-group CES-DC, d=1.2

Abbreviations: NR, Not reported; CBT, cognitive behaviour therapy; PHQ-9, Patient Health Questionnaire; RCT, Randomised Control Trial; CESD, Centre for Epidemiologic Studies Depression Scale; STAI, State-Trait Anxiety Inventory; BADS, Behavioural Activation for Depression Scale; GAD, Generalised Anxiety Disorder Scale; MSP, Measure du Stress Psychologique; mCBT, mobile-based cognitive behaviour therapy; MIPT, mobile-based interpersonal therapy; LSAS-SR, Liebowitz Social Anxiety Scale; MADRS-S, Montgomery-Åsberg Depression Rating Scale; BAI, Beck Anxiety Inventory; DSM IV, Diagnostic and Statistical Manual of Mental Disorders; SAD, Social Anxiety Disorder; BDI-II, Beck Depression Inventory; DBT, Dialectical behaviour therapy; HAMD-17, Hamilton Depression Rating Scale; HADS, Hospital Anxiety and Depression Scale; ART, Audio relaxation technique; MI, Music intervention; NVA, Nature video application without music; TAU, Treatment as Usual; NVAM, Nature video application with music; APAIS, Amsterdam Preoperative Anxiety and Information Scale; M-YPAS, Mobile-Yale Pre-operative Anxiety Scale; DASS 21, Depression, Anxiety and Stress Scales; DASS-D, Depression, Anxiety and Stress Scales-Depression Subscale; ASS-A, Anxiety and Stress Scales, Anxiety Subscale; PTSD, Post-Traumatic Stress Disorder; CAP-CR, Care Assessment Platform, Cardiac Rehabilitation.



### 1.4.2 Quality Criteria

Table 2 outline the quality ratings of the 27 included papers using an adapted version of the Downs and Black Study Quality Appraisal Checklist [16]. The original criteria did not specify categories of quality for the paper. Within this review the categories good, moderate, and poor were used to distinguish between quality. All but two of the included studies [35,45] were published in peer-reviewed journals. The two remaining studies were published under research protocols [35] or a poster presentation [45]. The overall qualities of the studies were quite variable ranging from 11-27, with only one of the studies was categorised as poor [45]. In fact, this study had only information available from a poster provided by the authors, so may not accurately reflect the overall quality of the study. Fifteen of the studies had score over 21 points so were categorised as good quality. An overall strength of the majority of papers was the quality of reporting, apart from the reporting of adverse events, in which only 37% of papers reported. External validity across the studies varied, within 41% of studies there was some concern about whether the participants approached were representative of the population. Within 56% there were concerns whether those who were prepared to take part were representative of the target population. There were 22 RCT's in the final included studies, and of these only 7 reported blinding subjects from the intervention and blinding the assessors of the main outcomes (n=13). However other areas of bias were rated highly across the majority of the papers. Finally, 53% of the studies did not report on power for sample size. The selected sample overall quality of papers appears to be mid to high average quality, with little difference between the overall quality of papers for physical and mental health.

Table 2 Methodological quality of the included studies.

Author, (year)	Reporting (0-11)	External Validity (0-3)	Internal Validity Bias (0-7)	Internal Validity Confounding (selection bias) (0-6)	Power (0-1)	Total (28)	Overall Quality categories
Ahmedani et al. (2015). [19]	11	3	4	1	0	19	Moderate
Baron et al. (2016). [20]	10	0	4	4	0	18	Moderate
Birney et al. (2016). [21]	9	2	7	6	1	25	Good
Burns et al. (2011). [22]	9	0	4	3	0	16	Moderate
Carissoli et al. (2015). [23]	9	1	4	2	0	16	Moderate
Choi et al. (2015). [24]	11	3	5	6	0	25	Good
Dagöo et al. (2014). [25]	10	2	7	6	0	25	Good
Dennis and O'Toole (2014). [26]	10	0	7	4	0	21	Good
Depp et al. (2015). [27]	11	1	6	6	1	25	Good
Dicianno et al. (2015). [28]	9	3	6	6	1	25	Good
Faurholt-Jepsen et al. (2015). [29]	11	1	6	6	1	25	Good
Glynn et al. (2014). [30]	10	3	7	6	1	27	Good
Hansen (2015). [31]	11	3	4	5	1	24	Good
Howells et al. (2014). [32]	8	0	4	5	1	18	Moderate
Ji, et al. (2016). [33]	6	2	5	4	0	17	Moderate
Johnson, et al. (2014). [34]	11	1	4	2	0	18	Moderate
Lappalainen et al. (2013). [35]	10	2	5	4	0	21	Good
Ly., et al. (2015). [36]	10	2	7	5	1	25	Good
Ly et al. (2014). [37]	10	3	6	4	1	24	Good
Ly et al. (2012). [38]	10	0	3	2	0	15	Moderate
Possemato, et al. (2016). [39]	11	3	6	4	0	24	Good
Quinn et al. (2011). [40]	9	2	5	2	1	19	Moderate
Rizvi et al (2011). [41]	9	2	4	1	0	16	Moderate
Roepke et al. (2015). [42]	10	3	6	5	1	25	Good
Varnfield et al. (2014). [43]	9	2	2	6	1	20	Moderate
Watts et al. (2013). [44]	10	3	5	5	0	23	Good
Worthen-Chaudhari et al. (2015). [45]	6	1	4	0	0	11	Poor

### **1.4.3 Effects of physical health mobile applications**

The database search identified 10 papers that focused on physical health, which also included a standardised measure of anxiety or depression. Of these 10 papers, 9 were randomised controlled trials and one was a controlled before-after study. Four of the included studies focused on the management of chronic health conditions: diabetes, spina bifida, and myocardial infarctions. Two further studies focused on increasing physical activity in inactive general population and physically inactive pregnant participants. Another three studies focused on medical procedures, surgical and imaging procedures, and the final study was focused on people who had unresolved symptoms of concussion.

#### **Depression Measures**

Seven of the identified studies included standardised self-report measures of depression. Different variations of the CESD was the most commonly used (3). All other measures were only used once (BDI-II, HADS, DASS-21 and PHQ-9) of these 7 studies, one included a standardised depression measure as a primary outcome measure, five as a secondary measure, and one study did not differentiate.

#### **Anxiety Measures**

Six of the identified studies include standardised measures of anxiety. The STAI was the most commonly used measure (4). All other measure were only used once; HADS, APAIS, M-YPAS and DASS-21 of these six studies, one included a standardised



measure as a primary outcome measure, three as a secondary measure, and two studies did not differentiate.

#### **1.4.4 Interpretation of Studies**

For the interpretation of the between-group comparisons effect sizes within each included study we used the relative boundaries, 0.2-0.3 considered a 'small' effect, around 0.5 a 'medium' effect and 0.8 to infinity would be considered a 'large' effect [65]. Shintani et al. [66] recommended boundaries for within-group comparisons (0.50 for small effect, 0.80 for medium and 1.10 for large effects).

#### **1.4.5 Physical Health Study finding**

##### **Chronic Health**

Baron et al. [20] saw participants with poorly controlled type 1 or type 2 diabetes randomised to either mobile Telehealth monitoring (n=45) or standard diabetes care (n=36). The intervention included blood glucose and blood pressure monitors interacting with mobile phone software, and users monitoring last meal and physical activity. All participants could receive graphical feedback accessed through the mobile phone menu. The intervention group demonstrated reduction in depressive symptoms compared to standard diabetes care as measured by the CESD-10 at 3 months (g=0.38) and at 9 months intervention (g=0.53). In addition, the intervention group anxiety as measured by the STAI-6 remained relatively stable over the 9 month period, whereas in standard diabetes care, anxiety increased (g=0.20).

A second study [40] looked at diabetes self-management using mobile application coaching vs standard care (n=56). The researchers used the patient-coaching system,

which was a mobile diabetes application allowing patients to enter diabetes self-care data, similar to Baron et al. [20]. However, the intervention differed by offering real-time educational, behavioural, and motivational messages relating to the data entered about diabetes self-care (blood glucose values, carbohydrate intake, medications, other diabetes management information) [40]. The study had three intervention groups to which participants were randomised, mobile only (n=23), mobile data linking to care provider (n=22), and mobile data linking to care provider with automatic links to standards of care and evidence based guidelines (n=62). Each of the intervention groups showed a reduction in depressive symptoms after 12 months, using the PHQ-9 in comparison to standard diabetes care. The effect sizes for mobile only was pre-post  $d = 1.09$ , vs control  $d = 0.5$ , mobile linking to care provider was pre-post  $d = 0.68$ , vs control  $d = 0.35$  and mobile data to standards of care and evidence base was pre-post  $d = 1.04$ , vs control  $d = 0.34$ .

A further randomised study looked at the self-management of the chronic health condition spina bifida [28] using the iMHere system, which includes smartphone modules for the patient and online clinician portal and communication system. The intervention included patient reminders and guidance on self-care tasks related to spina bifida (n=13). The control group received standard spina bifida care (n=10). Symptoms of depression, post intervention as measured by the BDI-II reduced in the intervention group ( $d = 0.39$ ) vs control ( $d = 0.28$ ). The control group symptoms actually increased post intervention.

The final study looking at the management of a chronic health condition, investigated a self-management system of cardiac rehabilitation using a smart phone [43]. The intervention included exercise monitoring, motivation and educational material and

weekly mentoring (n=53). The control group traditional care consisting of personalised exercise programmes, supervised exercise sessions and 1 hour educational session on a weekly basis for 6 weeks (n=41). Symptoms of anxiety and depression were measured by DASS-21. Symptoms of depression, post intervention as measured by the DASS-d subscale reduced in the smartphone assisted group (d=0.40) compared to the standard treatment. The within group effect size was (d=0.46) for the smartphone group. Symptoms of anxiety, post intervention as measured by the DASS-a subscale again reduced in the smartphone assisted group (d= 0.43) compared to control. The within group effect size for the smartphone assisted group was (d=0.43).

The incorporation of smartphone interventions within self-management of chronic health, seem to have roughly between small to medium effect sizes across the interventions versus standard care programmes. The common elements of the smartphone interventions with chronic health were recording of self-care, feedback and increased self-awareness. Information on self-care was provided in real time as opposed to more infrequent contact available in usual care. Each of the intervention could also provide guidance to the users on improving condition.

The quality of the four studies that focused on the management of chronic health conditions ranged from moderate (n=3) to good (n=1).

### **Management following acute trauma.**

Worthen-Caudari et al. [45] studied the effectiveness of using the Superbetter gamified application for 3 weeks with adolescents with persistent post-concussion symptoms. Using a controlled design, 10 participants underwent the intervention with 6 undertaking TAU. Depression symptom change was measured by CES-D for children.

The intervention group was only slightly superior to TAU ( $d=0.14$ ). However the within group effect size was relatively large ( $d=1.2$ ). The quality of the included study [45] that focused on management of acute trauma was poor.

### **Physical Activity**

Two studies look at increasing physical activity in inactive participants. The first study [24] looked to increase physical activity in pregnant women between 10-20 weeks gestation. The participants were randomly assigned to using a Fitbit and a trial app offering motivational support, goals, diary and weight management advice ( $n=14$ ). The control group were given a Fitbit with the same functions as the intervention group, but not access to the trial app or to any information contained on the summary menu of the app ( $n=15$ ). The trial app showed a slight pre-post reduction in depressive symptoms  $d=0.2$  using the CES-D. However, when compared against the Fitbit only group, the trial app was more effective ( $d=0.43$ ).

The second study [30] looked at increasing physical activity in inactive patients. The participants were either randomised to receive Accupedo-Pro app ( $n=37$ ) or just receive information about the benefits of increasing number of steps per day ( $n=39$ ). Depression and anxiety was measure using the HADS, however, the subscales were not reported, therefore we were only able to report effect size based on total score. The Accupedo-Pro app showed a reduction in depressive anxiety pre-post ( $d=0.67$ ) and vs control group ( $d=0.15$ ). However, the total scores on the HADS were initially low in both groups. The Accupedo-Pro app and the Fitbit are both available for general public use. There was a small to medium effect size in the reduction in depressive symptoms when patients utilise physical activity applications, however given the sub clinical baselines scores in both studies it is difficult to generalise

findings to those with more severe presentations. Further research needs to be carried out looking at the psychological benefits of using physical health applications within the general population. The overall quality of the two studies [24, 30] that focused on physical activity levels were both categorised as good quality.

## **Medical Interventions**

The studies that included the majority of standardised anxiety measures were focused on surgical procedures or imaging procedures. One study [33] randomised patients to either use a mobile application, drawMD app to provide children and parents with a personalised drawing of operations and information to explain surgical procedures or the same information presented verbally. The drawMD app group showed a significant reduction in parental anxiety symptoms vs control post intervention using the SAI ( $d=0.56$ ), TAI ( $d=0.3$ ) and APAIS ( $d=0.85$ ), whereas the child's anxiety showed little difference between the two groups ( $d=0.23$ ). The drawMD app was not available commercially at the time of review.

Another study that looked at pre-operative anxiety [31] randomised patients to three separate interventions prior to general surgery or gynaecological surgery: audio relaxation ( $n=24$ ), music ( $n=24$ ), nature video application ( $n=16$ ) with and without ( $n=14$ ) music and control ( $n=24$ ). The nature video application with music showed a slight reduction in anxiety symptoms pre-post intervention ( $d=0.16$ ), however, no significant changes in anxiety scores for any of the other groups, in fact some groups increased in anxiety post operation. The effect sizes were calculated for this paper for the individual interventions, as the original paper used the data from all the groups combined, due to problems with small sample size, therefore within group effects were

not calculated. The final paper [34] assigned children with ASD who required imaging in hospital to either an iPad application interactive social script intervention or TAU. Parental anxiety was measured pre and post intervention using the STAI. Parents of the children exposed to the app (n = 16) had lower state anxiety compared to the control condition (n = 16) (d= 0.33).

None of the applications from the medical interventions were available at the time of review. This is likely due to the very specialist nature of the developed mobile applications, that they would only be applicable to specific situations and settings. Two of the studies that focused on medical interventions [33,34] were categorised as moderate quality, while the other [31] was of good quality.

#### **1.4.6 Effects of mental health mobile applications**

The database search uncovered 17 papers that focused on mental health, which also included a standardised measure of anxiety or depression. Of these 17 papers, 13 were randomised controlled trials and four were pre-post comparisons with no control group.

Seven of the included studies had a depression focus for the intervention. Two further studies had an anxiety focus. One study focused on happiness and another focused on stress. Further studies focused on self-management for more severe mental health presentations; bipolar disorder, PTSD and Borderline Personality Disorder.

##### **Depression**

Sixteen of the identified studies included standardised self-report measures of depression. The PHQ-9 was the most commonly used measure (n=7) followed by

different variations of the BDI (n=5), CESD (n=2) and MADRS (n=2). All other measures were only used once.

Of these, eight included a standardised depression measure as a primary outcome measure, one as a secondary measure, and six studies did not differentiate. One study included the MSP [23] which has a one subscale incorporating depressive anxiety as one measurement.

## **Anxiety**

Seven of the identified studies include standardised measures of anxiety. One of the studies used two standardised measures of anxiety [25]. The BAI was the most commonly used measure (3), the GAD was used in two studies, and all other measure were only used once: LSAS-SR, DASS-a and STAI.

Of these seven studies, one was included as primary outcome measure of anxiety, five studies included them as secondary measures, and two studies did not differentiate.

## **1.4.7 Mental Health Studies Findings**

### **Depression Focused Studies**

Birney et al. [21] conducted an RCT of MoodHacker, a web app, providing psycho education and CBT-based strategies, along with mood monitoring to participants with mild to moderate depression. At 6-week follow-up, significant within group effects were found for depression using the PHQ-9 (d=0.93) and behavioural activation for depression scale (d=0.7), however only small effects sizes were found vs control of email directing to self-help depression information online (PHQ-9, d=0.14, BADS, d=0.13).

Ly et al. [37] as part of a RCT assigned participants with major depressive disorder to either a smartphone application based on behavioural activation (n=40) or smartphone application delivering a mindfulness programme (n=41). Behavioural Activation was superior to mindfulness in reducing depressive symptoms using the BDI-II (d=0.25) and using the PHQ-9 (d=0.28). Both Behavioural Activation (d=1.83) and the Mindfulness programme (d=1.21) were effective pre-post using the BDI. The Behavioural Activation (d=1.63) and Mindfulness programme were also effective pre-post using the PHQ-9 (d=1.15). The study also used the BAI to measure anxiety. Behavioural Activation was slightly superior to mindfulness in reducing anxiety symptoms (d=0.06). Both the behavioural activation (d=0.76) and mindfulness programme (d=0.51) were effective in reducing anxiety symptoms pre-post intervention.

Ly et al. [36] conducted another RCT assigning participants with major depression to a four session face to face and a smartphone application (n=46) or to a full face-to-face behavioural activation treatment (n=47). Full treatment was slightly superior to blended treatment in reducing depressive symptoms using the BDI-II (d=0.13) though there was no difference with the PHQ-9 (d=0.01). Blended treatment was effective in reducing depressive symptoms pre-post intervention (BDI-II, d=1.4 and PHQ-9, d=1.58). Blended treatment was superior to face-to-face treatment in reducing anxiety (BAI, d=0.36). Blended treatment was effective in reducing anxiety symptoms pre-post intervention (BAI, d=0.72).

An RCT [42] using a CBT version of Superbetter (SB) (n=93) vs the commercially available general SB (n=97) compared with waiting listing (n=93) found that



participants with depression achieved greater reductions in CES-D scores post-test in both groups compared to WL (CBT-SB,  $d=0.31$ , SB,  $d=0.61$ ). Contrary to their hypothesis, the CBT-SB was inferior to standard SB app ( $d=0.37$ ). Both CBT SB ( $d=0.93$ ) and General SB ( $d=1.46$ ) were effective in reducing depressive symptoms pre-post intervention. General SB was also superior to CBT SB in reducing anxiety symptoms using the GAD-7 ( $d=0.25$ ). Both were superior to WL (CBT SB,  $d=0.29$ , General SB,  $d=0.61$ ) and both were effective pre-post intervention (CBT SB,  $d=0.79$  General SB,  $d=0.89$ ).

Watt et al. [44] piloted an RCT with participants with major depression, to be assigned to mobile delivered CBT (Get Happy Programme), or computer delivered CBT (The Sadness Programme). The Get Happy Programme, was a mobile version of the previously evaluated Sadness Programme. Mobile delivered CBT was slightly superior to control in reducing depression symptoms (BDI-II,  $d=0.37$ , PHQ-9,  $d=0.47$ ). Mobile delivered significant within group reduction in depression symptoms (BDI-II,  $d=1.79$ , PHQ-9,  $d=1.41$ ).

Ly et al. [38], conducted a pre-post-test design, to evaluate an ACT-based smartphone-application, Viary, which allows participants to register and remember behaviours that are in line with their values ( $n=11$ ). Depression symptoms and anxiety symptoms measured by the DASS-21 showed no significant difference pre-post, and small effect size (DASS-d,  $d=0.38$ , DASS-a,  $d=0.27$ ).

Lappalainen et al. [35] integrated various mobile applications (wellness diary, fitness coach and relaxation assistant) into a 3 group session of psychotherapy based on ACT and CBT. Depressive symptoms decreased using the BDI in the intervention group ( $n=11$ ) vs control ( $n=12$ ) (TAU) ( $d= 0.57$ ) and within group ( $d=1.11$ ). However, it is

difficult to determine whether the reduction in symptoms was due to the psychotherapy content of the group sessions or the integration of the smartphone applications. Within the study the relaxation application and pedometer were the most utilised functions.

Burns et al. [22] conducted a pre/post pilot of a mobile application, Mobilyze. They used smartphone sensors to link with self-reports about mood, social context, activity and location. If the predicted mood states changed for participants (n=7), the application would send personalised feedback in real time, and send information to a website for clinicians. The study found large effect sizes within-group for depressive symptoms using the PHQ-9 (d=3.43). Additionally, the intervention group had a significant reduction in anxiety symptoms using the GAD-7 (d=2.58). However, this study lacked a control group for comparison.

Ahmedani et al. [19] tested the feasibility pre/post-test of a web-based mobile intervention, which included animated narration and interactive tailored feedback (n=64). Depressive symptoms were measured using the PHQ-9 in participants with chronic pain. The study found an effect size within-group of d=0.39.

The majority of the studies that focused primarily on depression were categorised as good quality studies (n=6) with the remaining of moderate quality (n=3).

### **Anxiety Focused Studies**

Dagoo et al. [25] evaluated cognitive behaviour therapy for social anxiety disorder delivered through a mobile device (mCBT) compared to mobile delivered interpersonal psychotherapy (mIPT). Participants were randomised to mCBT (n = 27)

or mIPT (n = 25). mCBT was superior to mIPT using the BAI (d= 0.46) and the LSAS-SR (d=0.64). mCBT showed small effect size within group using the BAI (mCBT, d=0.25, mIPT, d=0.02) and LSAS-SR (mCBT, d=0.99, mIPT d=0.43). mCBT also showed a within groups slight reduction in depression symptoms using the MADRS-S (d= 0.26).

Dennis et al. [26] created a gamified attention-bias modification training (ABMT) mobile application to reduce threat bias in highly trait-anxious university undergraduates. Participants were randomised to either a single session of the active short training (n=18), long training (n=19) and placebo (n=20). Short training reduced subjective anxiety using the STAI compared to placebo (d=0.49) and long training (d=0.66). Both of the papers [25,26] that focused on anxiety were categorised as good quality studies.

### **Seeking Happiness Studies**

Howells et al. [32] randomised a self-selected pool of happiness seekers to either Headspace, a mindfulness based application or another application that was an unrelated list-making app called catch note, however it was unclear the adherence to catch note. The intervention group showed reduced depressive symptoms measured by the CES-D between groups with a small effect size (d=0.36) and within groups (d=0.39). The quality of the included study [32] that focused on seeking happiness was categorised as moderate. However, this study particularly lacked in components related to external validity.

## **Stress Focused Studies**

Carissoli et al. [23] conducted a controlled trial for a smartphone application delivering a Meditation application 'It's time to Relax' vs listening to music on a phone for 15 mins twice a day. The measure was MSP, which contained a dimension for depressive anxiety. There was no significant difference for depressive anxiety between the two groups ( $d=0.13$ ) post intervention. No significant difference was found on the dimension for within group effect ( $d=0.06$ ). The study did not report means for the control group so the reviewers were unable to calculate effect size vs waiting list control. The quality of the included study [23] that focused on management of stress was moderate.

## **Major mental health presentations**

### **Bi-polar Studies**

Depp et al. [27] conducted an RCT in which initially participants all attended a four-session psychoeducation group. They were then either randomly assigned to mobile application ( $n=41$ ) in which participants reported mood states with personalised self-management strategies, or a control group ( $n=41$ ) of paper-and-pencil mood monitoring. The mobile intervention within group showed greater reductions in depressive symptoms at 6 weeks post intervention ( $d=0.37$ ).

Faurholt et al. [29] randomised participants with bi-polar disorder to an intervention which required users to self-monitor mood, sleep, medication, activity, cognitions and stress using a smartphone that was linked to a clinician. The clinician could review the data and contact the user if there were signs of deterioration. The control group used the smartphone as a regular communication tool. The study showed no significant

effects of daily self-monitoring on depressive symptoms using the Hamilton Depression Rating Scale (HAMD-17) ( $p=0.08$ ). Faurholt et al. [29] suggested that electronic self-monitoring, although intuitive should be further studied before being used as a clinical tool. Additionally, both of these studies looking into the management of bi-polar disorder were considered to be of good quality.

## **PTSD Studies**

Possemato et al. [39] piloted an RCT looking at self-managed PTSD Coach vs clinical supported PTSD Coach for veterans with significant PTSD symptoms. PTSD Coach provides psycho-education on PTSD symptoms, symptom monitoring and suggests ways of coping. Both treatments resulted in slight reductions in depressive symptoms using the PHQ-9 (Within Group, SM-PTSD Coach,  $d=0.27$  CS-PTSD Coach  $d=0.33$ ). The clinician supported PTSD Coach was slightly superior to self-managed PTSD Coach ( $d=0.09$ ) in reducing depressive symptoms. The overall quality of the included study [39] was good.

## **Borderline Personality Disorder**

Rizvi et al. [41] conducted a feasibility study using DBT Coach in conjunction with face to face DBT to reduce substance use in participants diagnosed with borderline personality disorder. DBT Coach, in conjunction with face-to-face DBT therapy produced a within group, significant reduction in symptoms of depression (BDI:  $d=0.55$ ). However, the overall quality of the study was moderate, with lack of reporting of potential selection bias.

## 1.5 Discussion

Overall, 80 percent of the studies in this review found that at least one of the standardised measures showed a favourable result in reducing depressive or anxious symptoms

### 1.5.1 Depression

15 of the 19 studies showed a small effect in reducing depressive symptoms with a standardised measure of depression. Only 19 studies had enough information to calculate effect sizes on purely depression alone. Of the 23 studies that included a within-subjects design, 10 showed at least a medium effect size. 8 of these studies primarily target mental health as opposed to physical health.

Of the nine studies which actively targeted depression with a mental health application [19, 21, 22, 35, 36, 37, 38, 42, 44], four randomised controlled trials and two pilot RCT's have been reported. The remaining three studies were case series. The number of participants in these studies ranges from  $n = 7$  to  $n = 150$  with the total across studies  $n = 444$ . Five of the studies included an active control condition, with only two studies [21, 37] reporting superior effect sizes to active control ( $d = 0.14$  &  $d = 0.28$ ). The two active control interventions were receiving emails of health information and a mindfulness mobile application. The remaining three studies in which the active control intervention was superior were face to face behavioural activation treatment ( $d = -0.13$ ), the original version of SuperBetter app ( $d = -0.37$ ), and a computerised version of the mobile application program ( $d = -0.37$ ). Interestingly, two of the active control interventions were mobile applications. Two of the studies used a passive

control condition [35, 42]. Roepke et al. [42] included two mobile applications, reporting one small and the other a medium effect size. The other study also reported medium effect size [35]. Of the eight studies, six reported large within group effect sizes ( $d=1.11-3.43$ ), one reported a medium effect size ( $d=0.93$ ) and two a small effect size ( $d=0.38, 0.39$ ). The study reporting the largest effect size [22] also reported the lowest number of participants ( $n=7$ ). This study was considered moderate quality. Of the nine studies that targeted depression, six of the studies were rated as good quality. These papers [21,25,36,37,42,44] which were rated as good quality contained the majority of participants ( $n=358/444$ ) across all depression focussed studies.

A further 6 studies utilised mental health mobile applications and included a measure of depression [25, 27, 29, 32, 39, 41]. Five of the studies used an RCT design with one being a pilot study and one a case series [41]. The study numbers ranged from  $n=10$  to  $n=57$ , with the total number being  $n = 188$ . Of the RCT studies only four of these studies reported enough information for effect sizes to be compared. Three of the studies compared against an active control [25, 27, 39] and one against a passive control [32]. The three studies [25, 27, 39] that used an active control were considered good quality. Only one study that included an active control group was superior to control [25]. mCBT was superior to mIPT ( $d= 0.88$ ). The other two studies found no difference between intervention and active control, the control group were paper-pencil mood monitoring ( $d=0.17$ ) and a clinician supporting a mobile application ( $d= 0.09$ ). The only study comparing against a passive control compared *Headspace* against a neutral mobile application, and this demonstrated a small effect size ( $d=0.36$ ). Only one of the six studies reported a within group effect size significant enough to be considered a small effect using Shintani's [66] boundaries. Rizvi et al. [41] reported a

small within effect size (0.55), however this study was considered only moderate quality.

Each of the studies targeted different mental health conditions, with the mobile application interventions being varied. One focused on prolonged exposure, two utilised a mood monitoring diary, another, modules of CBT or IPT, one used DBT and finally mindfulness exercises. Mental Health mobile applications that are more focused on depression, showed superior effect sizes, compared with those that target other mental health presentations. The applications that focused on other mental health presentations showed little effectiveness in reducing depressive symptoms using a standardised measure. This potentially could be due to the severity of the mental health conditions, with more intense interventions for reduction of symptoms.

An additional 7 studies that focused on physical health included a measure of depression [20, 24, 28, 30, 40, 43, 45]. An RCT design was used in all but one of the studies with two of these RCT's a feasibility/pilot study. One of the studies did not randomise the participants, but did include a control condition [45]. The study numbers ranged from n=10 to n=56, with the total number being n = 228. The majority of the papers 4/7 were categorised as moderate to poor quality. These papers [20,40,43,45] accounted for 189 of 228 of the total participants. Four of these studies focused on self-care for a physical health condition, one focused on recovery from an acute trauma, while the other two focused on the effects of increasing exercise. Of the four studies reporting on self-care only three have reported enough information for effect sizes to be compared [20, 28, 40]. All three of the studies had a passive control condition, which was treatment as usual. All three studies reported similar effect sizes, (d=0.34—0.39). The within effect sizes varied across the studies. Two of the three



studies reported a within group effect size not significant enough to be considered a small effect [20, 28]. The other study reported a medium within group effect size [40].  $d=1.04$ ). Only one study was comparable with targeted mental health interventions for effectiveness of reducing symptoms of depression [40]. The one study [45] using SuperBetter looked at recovery post-concussion and used a control group with low effect size ( $d=0.14$ ) but within group effects were large ( $d=1.2$ ). There were no details of the control group available.

The two studies [24, 30] that investigated increasing physical activity both had active control conditions, one using a Fitbit without corresponding mobile applications and the other giving the control group the same pedometer mobile application as the intervention group but without prior information and instructions. Between group effectiveness varied across the two studies, with Choi et al. [24] reporting a small effect size ( $d=0.43$ ) and Glynn et al. [30] reporting an increase in symptoms post intervention ( $d=0.15$ ). However, in both studies the baseline scores on the standardised measures were low. Only Glynn et al. [30] reported a within group score that would be considered a small effect ( $d=0.67$ ), suggesting an app that supports physical exercise has limited research and the effectiveness could be minimal. Additionally, Glynn et al. [30], did not report the subscales for the depression subscale for the HADS, which could affect the interpretation of the findings. Once again more focused targeted mental health interventions appear to be superior in reducing depressive symptoms.

Overall, the review suggests that targeted and more focused depression interventions are superior to mobile applications that promote self-care and physical activity, or those that are designed for more specific health procedures. The overall quality of

papers in more focused depression interventions appear to be rated higher and include more of the total participants.

### **1.5.2 Anxiety**

Only two studies actively targeted anxiety with a mental health application [25, 26], both studies randomised participants to intervention or control. The two applications varied significantly, one using modules of CBT or IPT, and the other was a gamified ABMT mobile application. The number of participants in these studies was 52 and 18. The mCBT showed the most potential in reducing anxiety symptoms ( $d=0.64$ ), however the evidence is still very limited with only two dissimilar studies targeting anxiety within mental health. The quality of both of these studies were rated as good quality. Three studies actively targeted anxiety prior to medical interventions [31, 33, 34]. The studies all looked different types of intervention: relaxation, social story and interactive education. Two of the studies [33,34] were rated as moderate quality, with one rated as good quality [31]. The two studies that included a passive control found between group effect sizes of  $d=0.33$  and  $0.39$  representing a small effect size. Whereas, Ji et al. [33] was compared against an active control and for one measure (APAIS) had a medium between group effect size. Of the three studies, only one reported a medium within group effect size [33], with the other two not even a small effect. Seven further studies include a standardised measure of anxiety, [20, 22, 36, 37, 38, 42, 43]. Five of these studies primarily targeted depression with a mental health application. Of these five studies, two were case series and the remaining studies were RCT's. Of the five studies, three reported small within-group effect sizes for the reduction of anxiety and one a large effect size, but the sample was small ( $n=7$ ). Of the remaining two studies only one reported enough information for effect sizes to be

calculated [20]. This study showed very little change in anxiety reduction in a self-care intervention. Overall, the review suggests that mobile applications for the reduction of anxiety within mental health could potentially yield a small effect. However, the quality of evidence for mobile applications for anxiety is severely lacking within mental health and physical health. At present the review highlights that no firm conclusions for the effectiveness of such interventions can be drawn.

The review suggests that overall the quality of studies was higher for those studies that actively targeted anxiety or depression with a mental health mobile application. The majority of those studies [21,25,26,35,36,37,42,44] were rated as good quality.

### **1.5.3 Considerations**

It is important to consider that since the review by Donker et al. [7] of mental health applications, 12 further studies that contained a standardised measure of anxiety or depression have been published. With very few of the physical health interventions including a measure of psychological symptom reduction, it is likely given the popularity and drive by developers to incorporate health professionals in the development of the health applications that future studies of physical health applications may consider psychological wellbeing as a secondary outcome.

### **1.5.4 Availability in App Stores**

The majority of studies did not include the name of the mobile application they used. Of the studies that did report, three applications were not available to the general public, Moodhacker, Livvy and Viary. The only available applications found within

the UK app stores were Headspace, PTSD Coach, Superbetter, Accupedo and the DBT Diary card and skills coach. The availability of the applications may differ globally. Similar to a previous review, [7] we carefully considered what interventions constituted a mobile application. We considered that all of the included interventions have some sort of interactive or choice element that could be selected by the user. As such, several studies were excluded because they used the smartphone or smart device as a portable video player, rather than a mobile application. Some of the mobile applications included in the review only applied to very specific conditions or procedures. However, the technology and features could be more widely introduced to other similar services across the NHS.

### **1.5.5 Limitations**

A limitation of the current review was that it was only a descriptive review of the literature. At present, the authors felt that due to the diversity in the interventions, methodologies and the populations, quantitative analysis was not appropriate. However, given the rapid development of mobile applications as physical health and mental health interventions in the past three years, it is likely further methodically similar studies will emerge shortly. A further limitation of the review was that only one reviewer screened titles and abstracts. Due to the large volume of studies initially retrieved from the databases, the first reviewer was cautiously over inclusive at both the title and abstract stage and it was agreed the second screener would screen only the full text articles.

Inclusion and exclusion criteria were developed to capture the most relevant studies that included a mobile application, however, no distinction was made between studies that use the mobile application as part of a blended treatment protocol, or those that had the application as the principal intervention. Finally, it is acknowledged that the review set out to explore the efficacy of mobile applications for anxiety or depression. One reflection while searching the multiple databases was that those studies that were excluded from the final qualitative analysis for not using a standardised measure of anxiety or depression sometimes included a measure of wellbeing or quality of life. Some of the included studies used a standardised measure of anxiety or depression as a secondary outcome, whereas the interventions might not be targeting symptom reduction but rather improving quality of life and wellbeing.

### **1.5.6 Future Research**

In the past 3 years there has been a substantial increase in research utilising mobile applications in treatment protocols. This review has 22 papers from the period 2014-2016. However, many of the mobile applications cited in these papers are provided in conjunction with other treatments. Future research should look at the effectiveness of mobile applications as stand-alone treatments, preferably using an RCT design. However, it is important to consider the time required to design mobile applications, carry out and disseminate an RCT. Researchers may find at the end of the trial period, much of the technology embed within the interventions, may have evolved substantially, and the application and findings may be redundant. Further research should look at evaluating the most popular mobile applications already available in

the apps stores, for their clinical effectiveness. Such applications often have considerable commercial success so are likely to be continually updated with technology unlike application developed as part of a research grant.

From this review, evidence based applications that target depression are more widely researched and more readily available to the public. Research needs to focus on mental health applications that target anxiety. Future studies and reviews might consider outcomes of improved wellbeing or quality of life as a measure of improvement rather than clinical measures of symptom reduction. Some of the online community samples included in this review have relatively low baseline scores on symptom measures, so it is often difficult to ascertain meaningful changes in symptom reductions if few were present initially.

Much of the mental health research seems to focus on depression, with a clear need for research focusing on the use of mobile applications other areas particularly, anxiety. Finally, researchers in physical health and public health interventions may consider including a standardised measure of psychological wellbeing, as a secondary outcome measure, as opposed to just physical health markers, such as BMI.

### **1.5.7 Implications for practice**

It is premature to recommend the widespread introduction of physical health applications to target anxiety or depression in those waiting for psychological services.

It is also premature to suggest using physical health intervention blended with ongoing psychological treatment. Though, the physical health interventions may be more beneficial for more specialist conditions or procedures, by promoting self-care or reducing psychological distress.

Interestingly, the use of targeted mental health interventions to reduce anxiety or depression could be more widely integrated into psychological services either waiting or undergoing psychological treatment. Additionally, if marketed correctly as an alternative to face to face psychological therapy, such interventions could potentially reduce face to face contacts and reinforce treatment strategies and monitoring with ongoing easily accessible, real time resource.

Some of the mobile applications included in the review contain features or content that could inform the development of future mobile applications. For mental health applications, many were based on a therapeutic framework or provided psychoeducation. Some of the physical health applications contained feedback loops, which provide the user with real-time information (eg. activity level, heart rate, blood glucose levels etc.), which could monitor their self-care activities. Additionally, three of the studies introduced gamified mobile applications to engage users. Future psychological mobile applications should consider, integrating the feedback systems available in the majority of smartphones (eg. sleep quality, HR, activity levels etc.) with evidence based therapeutic interventions. This could be presented in a gamified intervention which promotes the user to make positive changes in wellbeing.

### **1.5.8 Conclusions**

This updated systematic review of mental health mobile applications demonstrates that there is evidence that they may be effective in reducing symptoms of anxiety or depression with 80 percent of studies reporting at least a small effect size. The review results suggest that mobile applications that specifically target mental health, are more effective in reducing symptoms of anxiety or depression. However mobile

applications that target depression appear to have the superior evidence base for reducing symptoms of depression and have more evidence based applications available to the public. However, no firm conclusions can be made regarding interventions that target physical health, and those measuring anxiety. There is potential that these interventions may be effective when further research is carried out. The continued growth of smart device usage and health related mobile applications, means the evidence base is likely to grow and more specific applications be developed. For the general public, it is important that these evidences based applications become more widely available on the various mobile platforms. Furthermore, the various platforms should incorporate an authorised symbol from an authorised source to indicate to consumers whether an application is clinically effective. Finally, continually adding new applications to the apps market may mean that future applications get saturated by the high volume of other available mobile applications. Potentially, researchers could team up with the developers of the most prominent health related mobile applications to test their effectiveness.



## 1.6 Abbreviations

<b>mHealth</b>	Mobile Health
<b>WHO</b>	World Health Organisation
<b>NHS</b>	National Health Service
<b>QI</b>	Quality Index
<b>PHQ-9</b>	Patient Health Questionnaire
<b>RCT</b>	Randomised Control Trial
<b>NR</b>	Not Reported
<b>CESD</b>	Centre for Epidemiologic Studies Depression Scale
<b>STAI</b>	State-Trait Anxiety Inventory
<b>BADS</b>	Behavioural Activation for Depression Scale
<b>GAD-7</b>	Generalised Anxiety Disorder Scale
<b>CBT</b>	Cognitive Behavioural Therapy
<b>IPT</b>	Interpersonal Psychotherapy
<b>DBT</b>	Dialectical behaviour therapy
<b>MSP</b>	Mesure du Stress Psychologique
<b>SAD</b>	Social Anxiety Disorder
<b>DSM IV</b>	Diagnostic and Statistical Manual of Mental Disorders
<b>LSAS-SR</b>	Liebowitz Social Anxiety Scale
<b>MADRS</b>	Montgomery-Åsberg Depression Rating Scale
<b>BAI</b>	Beck Anxiety Inventory
<b>ABMT</b>	attention-bias modification training
<b>BDI</b>	Beck Depression Inventory
<b>HAMD-17</b>	Hamilton Depression Rating Scale
<b>HADS</b>	Hospital Anxiety and Depression Scale
<b>APAIS</b>	Amsterdam Preoperative Anxiety and Information Scale
<b>M-YPAS</b>	Yale Pre-operative Anxiety Scale
<b>ASD</b>	Autism Spectrum Disorder
<b>ACT</b>	Acceptance and Commitment Therapy
<b>DASS 21</b>	Depression, Anxiety and Stress Scales
<b>PTSD</b>	Post-Traumatic Stress Disorder
<b>ES</b>	Effect Size
<b>WL</b>	Waiting List
<b>SB</b>	SuperBetter
<b>TAU</b>	Treatment as Usual

## 1.7 References

1. Adibi, S. (Ed.). (2015). *Mobile Health: A Technology Road Map* (Vol. 5). Springer.
2. Kay, M., Santos, J., & Takane, M. (2011). mHealth: New horizons for health through mobile technologies. *World Health Organization*, 66-71.
3. Mariani, A. W., & Pêgo-Fernandes, P. M. (2012). Telemedicine: a technological revolution. *Sao Paulo Medical Journal*, 130(5), 277-278.
4. MHealth App Developer Economics 2015 - research2guidance. (n.d.). Retrieved November 25, 2015, from <http://www.bing.com/cr?IG=595ABB01254346AD9E921920EC165698&CID=0C89021CCEDA612D0C43093BCFDC60C0&rd=1&h=qzez5Qn55HYZ-WKQnsiyCKk3tButwDtbWHXRUSGcYYM&v=1&r=http%3a%2f%2fwww.research2guidance.com%2fwp-content%2fuploads%2f2015%2f11%2fr2g-mHealth-App-Developer-Economics-2015-Preview.pdf&p=DevEx,5065.1>
5. Higgins, J. P. (2016). Smartphone applications for patients' health and fitness. *The American journal of medicine*, 129(1), 11-19.
6. Payne, H. E., Lister, C., West, J. H., & Bernhardt, J. M. (2015). Behavioural functionality of mobile apps in health interventions: a systematic review of the literature. *JMIR mHealth and uHealth*, 3(1).
7. Donker, T., Petrie, K., Proudfoot, J., Clarke, J., Birch, M. R., & Christensen, H. (2013). Smartphones for smarter delivery of mental health programs: a systematic review. *Journal of medical Internet research*, 15(11)
8. Martínez-Pérez, B., de la Torre-Díez, I., & López-Coronado, M. (2013). Mobile health applications for the most prevalent conditions by the World

- Health Organization: review and analysis. *Journal of medical Internet research*, 15(6).
9. Morris, M. E., & Aguilera, A. (2012). Mobile, social, and wearable computing and the evolution of psychological practice. *Professional Psychology: Research and Practice*, 43(6), 622.
  10. Nicholas, J., Larsen, M. E., Proudfoot, J., & Christensen, H. (2015). Mobile apps for bipolar disorder: a systematic review of features and content quality. *Journal of medical Internet research*, 17(8).
  11. Mani, M., Kavanagh, D. J., Hides, L., & Stoyanov, S. R. (2015). Review and evaluation of mindfulness-based iPhone apps. *JMIR mHealth and uHealth*, 3(3).
  12. Shen, N., Levitan, M. J., Johnson, A., Bender, J. L., Hamilton-Page, M., Jadad, A. A. R., & Wiljer, D. (2015). Finding a depression app: A review and content analysis of the depression app marketplace. *JMIR mHealth and uHealth*, 3(1), e16.
  13. Conroy, D. E., Yang, C. H., & Maher, J. P. (2014). Behaviour change techniques in top-ranked mobile apps for physical activity. *American journal of preventive medicine*, 46(6), 649-652.
  14. Price, M., Yuen, E. K., Goetter, E. M., Herbert, J. D., Forman, E. M., Acierno, R., & Ruggiero, K. J. (2014). mHealth: a mechanism to deliver more accessible, more effective mental health care. *Clinical psychology & psychotherapy*, 21(5), 427-436.
  15. Fineberg, N. A., Haddad, P. M., Carpenter, L., Gannon, B., Sharpe, R., Young, A. H., ... & Sahakian, B. J. (2013). The size, burden and cost of disorders of the brain in the UK. *Journal of Psychopharmacology*, 27(9), 761-770.

16. Downs, S. H., & Black, N. (1998). The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non-randomised studies of health care interventions. *Journal of epidemiology and community health, 52*(6), 377-384.
17. Tan, L., Wang, M. J., Modini, M., Joyce, S., Mykletun, A., Christensen, H., & Harvey, S. B. (2014). Preventing the development of depression at work: a systematic review and meta-analysis of universal interventions in the workplace. *BMC medicine, 12*(1), 1.
18. Banerjee, M., Capozzoli, M., McSweeney, L., & Sinha, D. (1999). Beyond kappa: A review of interrater agreement measures. *Canadian journal of statistics, 27*(1), 3-23.
19. Ahmedani, B. K., Crotty, N., Abdulhak, M. M., & Ondersma, S. J. (2015). Pilot feasibility study of a brief, tailored mobile health intervention for depression among patients with chronic pain. *Behavioural Medicine, 41*(1), 25-32.
20. Baron, J. S., Hirani, S., & Newman, S. P. (2016). A randomised, controlled trial of the effects of a mobile telehealth intervention on clinical and patient-reported outcomes in people with poorly controlled diabetes. *Journal of telemedicine and telecare, DOI:1357633X16631628*.
21. Birney, A. J., Gunn, R., Russell, J. K., & Ary, D. V. (2016). MoodHacker Mobile Web App with Email for Adults to Self-Manage Mild-to-Moderate Depression: Randomized Controlled Trial. *JMIR mHealth and uHealth, 4*(1).
22. Burns, M. N., Begale, M., Duffecy, J., Gergle, D., Karr, C. J., Giangrande, E., & Mohr, D. C. (2011). Harnessing context sensing to develop a mobile intervention for depression. *Journal of medical Internet research, 13*(3), e55.

23. Carissoli, C., Villani, D., & Riva, G. (2015). Does a meditation protocol supported by a mobile application help people reduce stress? Suggestions from a controlled pragmatic trial. *Cyberpsychology, Behaviour, and Social Networking*, 18(1), 46-53.
24. Choi, J., Hyeon Lee, J., Vittinghoff, E., & Fukuoka, Y. (2015). mHealth Physical Activity Intervention: A Randomized Pilot Study in Physically Inactive Pregnant Women. *Maternal and child health journal*, 1-11.
25. Dagöo, J., Asplund, R. P., Bosanko, H. A., Hjerling, S., Holmberg, A., Westh, S., ... & Andersson, G. (2014). Cognitive behaviour therapy versus interpersonal psychotherapy for social anxiety disorder delivered via smartphone and computer: A randomized controlled trial. *Journal of anxiety disorders*, 28(4), 410-417.
26. Dennis, T. A., & O'Toole, L. J. (2014). Mental health on the go effects of a gamified attention-bias modification mobile application in trait-anxious adults. *Clinical Psychological Science*, 2167702614522228.
27. Depp, C. A., Ceglowski, J., Wang, V. C., Yaghouti, F., Mausbach, B. T., Thompson, W. K., & Granholm, E. L. (2015). Augmenting psychoeducation with a mobile intervention for bipolar disorder: a randomized controlled trial. *Journal of affective disorders*, 174, 23-30.
28. Dicianno, B. E., Fairman, A. D., McCue, M., Parmanto, B., Yih, E., McCoy, A., ... & Brienza, D. M. (2015). Feasibility of Using Mobile Health to Promote Self-Management in Spina Bifida. *American journal of physical medicine & rehabilitation/Association of Academic Physiatrists*.
29. Faurholt-Jepsen, M., Frost, M., Ritz, C., Christensen, E. M., Jacoby, A. S., Mikkelsen, R. L., ... & Kessing, L. V. (2015). Daily electronic self-monitoring

- in bipolar disorder using smartphones—the MONARCA I trial: a randomized, placebo-controlled, single-blind, parallel group trial. *Psychological medicine*, 45(13), 2691-2704.
30. Glynn, L. G., Hayes, P. S., Casey, M., Glynn, F., Alvarez-Iglesias, A., Newell, J., ... & Murphy, A. W. (2014). Effectiveness of a smartphone application to promote physical activity in primary care: the SMART MOVE randomised controlled trial. *Br J Gen Pract*, 64(624), e384-e391.
31. Hansen, M. M. (2015). A feasibility pilot study on the use of complementary therapies delivered via mobile technologies on Icelandic surgical patients' reports of anxiety, pain, and self-efficacy in healing. *BMC complementary and alternative medicine*, 15(1), 1.
32. Howells, A., Ivtzan, I., & Eiroa-Orosa, F. J. (2014). Putting the 'app' in Happiness: A Randomised Controlled Trial of a Smartphone-Based Mindfulness Intervention to Enhance Wellbeing. *Journal of Happiness Studies*, 1-23.
33. Ji, L., Zhang, X., Fan, H., Han, M., Yang, H., Tang, L., ... & Li, D. (2015). drawMD APP-aided preoperative anesthesia education reduce parents anxiety and improve satisfaction. *Patient education and counselling*.
34. Johnson, N., Bree, O., Lalley, E. E., Rettler, K., Grande, P., Gani, M. O., & Ahamed, S. I. (2014). Effect of a social script iPad application for children with autism going to imaging. *Journal of pediatric nursing*, 29(6), 651-659.
35. Lappalainen, P., Kaipainen, K., Lappalainen, R., Hoffrén, H., Myllymäki, T., Kinnunen, M. L., & Korhonen, I. (2013). Feasibility of a personal health technology-based psychological intervention for men with stress and mood

- problems: randomized controlled pilot trial. *JMIR Research Protocols*, 2(1), e1.
36. Ly, K. H., Topooco, N., Cederlund, H., Wallin, A., Bergström, J., Molander, O., ... & Andersson, G. (2015). Smartphone-supported versus full behavioural activation for depression: a randomised controlled trial. *PloS one*, 10(5), e0126559.
37. Ly, K. H., Trüschel, A., Jarl, L., Magnusson, S., Windahl, T., Johansson, R., ... & Andersson, G. (2014). Behavioural activation versus mindfulness-based guided self-help treatment administered through a smartphone application: a randomised controlled trial. *BMJ open*, 4(1), e003440.
38. Ly, K. H., Dahl, J., Carlbring, P., & Andersson, G. (2012). Development and initial evaluation of a smartphone application based on acceptance and commitment therapy. *Springer Plus*, 1(1), 1-11.
39. Possemato, K., Kuhn, E., Johnson, E., Hoffman, J. E., Owen, J. E., Kanuri, N., ... & Brooks, E. (2016). Using PTSD Coach in primary care with and without clinician support: a pilot randomized controlled trial. *General hospital psychiatry*, 38, 94-98.
40. Quinn, C. C., Shardell, M. D., Terrin, M. L., Barr, E. A., Ballew, S. H., & Gruber-Baldini, A. L. (2011). Cluster-randomized trial of a mobile phone personalized behavioural intervention for blood glucose control. *Diabetes care*, DC\_110366.
41. Rizvi, S. L., Dimeff, L. A., Skutch, J., Carroll, D., & Linehan, M. M. (2011). A pilot study of the DBT coach: an interactive mobile phone application for individuals with borderline personality disorder and substance use disorder. *Behaviour Therapy*, 42(4), 589-600.

42. Roepke, A. M., Jaffee, S. R., Riffle, O. M., McGonigal, J., Broome, R., & Maxwell, B. (2015). Randomized controlled trial of SuperBetter, a smartphone-based/Internet-based self-help tool to reduce depressive symptoms. *Games for health journal*, 4(3), 235-246.
43. Varnfield, M., Karunanithi, M., Lee, C. K., Honeyman, E., Arnold, D., Ding, H., ... & Walters, D. L. (2014). Smartphone-based home care model improved use of cardiac rehabilitation in post myocardial infarction patients: results from a randomised controlled trial. *Heart*, heartjnl-2014.
44. Watts, S., Mackenzie, A., Thomas, C., Griskaitis, A., Mewton, L., Williams, A., & Andrews, G. (2013). CBT for depression: a pilot RCT comparing mobile phone vs. computer. *BMC psychiatry*, 13(1), 1.
45. Worthen-Chaudhari, L., Logan, K., McGonigal, J., Yeates, K., & Mysiw, W. J. (2015). Concussion Symptoms in Adolescents Are Alleviated Through Use of a Gamified Health App. *Archives of Physical Medicine and Rehabilitation*, 96(12), e8.
46. Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The phq-9. *Journal of general internal medicine*, 16(9), 606-613.
47. Andresen, E. M., Malmgren, J. A., Carter, W. B., & Patrick, D. L. (1994). Screening for Depression in Well Older Adults: *Evaluation of. Prev Med*, 10, 77-84.
48. Marteau, T. M., & Bekker, H. (1992). The development of a six-item short-form of the state scale of the Spielberger State—Trait Anxiety Inventory (STAI). *British Journal of Clinical Psychology*, 31(3), 301-306.
49. Kanter, J. W., Mulick, P. S., Busch, A. M., Berlin, K. S., & Martell, C. R. (2007). The Behavioural activation for depression scale (BADs):



- Psychometric properties and factor structure. *Journal of Psychopathology and Behavioural Assessment*, 29, 191-202.
50. Spitzer, R. L., Kroenke, K., Williams, J. B., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of internal medicine*, 166(10), 1092-1097.
51. Lemyre, L., & Tessier, R. (1988). Mesure de Stress Psychologique (MSP): Se sentir stressé-e. *Canadian Journal of Behavioural Science/Revue canadienne des sciences du comportement*, 20(3), 302.
52. Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied psychological measurement*, 1(3), 385-401.
53. Heimberg, R. G., Horner, K. J., Juster, H. R., Safren, S. A., Brown, E. J., Schneier, F. R., & Liebowitz, M. R. (1999). Psychometric properties of the Liebowitz social anxiety scale. *Psychological medicine*, 29(1), 199-212.
54. Fantino, B., & Moore, N. (2009). The self-reported Montgomery-Åsberg depression rating scale is a useful evaluative tool in major depressive disorder. *BMC psychiatry*, 9(1), 26.
55. Beck AT, Epstein N, Brown G, Steer RA (1988). "An inventory for measuring clinical anxiety: Psychometric properties". *Journal of Consulting and Clinical Psychology*. 56: 893–897. DOI:10.1037/0022-006x.56.6.893
56. Spielberger, C. D. (1989). *State-trait anxiety inventory: a comprehensive bibliography*. Consulting Psychologists Press.
57. Beck, A. T., Steer, R. A., & Brown, G. K. (1996). Beck depression inventory-II. *San Antonio*, 78(2), 490-8.

58. Hamilton, M. (1960). A rating scale for depression. *Journal of neurology, neurosurgery, and psychiatry*, 23(1), 56.
59. Zigmond, A. S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta psychiatrica scandinavica*, 67(6), 361-370.
60. Moerman, N., van Dam, F. S., Muller, M. J., & Oosting, H. (1996). The Amsterdam preoperative anxiety and information scale (APAIS). *Anesthesia & Analgesia*, 82(3), 445-451.
61. Jenkins, B. N., Fortier, M. A., Kaplan, S. H., Mayes, L. C., & Kain, Z. N. (2014). Development of a short version of the modified Yale Preoperative Anxiety Scale. *Anesthesia & Analgesia*, 119(3), 643-650.
62. Beck, A. T., Steer, R. A., & Carbin, M. G. (1988). Psychometric properties of the Beck Depression Inventory: Twenty-five years of evaluation. *Clinical psychology review*, 8(1), 77-100.
63. Henry, J. D., & Crawford, J. R. (2005). The short-form version of the Depression Anxiety Stress Scales (DASS-21): Construct validity and normative data in a large non-clinical sample. *British journal of clinical psychology*, 44(2), 227-239.
64. Faulstich, M. E., Carey, M. P., Ruggiero, L., Enyart, P., & Gresham, F. (1986). Assessment of depression in childhood and adolescence: An evaluation of the Center for Epidemiological Studies Depression Scale for Children (CES-DC). *The American journal of psychiatry*.
65. Cohen, J. (1988). *Statistical Power Analysis for the Behavioural Sciences*. 2nd edn. Hillsdale, New Jersey: L.

66. Shintani, N., Li, S., & Ellis, R. (2013). Comprehension-Based Versus Production-Based Grammar Instruction: A Meta-Analysis of Comparative Studies. *Language learning*, 63(2), 296-329.

## **Chapter 2 Journal Article**

**Comparing the expectations and acceptability of computerised and mHealth interventions vs face-to-face for mental health and physical health problems.**

## 2.1 Abstract

**Background:** There is an increased acceptance and demand for mobile health (mHealth) applications to manage behaviour change. However, the uptake and engagement of mHealth interventions by the public is relatively low.

**Objective:** The aim of this study was to explore the acceptability of mHealth interventions for both mental health and physical health problems. Additionally, whether there was a difference between what particular elements of the treatment the public considers important when hypothetically engaging in treatment for either a mental or physical health problems.

**Methods:** As part of wider project looking at the public's use of online interventions, a public sample (N = 216) recruited through emails and social media were asked to rate the acceptability of different treatment options for mental and physical health problems. Twelve pre-identified elements that could potentially influence an individual's decision to engage with treatment were used for comparison. Results were analysed using repeated measures MANOVA and post hoc tests.

**Results:** Participants rated a number of elements across physical health and mental health treatment as equally important: perceived helpfulness of the treatment, credibility, wait-time and accessibility. Participants anticipated that face-to-face therapy would be more likely to meet expectations for treatment for both physical and mental health problems compared to mHealth interventions. Computerised interventions in general would more likely meet expectations, compared to mobile applications or bibliotherapy for mental health problems. Participants indicated that

expectations were higher for the treatment of a mental health problem compared to the treatment of a physical health problem.

**Conclusion:** Although mHealth interventions have a good evidence for clinical effectiveness, the interventions still fall short of the public's expectations, particularly for helpfulness and credibility verses more traditional face to face interventions. To improve the credibility of such interventions, perhaps they need to be incorporated more widely into existing care, alongside face to face interventions and alongside regulatory standards for mHealth interventions.

*Keywords:* eHealth, mHealth, Computerised CBT, Mobile applications, Internet, Smartphones, Mental health, Blended Therapy.

## 2.2 Introduction

With the continual development of technology, there is potential to deliver technically advanced, intuitive health interventions to a substantial portion of the population [1]. In late 2015, there were approximately 103,000 unique mHealth applications across multiple mobile platforms (eg. Apple, Android, and Windows) [2] with approximately 3 billion downloads worldwide in 2015 [2]. Evidence suggests that there is an increased acceptance and demand for mobile health applications to manage behaviour change [3]. mHealth interventions include many of the elements used in face to face support such as interactivity, motivational messages, monitoring, and tools for behaviour change [4] and can often be tailored to individual needs [4, 5]. Substantial effort has been made to develop cost effective, easily accessible interventions for a variety of mental health conditions while trying to ensure clinical effectiveness, particularly computerised interventions [6]. Some studies have highlighted the effectiveness of computerised interventions (eg. Computerised cognitive behavioural therapy) versus waiting list for common mental health problems [7, 8, 9, 10, 11, 12, 13, 14, 15, and 16]. However, some questions still remain about long term effectiveness of the interventions, along with publication bias and methodological problems in some studies [17]. Additionally, uptake and adherence to open access online interventions can be very low [18]. Two studies found that registered public users' adherence to a 12 week CBT programme [19] and 5 CBT modules [20] was approximately 1% completion whereas this can be upwards of 50% in Randomised Controlled Trials (RCT) [20], regardless of treatment effectiveness. Given the number of studies supporting the clinical effectiveness of such types of interventions, [7, 8, 9, 10, 11, 12, 13, 14, 15, 16], it is understandable for health care organisations to want to

incorporate them into routine care. However, this could be at considerable cost for potentially relatively poor uptake. Low levels of uptake may be due to universal barriers such as availability, funding, clinician engagement and time allocated to resource promotion [21].

Currently in the UK, there is no regulatory framework guiding the assessment and regulation of mHealth applications. Despite the lack of regulatory framework, there is increasing pressure on healthcare (budget) providers to develop cheaper, clinically effective, accessible self-help interventions for physical and mental health problems. Consequently, mobile applications for depression are proving to be a cost effective intervention [22], showing moderate clinical effectiveness [23]. mHealth interventions targeting physical health have also been shown to be effective [24, 25, 26, 27] and well received [28] when managing conditions such as diabetes, and asthma. Users felt mHealth inventions were more accurate and efficient than more traditional self-monitoring [29]. mHealth interventions may provide users with a greater sense of anonymity, potentially improving adherence to treatment [30]. However, there is discrepancy between the apparent research effectiveness and cost effectiveness of such interventions and their uptake within the health care service. This discrepancy may be due to the majority of evidence being provided by specific RCT's. Generalising an RCT's findings into routine clinical practice can become problematic as there are often concerns about external validity and generalisability [31]. This is often not taken into consideration by clinicians and it becomes unclear how interventions are best applied to the larger population. Wallin et al. [32] highlighted that studies incorporating internet interventions identified concerns regarding low consumer uptake. This may indicate a hesitancy amongst the population to utilise internet interventions and that



this research may be biased as those who do participate are likely to be more accepting of alternative interventions from the outset.

To date, one study has looked into the acceptability of mHealth self-help interventions compared with face-to-face interventions for the treatment of mental health problems [33]. This study highlighted that potential consumers do not show the same interest in computerised and mHealth interventions as researchers and clinicians would hope, suggesting that such interventions may be viewed as inferior by consumers. Technological interventions may be viewed as mechanical and impersonal, [34] and the lack of a therapeutic alliance may have a negative impact on outcomes and engagement with alternative interventions [34]. There has been minimal research investigating the differences between consumers' expectations and acceptability of physical and mental health self-help interventions. There may be a disparity between the two types of services, from which changes could be adopted to benefit the other. Evidence suggests that the stigma attached to mental illness has been associated with failure to fully engage with treatment [35] and that consumers may have higher expectations of mental health treatment than of physical health treatment. mHealth interventions could potentially reduce stigma and other barriers [36], increasing treatment acceptability, promoting behavioural change and increasing overall improvement and treatment adherence [37]. Social cognitive theory (SCT) [38] offers a framework for understanding why consumers engage and maintain health behaviour change. The key elements of SCT are i. Potential barriers to making changes, ii. Perceived knowledge of health risks and benefits; iii, Costs and benefits of change, iv, Understanding health goals, v. social support and professional support [39]. A number

of these elements may be lacking or reduced in mHealth interventions; most noticeably, clinician support and addressing potential barriers to change.

The aim of this study was to explore the acceptability of face to face, bibliotherapy, computerised interventions and mobile applications for both mental health and physical health problems. As these interventions are designed to be accessed by the majority of the population, a survey was conducted to include a broad population with minimal exclusion criteria. Additionally, this study aimed to identify whether there was a difference between what the public considers important when hypothetically engaging in treatment for either a mental or physical health problem.

## **2.3 Methods**

### **2.3.1 Sample and Recruitment**

A survey was administered online for a three-month period between December 2015 and February 2016. The survey was created and launched using the web-based tool 'KwikSurvey'. The survey was separated into three sections. Firstly, demographic information, details of current technology use and use of internet for health seeking behaviour was gathered. The second section asked participants to consider their use of and expectations towards physical health interventions. Finally the use of and expectations of mental health interventions were explored.

Recruitment methods included the survey being hosted on a mental health website ([www.moodcafe.co.uk](http://www.moodcafe.co.uk)), advertised / promoted on / social media and email recruitment via local NHS mailing groups within physical and mental health. Local community groups and charities within England and Scotland were also targeted. Inclusion criteria included anyone over the age of 18 years and living in the United Kingdom who could

complete the survey in English. An advertisement was placed on Facebook, and Twitter, during the peak use periods, weekdays between 1-4pm [40]. Participants were encouraged to share the survey with their peers, who would then further share the study to others within their network, increasing the pool of participants – a technique known as snowballing. The survey was also specifically advertised through the public social media of charities, universities and social media users with a high number of followers.

A total of 415 people provided consent, and 393 completed the survey. 216 (55%) participants completed all sections of the survey. Retention for the Demographic and Technology use and attitudes towards support for personal problems online was n= 362 (92%). Retention for people's use of online resources for Physical Health problems and aspects of treatment preference was n = 264 (67%). Finally, retention for Mental Health problems and aspects of treatment preference was 216 (55%). The survey outlined the main aims of the study, informed consent and contact details of the lead author. Participants could opt to receive a summary of the research findings upon completion. Once informed consent was provided, participants were able to commence the online survey and were offered the chance to win £50 worth of Amazon vouchers in exchange for their participation. This study received ethics approval from The University of Edinburgh, Department of Clinical and Health Psychology Ethics Research Panel.

### **2.3.2 Online Survey**

The research team developed the survey questions on internet use by utilising previous surveys from within the literature, and consulting with those with expertise in the field and field-tested among NHS staff. It consisted of 55 questions (appendix 5)

encompassing the following areas: (1) sociodemographic characteristics (ethnicity, gender, age, location, employment status, education and marital status), (2) internet use, internet expertise and technology use, (3) internet use for personal problems, (4) use of internet for physical health problems, (5) acceptability of various physical health interventions, (6) use of internet for mental health problems, (7) acceptability of mental health interventions, (8) perceptions of current mental health information available online. Participants were also asked to rate how likely they would be to suggest particular interventions to others. The survey questions were presented in the same order to each participant; however, the order of some of the within-item responses was randomly assigned to decrease response bias [41]. The survey took participants an average of 24 minutes to complete.

The majority of the survey asked participants to rate the perceived importance of twelve elements that could influence members of the public decision to engage with particular health interventions. The participants were asked to rate on the importance of the twelve elements outlined in Table 1. The elements were initially devised in a study by Musiat et al. [33] from a focus group identifying particular features and qualities that can affect engagement with mental health interventions (eg. talking therapies, mental health websites, mental health mobile applications etc.). For the purpose of this study the same elements were also used to understand engagement with physical health interventions (eg. physiotherapy interventions, smoking cessation support, medical condition management etc.).

**Table 1.** Evaluation dimensions for Physical and Mental Health interventions

Helps with the problem	Appeals/ Is appealing / has positive appeal
Is accessible without waiting time	Can be accessed at a convenient time
Motivates me to get better	Is free of charge
Is credible	Can be accessed anonymously
Can be accessed at a convenient location	Provides feedback
Includes personal support	Suits own learning style

Initially, participants were asked to assess how important each of the elements were to them, if they were to receive a physical or mental health treatment. They were asked to rate each element on a 7 point Likert scale from 1 “not important at all” to 7 “very important”. Following this, participants were given a brief explanation of four separate interventions for treating physical and mental health problems. A face to face intervention was described as *‘a type of treatment, where patients meet a health professional for a limited number of sessions’*. A self-help book was described as *‘a type of treatment designed to provide a step-by-step manual for getting better’*. A computerised intervention was described as *‘a type of treatment where patients accesses self-help material on a computer, often in the form of weekly session. Some programs can include email contact or interactive component’*. Finally, smartphone intervention was described as *‘apps often provide information as well as tools and advice to overcome problems’*. Participants were asked to rate how each of the twelve elements would be met by the particular interventions. These elements were rated on a 7 point Likert scale from 1 “would not meet my expectations at all” to 7 “would fully meet my expectations”. The participants rated on physical and mental health interventions in separate questions.

### **2.3.3 Statistical analysis**

The data was exported from 'KwikSurvey' to Excel, then converted to SPSS 21 for statistical analyses. Descriptive statistics were carried out for all items. Comparisons were deemed statistically significant with a P value of less than 0.05. We utilised a repeated measures Multivariate Analysis of Variance (MANOVA) where possible to compare physical and mental health treatment expectations for each intervention type on the 12 elements. This was in a bid to minimise the risk of a Type 1 error. However, for parametric tests to be used, certain assumptions must be met. The twelve elements were measured on a 7 point Likert scale, which is usually classified as discrete or ordinal data. Clark-Carter [42] suggests that if ordinal data has a sufficient number of levels (usually 7) then it can be converted to continuous data and parametric tests used. All other assumptions of a MANOVA were met. Univariate statistics (t-test and ANOVA's) were carried out post-hoc to determine which individual elements contributed to a significant difference. Additionally, univariate statistics, Analysis of Variance (ANOVA) were carried out to compare the differences of individual elements across the various interventions, with further post hoc analysis conducted.

### **2.3.4 Power**

Power calculations were carried out assuming a power of 0.8 and error value of 0.05. G-power 3 was used for all calculations [43]. For a MANOVA: Repeated measures, within factors, across 12 variables, assuming a medium effect size, and a power of 0.8, G-power 3 [43] calculated a total sample size of 82 participants were required.

## **2.4 Results**

### **2.4.1 Demographic**

Table 2 outlines the demographic characteristics of those who completed the survey. The majority of the sample were white, female and within the 25-34 age category (38%). Most of the sample identified themselves as employed (76%) and with a post graduate degree (45%). The majority of the sample were based in Scotland (64.5%). Two hundred and eleven (98%) participants reported that they had searched online for information on a physical health problem in the past and 176 (82%) had searched online for information on a mental health problem. Overall the diversity of the sample recruited was relatively low.

Table 2. Demographic characteristics of study participants (n=216)

<b>Item</b>	<b>Characteristics</b>	<b>n(%)</b>
Ethnicity	White	210 (97.2)
	Mixed	2 (0.9)
	Asian, Asian Scottish or Asian British	1 (0.5)
	Black, Black Scottish or Black British	2 (0.9)
	Other Ethnic Background	1 (0.5)
Gender	Female	172 (79.6)
	Male	41 (19)
	Other	1 (0.5)
	Not Specified	2 (0.9)
Age	18-24	24 (11.1)
	25-34	83 (38.4)
	35-44	49 (22.7)
	45-54	33 (15.3)
	55-64	22 (10.2)
	65-74	5 (2.3)
Location	Scotland	140 (64.5)
	England	66 (30.6)
	Other	6 (3)
	Not Specified	4 (1.9)
Employment Status	Employed	165 (76.4)
	Self-Employed	19 (8.8)
	Out of work but looking	5 (2.3)
	Out of work, not looking	4(1.9)
	Carer	3 (1.4)
	Student	28 (28)
	Retired	4 (1.9)
	Unable to Work	6 (2.8)
	Voluntary Work	12 (5.6)
	Percentages don't equal 100% as multiple answers could be selected	
Education	No Schooling Complete	1 (0.5)
	Some Secondary No Qualifications	1 (0.5)
	Secondary School GCSE/Standard Grade	11 (5.1)
	A Level/ Highers	21 (9.7)
	Undergraduate Degree	64 (29.6)
	Trade/ Technical/Vocational Training	12 (5.6)
	Post Graduate Degree	97 (44.9)
	Not Specified	9 (4.2)
Marital Status	Single, Never Married	72 (33.3)
	Married or Domestic Partnership	123 (56.9)
	Widowed	1 (0.5)
	Divorced	10 (4.6)
	Separated	7 (3.2)
	Prefer Not to Say	3 (1.4)



## 2.4.2 Expectations towards physical health interventions

Each participant rated the importance of the twelve previously identified elements when receiving a treatment for a physical health problem. Each element was rated from 1 (not important at all) to 7 very important. ‘Helping with the problem’, ‘being accessible without wait time’ and ‘seeming credible’ were regarded as the most important. Having personal support available during the intervention and the anonymity assured were rated as least important. All elements scored as important ranging from 4.37 to 6.43 (Table 3).

Table 3. Importance ratings for 12 dimensions in relation to physical health interventions in order of importance (highest on top)

Dimensions (High to Low)	Mean (SD)
Helps with the problem	6.43 (0.922)
Is accessible without a wait time	6.35 (1.054)
Is credible	6.29 (1.130)
Can be accessed at a convenient time	6.07 (1.112)
Can be accessed at a convenient location	6.02 (1.136)
Is free of charge	5.81 (1.472)
Motivates to get better	5.71 (1.321)
Appeals	5.25 (1.508)
Suits own learning style	5.25 (1.615)
Provides feedback	5.08 (1.494)
Can be accessed anonymously	4.81 (1.92)
Includes personal support	4.37 (1.686)

### 2.4.3 Expectations towards mental health interventions

Participants rated the importance of the twelve elements when receiving treatment for a mental health problem. Again, the three most important elements were ‘Helping with the problem’, ‘seeming credible’ and ‘being accessible without wait time’. Similarly, the least important aspects were anonymity and personal support. However, each of the elements were rated as highly important with the scores ranging from 5.38 to 6.60 (Table 4).

Table 4. Importance ratings for 12 dimensions in relation to mental health interventions in order of importance (highest on top)

Dimensions (High to Low)	Mean (SD)
Helps with the problem	6.60 (0.889)
Is credible	6.52 (0.929)
Is accessible without a wait time	6.45 (0.979)
Motivates to get better	6.24 (1.142)
Can be accessed at a convenient time	6.22 (1.128)
Can be accessed at a convenient location	6.16 (1.097)
Appeals	6.07 (1.156)
Is free of charge	5.96 (1.324)
Suits own learning style	5.80 (1.429)
Provides feedback	5.78 (1.389)
Can be accessed anonymously	5.66 (1.747)
Includes personal support	5.38 (1.577)

#### **2.4.4 Comparisons of importance**

A repeated measures MANOVA was executed to detect differences between participants' ratings of importance of the twelve elements for mental health interventions and physical health interventions. The analysis detected a significant difference between mental health and physical health interventions,  $V=0.35$ ,  $F(11, 176) = 8.65$ ,  $p<0.001$ . At a univariate level, this difference between the importance of the twelve elements for physical and mental health was significant for helping with the problem ( $p=0.041$ ), motivating ( $p<0.001$ ), and credible treatment ( $p=0.004$ ), providing personal support ( $p<0.001$ ), being an appealing treatment ( $p<0.001$ ), anonymous ( $p<0.001$ ), providing feedback ( $p<0.001$ ), and suiting learning style ( $p<0.001$ ). For all of the significant elements, the mean ratings show that mental health was rated as more important than physical health.

#### **2.4.5 Physical Health Interventions**

##### **Acceptability of different physical health interventions**

Participants were required to rate from 1 (would not meet expectations) to 7 (would fully meet expectations), to what degree they thought a specific treatment for physical health problems would meet their expectations on the twelve identified elements. How well the participants felt that each specific treatment met their expectations compared with overall importance of the elements is shown in Figure 1.

### **Face to Face**

When accessing a face-to-face treatment for physical health, participants felt that the treatment would meet their expectations to a moderate to high degree for all of the elements. Rated particularly highly were credibility and helpfulness. However, ‘anonymity’, ‘accessible at a convenient time’ and ‘personal support’ were rated lowest.

### **Bibliotherapy**

When accessing a bibliotherapy treatment for physical health, participants felt that the treatment would partially meet their expectations for some of the elements. Most highly rated were: wait-time, location, being accessible at a convenient time and anonymity. Particularly low scores were recorded for personal support and feedback.

### **Computerised Interventions**

Participants predicted that computerised interventions for physical health treatment would likely meet their expectation to moderate degree for almost all elements, apart from personal support which was considered less likely to be available. Rated particularly highly were wait time and being accessible at a convenient time.

### **Mobile Applications**

Overall, participants indicated that mobile applications would meet their expectations to a moderate degree for a physical health treatment. Participants had a high expectation that mobile applications would be accessible, immediately available and

afford users anonymity. However, they did not expect them to be able to offer a high degree of personal support.

### **Intervention comparison of particular elements**

For physical health interventions, the top three expectations were that they would be helpful, accessible with minimal or no wait and credible. Additional analyses compared the different types of intervention for these three expectations. For helpfulness, Mauchly's test indicated that the assumption of sphericity had been violated,  $\chi^2(5) = 23.87$ ,  $p < 0.05$ , therefore multivariate tests are reported ( $\epsilon = 0.933$ ). The results show that there was a significant difference between types of interventions on their perceived helpfulness,  $V = 0.596$ ,  $F(3, 200) = 98.50$ ,  $p < 0.01$ ,  $\omega^2 = 0.596$ . Post hoc analysis using the Bonferroni correction revealed that participants felt that face to face treatment was more likely to meet their expectations for helpfulness than bibliotherapy ( $p < 0.001$ ), computerised treatment ( $p < 0.001$ ) and a mobile application ( $p < 0.001$ ). Computerised treatment was significantly more like to meet expectations than bibliotherapy ( $p < 0.001$ ). However, there was no significant difference between mobile applications and computerised treatment ( $p = 0.095$ ) or bibliography and mobile applications ( $p = 0.073$ ).

For wait time, sphericity had been violated,  $\chi^2(5) = 140.879$ ,  $p < 0.05$ , therefore multivariate tests are reported ( $\epsilon = 0.687$ ). The results show that there was a significant difference between types of interventions on their perceived wait time,  $V = 0.74$ ,  $F(3, 206) = 5.458$ ,  $p = 0.001$ ,  $\omega^2 = 0.074$ . Post hoc analysis using the Bonferroni correction revealed that participants felt that face to face treatment was less likely to meet

expectations for wait time than bibliotherapy ( $p=0.017$ ), computerised treatment ( $p=0.001$ ) and a mobile application ( $p=0.001$ ). There was no significant difference between mobile applications, computerised treatment and bibliography for wait time.

Finally for credibility of the intervention, sphericity had been violated,  $\chi^2(5) = 22.576$ ,  $p<0.05$ , therefore multivariate tests are reported ( $\epsilon=0.931$ ). The results show that there was a significant difference between types of interventions on their perceived credibility,  $V=0.52$ ,  $F(3, 195) = 0.393$ ,  $p<0.001$ ,  $\omega^2 = 0.520$ . Post hoc analysis using the Bonferroni correction revealed that participants felt that face to face treatment was more likely to be perceived as more credible than bibliotherapy ( $p<0.001$ ), computerised treatment ( $p<0.001$ ), and a mobile application ( $p<0.001$ ). Computerised treatment was perceived as more credible than a mobile application ( $p=0.022$ ) but not bibliotherapy ( $p=1.000$ ). There was no significant difference between mobile applications and bibliotherapy ( $p=1.000$ ).

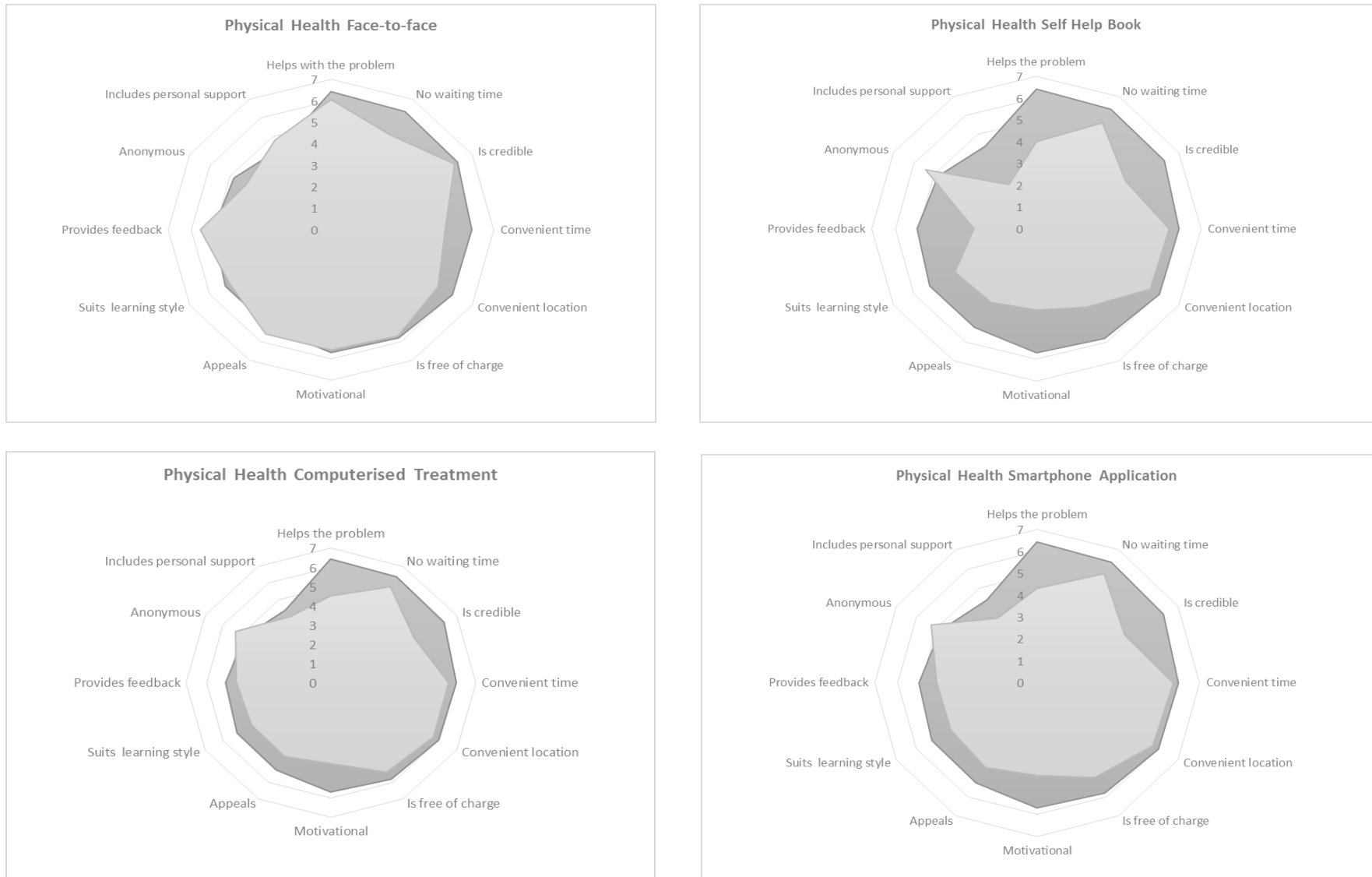


Figure 1. Importance and expectations towards different physical health treatment options. Adapted from Musiat et al. [33]

## **2.4.6 Mental Health Interventions**

### **Acceptability of different mental health interventions**

Participants were also requested to rate their expectations of various mental health interventions from 1 (would not meet expectations) to 7 (would fully meet expectations) on the twelve pre-identified elements. How well the participants felt that each specific treatment met their expectations compared with the overall importance, are shown in Figure 2.

#### **Face to Face**

When accessing a face-to-face treatment for mental health, participants felt that the treatment would meet their expectations to a moderate to high degree for all of the elements. Rated particularly highly were credibility and helpfulness. However, anonymity and wait time were rated less highly.

#### **Bibliotherapy**

When accessing a bibliotherapy treatment for mental health, participants felt that the treatment would partially meet their expectations for some of the elements particularly location, convenient time and anonymity. Particularly low rated were personal support and feedback.

#### **Computerised**

Participants predicted that computerised interventions for mental health would likely meet their expectation reasonably for almost all elements, apart from personal support.



Rated particularly highly were wait time and being accessible at a convenient location and time, being free and anonymous.

### **Mobile application**

For a mental health treatment participants highlighted that a mobile application would meet expectations for accessibility and wait time, but scores were considerably lower on a number of elements including ‘motivates to get better’, ‘feedback’, ‘personal support’ and ‘being an appealing treatment option’.

### **Treatment comparison of particular elements**

For mental health treatment, the top three expectations were again that they would be helpful, credible and accessible with minimal or no wait. Additional analyses compared the different types of intervention for these three expectations. For helpfulness, Mauchly’s test indicated that the assumption of sphericity had been violated,  $\chi^2(5) = 36.03$ ,  $p < 0.05$ , therefore multivariate tests are reported ( $\epsilon = 0.899$ ). The results show that there was a significant difference between types of interventions on their perceived helpfulness,  $V = 0.722$ ,  $F(3, 197) = 170.226$ ,  $p < 0.01$ ,  $\omega^2 = 0.722$ . Post hoc analysis using the Bonferroni correction revealed that participants felt that face to face treatment was more likely to meet expectations for helpfulness than bibliotherapy ( $p < 0.001$ ), computerised treatment ( $p < 0.001$ ) and a mobile application ( $p < 0.001$ ). Computerised treatment was significantly more likely to meet expectations than bibliotherapy ( $p = 0.048$ ) and mobile application ( $p = 0.001$ ). However there was no significant difference between mobile applications and bibliotherapy ( $p = 1.0000$ ).

For wait time, sphericity had been violated,  $\chi^2(5) = 272.089$ ,  $p < 0.05$ , therefore multivariate tests are reported ( $\epsilon = 0.529$ ). The results showed that there was a significant difference between types of interventions on their perceived wait-time,  $V = 0.128$ ,  $F(3, 198) = 9.656$ ,  $p < 0.001$ ,  $\omega^2 = 0.128$ . Post hoc analysis using the Bonferroni correction revealed that participants felt that face to face treatment was less likely to meet expectations for wait time than bibliotherapy ( $p < 0.001$ ), computerised treatment ( $p < 0.001$ ) and a mobile application ( $p < 0.001$ ). There was no significant difference between mobile applications, computerised treatment and bibliotherapy for wait time.

Finally for credibility of the intervention, sphericity had been violated,  $\chi^2(5) = 34.192$ ,  $p < 0.05$ , therefore multivariate tests are reported ( $\epsilon = 0.895$ ). The results show that there was a significant difference between types of interventions on their perceived credibility,  $V = 0.565$ ,  $F(3, 196) = 84.727$ ,  $p < 0.001$ ,  $\omega^2 = 0.565$ . Post hoc analysis using the Bonferroni correction revealed that participants felt that face to face treatment was more likely to be perceived as more credible than bibliotherapy ( $p < 0.001$ ), computerised treatment ( $p < 0.001$ ), and a mobile application ( $p < 0.001$ ). Computerised treatment was perceived as more credible than a mobile application ( $p < 0.001$ ) but not bibliotherapy ( $p = 0.533$ ). There was no significant difference between mobile applications and bibliotherapy ( $p = 0.053$ ).

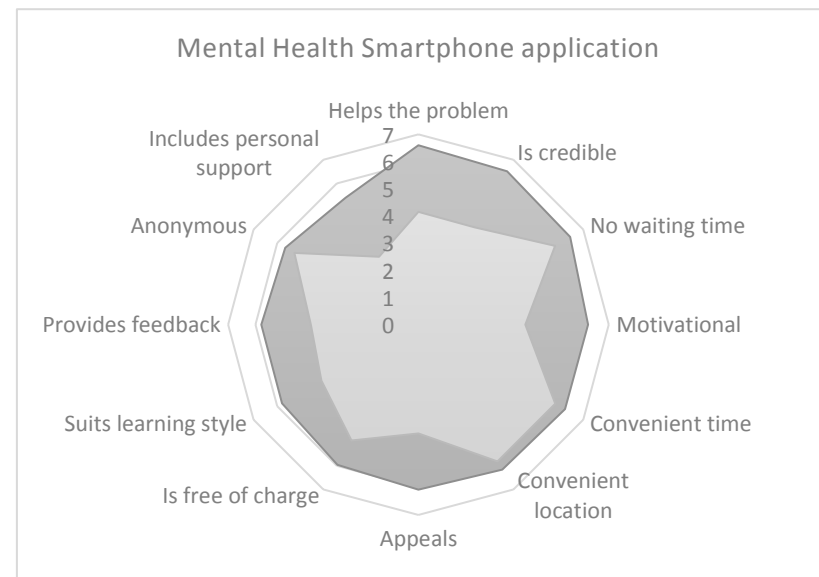
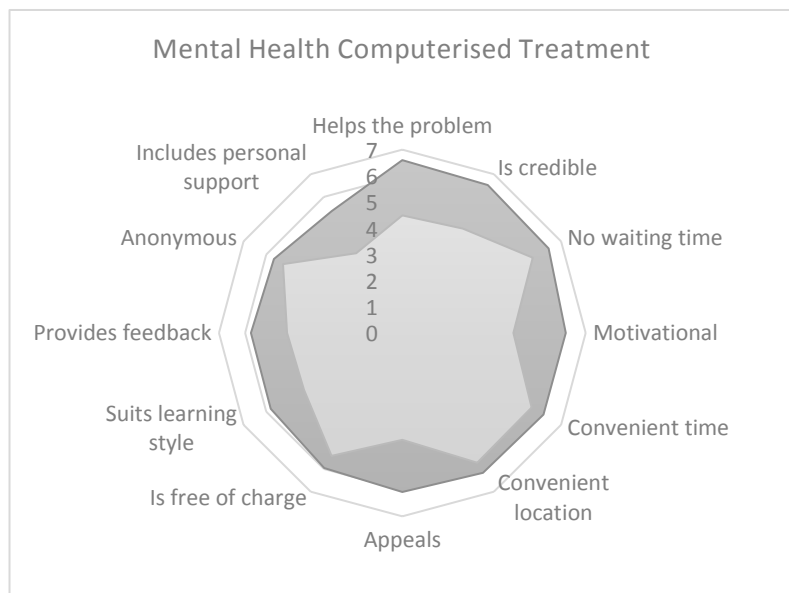
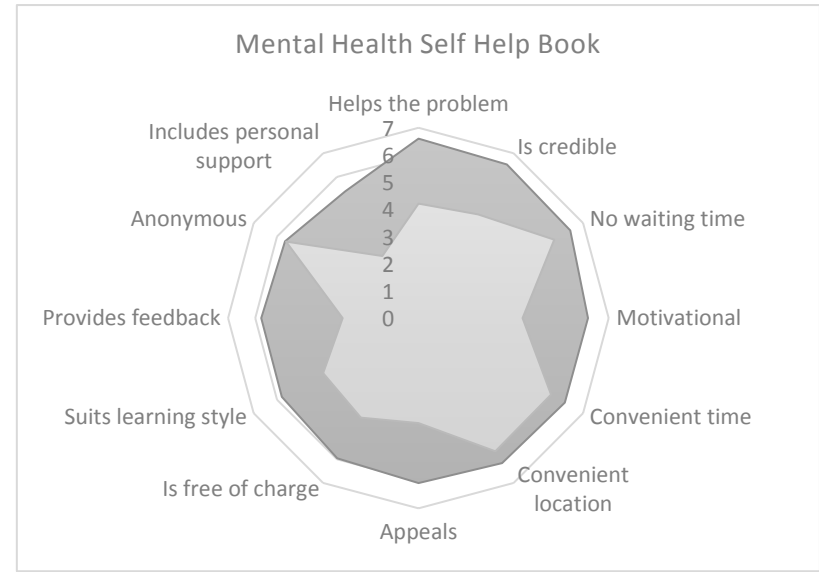
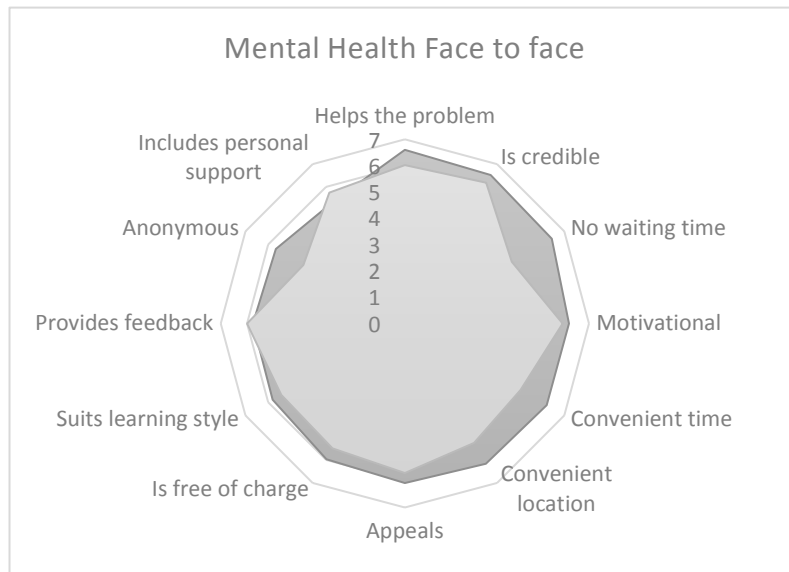


Figure 2. Importance and expectations towards different mental health treatment options. Adapted from Musiat et al. [33]

## **2.4.7 Comparisons of different interventions**

### **Face to Face**

A repeated measures MANOVA was executed to detect differences between participants' acceptability of similar interventions for physical health and mental health. The analysis detected a significant difference between mental health and physical health acceptability of face to face treatment across the twelve elements,  $V=0.28$ ,  $F(11, 174) = 5.991$ ,  $p<0.001$ . At a univariate level, expectations were more likely to be met for wait-time ( $p=0.001$ ) within a physical health treatment. Whereas, for motivation ( $p<0.001$ ), providing personal support ( $p<0.001$ ), providing feedback ( $p<0.001$ ), and suiting learning style ( $p=0.001$ ) mental health treatment would more likely meet expectations.

### **Bibliotherapy**

A repeated measures MANOVA did not detect a significant difference between mental health and physical health acceptability of bibliography treatment across the twelve elements,  $V=0.92$ ,  $F(11, 175) = 1.603$ ,  $p=0.101$ .

### **Computerised**

A repeated measures MANOVA detected a significant difference between mental health and physical health acceptability of computerised treatment across the twelve elements,  $V=0.195$ ,  $F(11, 175) = 3.844$ ,  $p<0.001$ . At a univariate level, expectations were more likely to be met for appealing ( $p=0.002$ ) and personal support ( $p=0.001$ ) within a physical health treatment.

## **Mobile application**

A repeated measures MANOVA detected a significant difference between mental health and physical health acceptability of mobile applications across the twelve elements,  $V=0.159$ ,  $F(11, 165) = 2.845$ ,  $p=0.002$ . At a univariate level, expectations were more likely to be met for motivation ( $p=0.01$ ), providing personal support ( $p<0.001$ ), appealing ( $p<0.001$ ), and providing feedback ( $p=0.001$ ) for physical health treatments.

## **2.5 Discussion**

### **2.5.1 Principal Findings**

This study explored the differences in participants' attitudes and expectations towards various types of treatment modalities when considering a physical health or a mental health problem. In particular, it assessed whether ratings for 12 pre-identified elements differed depending on whether treatment was delivered face-to-face, via bibliotherapy, a computerised intervention, or using a mobile application.

In general, participants rated a number of elements across physical and mental health treatment as equally important. Whether the intervention would help with the problem was considered the most important element for both. Credibility, wait-time and accessibility were also important across both interventions. Interestingly, motivation to recover was a factor considered to be more important for mental health interventions. mHealth interventions, appeared not to be regarded as motivating compared to face to

face. Wilhelmsen and colleagues [44] concluded that enhancing motivation was key to increasing compliance with alternative eHealth interventions. For mHealth interventions to be utilised effectively, key elements of the intervention need to be relayed to participants: communicating the effectiveness of such interventions, using other people as support networks, whether the intervention can provide qualified feedback from a professional and the clinician acknowledging concerns regarding the intervention with flexibility and understanding. Some of these elements appear to be lacking in the implementation of the majority of eHealth and mHealth interventions.

For both physical and mental health interventions, the expectation of receiving personal support during treatment was rated low. Paradoxically this finding is not reflected through participants' perceived acceptability of intervention type, as face to face treatment may be thought to include more personal support yet was viewed as more acceptable. This finding was contrary to the previous study by Musiat et al. [33]. While the lack of importance placed on the element of personal support within this sample should benefit the acceptability of self-help inventions, this is not reflected in the results. An alternative hypothesis may be that low scores for personal support and feedback could indicate that these were weak features of the intervention. Furthermore, it may indicate these expectations did not play an important role when engaging in that form of therapy.

When comparing the top three elements for both mental and physical health problems, face to face treatment was perceived as most likely to be helpful. This is supported by previous studies [33 & 45], which reported that face to face interventions were perceived

as more helpful than any of the self-help interventions. Interestingly, computerised treatment (eg. computerised-CBT) was perceived to be more helpful in treating mental health problems than a mobile application or bibliotherapy, whereas for physical health treatment, computerised treatment was perceived as being superior only to bibliotherapy. Waller et al. [46] found computerised CBT to be more user friendly than bibliotherapy and reported that some users found it helpful and were appreciative of their opportunity to access alternative interventions; however, other users reported their experience as too fast paced, demanding and patronising, and cited a preference for therapist led treatment.

For both physical and mental health problems, face to face interventions met expectations for credibility over the other forms of intervention, with computerised treatment superior only to mobile applications. Remarkably, mobile applications have evolved from computerised interventions, but consumers seem wary of the credibility of mobile applications. This could be due to the increasing number of reduced quality mobile applications available on various platforms (eg. Apple, Android and Windows) for various conditions [23]. A previous systematic review highlighted that acceptability for mobile interventions was higher in participants under the age of 35 years. Also acceptability of mobile phone interventions was higher if the intervention was supported by a clinician rather than standalone [47]. mHealth interventions are still in their infancy within healthcare settings, so perceived helpfulness and credibility may increase when such interventions become more mainstream and familiar to users. Previous research has highlighted that prior to recommending alternative interventions, aspects such as the abilities, needs and preferences of the patient must be considered [48]. Many eHealth and

mHealth interventions are text heavy and require a certain level of education, conceptual and verbal reasoning skill [49]. Therefore it is conceivable that no one type of intervention can be suitable for an entire patient group.

With developers moving towards mobile support for health interventions, many development teams are consulting with health care professions during the development phase of mobile applications [2], however the public has little information about such interactions to inform their decision of credibility of a mobile application. Whereas, computerised interventions appear to be more embedded into health care practice and endorsed by various health boards e.g. Beating the Blues and Moodgym [50]. Waller et al. [46] highlighted clinicians concerns regarding the introduction of computerised interventions. Some felt that the intervention should only be a supplement to traditional face to face interventions and concerns were raised about institutional backing of the intervention and its overall clinical effectiveness. Clinicians' reservations for such interventions could be a significant barrier to the uptake of alternative interventions in both physical and mental health.

Unsurprisingly, all forms of self-help were expected to be accessible with minimal waiting time, as opposed to the expectation that face to face support would involve some additional waiting time within both physical and mental health services. There was no difference between the types of self-help intervention. This highlights the public's awareness of the speed at which they could access self-help interventions.

Perhaps most interestingly, there appeared to be an overall higher expectation of treatment for mental health problems than physical health problems. This difference in expectation



seemed to be centred on how the intervention is delivered rather than accessibility or convenience. Perhaps this higher expectation is either due to the lack of understanding of what mental health treatment entails or that there is a perception that mental health problems are more complex than physical health problems to resolve. Therefore, it is possible that mHealth interventions could be more widely utilised in physical health treatment initially. This could potentially improve the credibility of mHealth interventions in general.

### **2.5.2 Future directions**

It would seem that particularly for mental health interventions, blended interventions could provide an alternative approach and could meet a number of the elements more effectively. Within blended therapy certain aspects of the face to face treatment are replaced by the supporting eHealth interventions but the therapeutic relationship is maintained [6]. Blending self-help, computer interventions and mobile applications with face to face treatment, could hypothetically reduce the number of sessions clinicians offer [51], because of alternative forms of support and information provided by technology or other resources. The technology can promote self-management capabilities of patients, reduce impact and costs on services [6]. Blended therapy could potentially reduce wait time [51] while also increasing the public's engagement and views of credibility of alternative methods of delivery, with the public knowing they have the personal support of the clinician. However, for blended therapy to be successful Wentzel et al. [48], highlighted that the intervention needs to be credible, motivating, supportive and that the user must be willing to engage. Additional research is required as the evidence to date is

sparse and conflicting, particularly in regard to additional benefits or cost effectiveness [52, 53, 54, 55].

Blended therapy links well with the SCT [38] framework, as it can potentially cover key elements for engagement in health behaviour change, specifically as the face to face component can address potential barriers to making changes, assessing someone's knowledge of health risks and benefits while introducing costs and benefits of change, and providing professional support. The technological component can introduce and update health goals while introducing social support. Interestingly, within the SCT framework, many of the key elements for engagement require the skill of the clinician. However, only a few elements identified by Bandura [38] are present within the elements highlighted by service users [33]. This again highlights that while mHealth interventions address a number of the elements originally identified by service users, they address very few of the key elements of engagement of health behaviour change [38].

There do not seem to be many substantial barriers with respect to acceptability of mHealth interventions but there is a need for such interventions to actually be helpful and be perceived as such. Further research would be needed to assess the best way to use mHealth interventions within a clinical setting, particularly when combined with more traditional face to face interventions. In addition, there needs to be more awareness of how the available computerised and mobile applications reduce demands on services, and the encouragement of their utilisation with the general public out with clinical services. For mHealth interventions to be widely adopted into routine therapeutic practice there needs to be further development of computerised and mobile applications that are

specially designed for a blended therapeutic approach. Attention also needs to focus on the potential and actual health economics of self-help and blended approaches.

Future research could centre on clinicians' views of acceptability and expectations of self-help interventions and how this impacts upon their implementation of such interventions in their therapy. Another area of research requiring further exploration may be to investigate whether the perceived inflexibility with mHealth interventions poses a potential barrier to engagement. Van de Vaart et al. [56] felt that when recommending the use of such interventions, clinicians needed to approach the implementation with a certain amount of flexibility, making the programs more individualised and less prescriptive and manualised.

### **2.5.3 Strengths and Limitations**

This research study is one of a limited number of studies comparing acceptability and public expectations of both physical health and mental health interventions. The primary recruitment via social media offered a cost effective recruitment strategy that increased the pool of applicants reached within a short time scale, and allowed for a targeted approach to incorporate those within certain geographical locations. However, recruiting from social media assumes a certain amount of computer literacy. The population is likely to have more exposure to various forms of technology, than if the sample was recruited using alternative methods, potentially introducing a certain level of bias towards technological interventions. Also the sample was obtained using snowball sampling via

Facebook, potentially calling to question the generalisability of the results. This is because snowball samples are biased towards individuals with interrelationships, and miss those who are isolated and not connected to any network the researcher has identified [57]. Another potential limitation is the generalisation of the twelve elements [33] originally identified for mental health interventions to physical health interventions. It was felt that the original elements could be comparable for physical health interventions. However, the original elements were from a service user group with experience of mental health problems, so potentially additional elements that are more applicable for physical health interventions have been overlooked. Additionally, the elements touched on more general expectations of treatment, focusing on structure and setup of such interventions, rather than the components within particular elements that were helpful. For example helpfulness might carry more weight than other elements when it comes to engagement with an intervention. The overall elements do not account for components such as relationship with the person or device or the communication of difficult content to a device rather than a person. Previous research has identified that these factors influence participant views about the acceptability of computerised interventions, which could then be more generalised to mobile applications [34].

Another important limitation of the study is the overall demographic of the population. The majority of the sample were highly educated, with a large proportion under the age of 35 years. Jansen et al. [58] highlighted that there is a higher preference for eHealth interventions among this particular population, therefore the acceptability and expectations of mobile applications and computerised interventions could be overestimated.

## 2.5.4 Conclusion

The findings of the current study highlights, that although stand-alone mHealth interventions have a good evidence for clinical use, the interventions still fall short of the public's expectations, particularly for helpfulness and credibility verses more traditional face to face interventions, within both physical and mental health. The study highlights that there may be more expectation of mental health interventions than physical health and as such, perhaps such mHealth interventions may be introduced more successfully within physical health services. The study also highlights that the expectations of treatment could be more widely met by blended therapeutic interventions, particularly with younger adults with higher education. Self-management interventions could be incorporated more flexibly by the clinician to supplement certain areas of clinical work. Within this framework, clinicians could more readily explain the evidence for such interventions while still retaining important components of the therapeutic relationship. Perhaps future research could further investigate the health economics and implementation of more blended therapeutic approaches incorporating face to face and mHealth interventions. Health services should consider developing a regulatory framework for the use of mHealth applications, while reintroducing information about the mHealth interventions it currently recommends for both physical and mental health problems. The public and clinicians' expectations and acceptability of treatment are likely to be guided by information about the helpfulness and credibility of such interventions, which at present is poorly disseminated within routine clinical practice.

## 2.6 Abbreviations

mHealth	Mobile Health
RCT	Randomised Controlled Trial
SCT	Social Cognitive Theory
MANOVA	Multivariate Analysis of Variance
ANOVA	Analysis of Variance

## 2.7 References

1. Free, C., Phillips, G., Galli, L., Watson, L., Felix, L., Edwards, P., & Haines, A. (2013). The effectiveness of mobile-health technology-based health behaviour change or disease management interventions for health care consumers: a systematic review. *PLoS med*, *10*(1), e1001362.
2. MHealth App Developer Economics 2015 - research2guidance. (n.d.). Retrieved November 25, 2015, from <http://www.bing.com/cr?IG=595ABB01254346AD9E921920EC165698&CID=0C89021CCEDA612D0C43093BCFDC60C0&rd=1&h=qzez5Qn55HYZ-WKQnsiyCKk3tButwDtbWHXRUSGcYYM&v=1&r=http%3a%2f%2fwww.research2guidance.com%2fwp-content%2fuploads%2f2015%2f11%2fr2g-mHealth-App-Developer-Economics-2015-Preview.pdf&p=DevEx,5065.1>
3. Payne, H. E., Lister, C., West, J. H., & Bernhardt, J. M. (2015). Behavioural functionality of mobile apps in health interventions: a systematic review of the literature. *JMIR mHealth and uHealth*, *3*(1).
4. Free, C., Whittaker, R., Knight, R., Abramsky, T., Rodgers, A., & Roberts, I. G. (2009). Txt2stop: a pilot randomised controlled trial of mobile phone-based smoking cessation support. *Tobacco control*, *18*(2), 88-91.
5. Allen, J. K., Stephens, J., Dennison Himmelfarb, C. R., Stewart, K. J., & Hauck, S. (2013). Randomized controlled pilot study testing use of smartphone technology for obesity treatment. *Journal of obesity*, *2013*.
6. Romijn, G., Riper, H., Kok, R., Donker, T., Goorden, M., van Roijen, L. H., & Koning, J. (2015). Cost-effectiveness of blended vs. face-to-face cognitive

behavioural therapy for severe anxiety disorders: study protocol of a randomized controlled trial. *BMC psychiatry*, 15(1), 1.

7. Cuijpers, P., Donker, T., van Straten, A., Li, J., & Andersson, G. (2010). Is guided self-help as effective as face-to-face psychotherapy for depression and anxiety disorders? A systematic review and meta-analysis of comparative outcome studies. *Psychological medicine*, 40(12), 1943-1957.
8. Spek, V., Cuijpers, P. I. M., Nyklíček, I., Riper, H., Keyzer, J., & Pop, V. (2007). Internet-based cognitive behaviour therapy for symptoms of depression and anxiety: a meta-analysis. *Psychological medicine*, 37(03), 319-328.
9. Andrews, G., Cuijpers, P., Craske, M. G., McEvoy, P., & Titov, N. (2010). Computer therapy for the anxiety and depressive disorders is effective, acceptable and practical health care: a meta-analysis. *PloS one*, 5(10), e13196.
10. Andersson, G., & Cuijpers, P. (2009). Internet-based and other computerized psychological treatments for adult depression: a meta-analysis. *Cognitive behaviour therapy*, 38(4), 196-205.
11. Reger, M. A., & Gahm, G. A. (2009). A meta-analysis of the effects of internet- and computer-based cognitive-behavioural treatments for anxiety. *Journal of clinical psychology*, 65(1), 53-75.
12. Lewis, C., Pearce, J., & Bisson, J. I. (2012). Efficacy, cost-effectiveness and acceptability of self-help interventions for anxiety disorders: systematic review. *The British journal of psychiatry*, 200(1), 15-21.
13. Andersson, G., Cuijpers, P., Carlbring, P., Riper, H., & Hedman, E. (2014). Guided Internet-based vs. face-to-face cognitive behaviour therapy for psychiatric



- and somatic disorders: a systematic review and meta-analysis. *World Psychiatry*, 13(3), 288-295.
14. Cuijpers, P., Marks, I. M., van Straten, A., Cavanagh, K., Gega, L., & Andersson, G. (2009). Computer-aided psychotherapy for anxiety disorders: a meta-analytic review. *Cognitive behaviour therapy*, 38(2), 66-82.
  15. Haug, T., Nordgreen, T., Öst, L. G., & Havik, O. E. (2012). Self-help treatment of anxiety disorders: a meta-analysis and meta-regression of effects and potential moderators. *Clinical psychology review*, 32(5), 425-445.
  16. Olthuis, J. V., Watt, M. C., Bailey, K., Hayden, J. A., & Stewart, S. H. (2015). Therapist-supported internet cognitive-behavioural therapy for anxiety disorders in adults. *BJPsych Advances*, 21(5), 290-290.
  17. So, M., Yamaguchi, S., Hashimoto, S., Sado, M., Furukawa, T. A., & McCrone, P. (2013). Is computerised CBT really helpful for adult depression? -A meta-analytic re-evaluation of CCBT for adult depression in terms of clinical implementation and methodological validity. *BMC psychiatry*, 13(1), 1.
  18. Christensen, H., Griffiths, K. M., & Farrer, L. (2009). Adherence in internet interventions for anxiety and depression: systematic review. *Journal of medical Internet research*, 11(2), e13.
  19. Farvolden, P., Denisoff, E., Selby, P., Bagby, R. M., & Rudy, L. (2005). Usage and longitudinal effectiveness of a Web-based self-help cognitive behavioural therapy program for panic disorder. *Journal of medical Internet research*, 7(1), e7.

20. Christensen, H., Griffiths, K. M., Korten, A. E., Brittliffe, K., & Groves, C. (2004). A comparison of changes in anxiety and depression symptoms of spontaneous users and trial participants of a cognitive behaviour therapy website. *J Med Internet Res*, 6(4), e46.
21. Liddell, A., Adshead, S., & Burgess, E. (2008). Technology in the NHS. Transforming the patient's experience of care. *London: King's Fund*.
22. Donker, T., Blankers, M., Hedman, E., Ljotsson, B., Petrie, K., & Christensen, H. (2015). Economic evaluations of Internet interventions for mental health: a systematic review. *Psychological medicine*, 45(16), 3357-3376.
23. Stone et al. (2016) Chapter One, Do Guided psychological or health and wellbeing mobile applications improve symptoms of anxiety or depression? A Systematic Review. Thesis Submission.
24. Déglise, C., Suggs, L. S., & Odermatt, P. (2012). SMS for disease control in developing countries: a systematic review of mobile health applications. *Journal of Telemedicine and Telecare*, 18(5), 273-281.
25. Fanning, J., Mullen, S. P., & McAuley, E. (2012). Increasing physical activity with mobile devices: a meta-analysis. *Journal of medical Internet research*, 14(6), e161.
26. Fjeldsoe, B. S., Marshall, A. L., & Miller, Y. D. (2009). Behaviour change interventions delivered by mobile telephone short-message service. *American journal of preventive medicine*, 36(2), 165-173.

27. Horvath, T., Azman, H., Kennedy, G. E., & Rutherford, G. W. (2012). Mobile phone text messaging for promoting adherence to antiretroviral therapy in patients with HIV infection. *The Cochrane Library*.
28. Bryant Howren, M., Van Liew, J. R., & Christensen, A. J. (2013). Advances in patient adherence to medical treatment regimens: The emerging role of technology in adherence monitoring and management. *Social and Personality Psychology Compass*, 7(7), 427-443.
29. Cleland, J., Caldow, J., & Ryan, D. (2007). A qualitative study of the attitudes of patients and staff to the use of mobile phone technology for recording and gathering asthma data. *Journal of telemedicine and telecare*, 13(2), 85-89.
30. Lieberman, G., & Naylor, M. R. (2012). Interactive voice response technology for symptom monitoring and as an adjunct to the treatment of chronic pain. *Translational behavioural medicine*, 2(1), 93-101.
31. Rothwell, P. M. (2005). External validity of randomised controlled trials: “to whom do the results of this trial apply?”. *The Lancet*, 365(9453), 82-93.
32. Wallin, E. E. K., Mattsson, S., & Olsson, E. M. G. (2016). The Preference for Internet-Based Psychological Interventions by Individuals Without Past or Current Use of Mental Health Treatment Delivered Online: A Survey Study with Mixed-Methods Analysis. *JMIR Mental Health*, 3(2), e25.
33. Musiat, P., Goldstone, P., & Tarrrier, N. (2014). Understanding the acceptability of e-mental health-attitudes and expectations towards computerised self-help treatments for mental health problems. *BMC psychiatry*, 14(1), 1.

34. Beattie, A., Shaw, A., Kaur, S., & Kessler, D. (2009). Primary-care patients' expectations and experiences of online cognitive behavioural therapy for depression: a qualitative study. *Health Expectations*, *12*(1), 45-59.
35. Corrigan, P. (2004). How stigma interferes with mental health care. *American psychologist*, *59*(7), 614.
36. Roepke, A. M., Jaffee, S. R., Riffle, O. M., McGonigal, J., Broome, R., & Maxwell, B. (2015). Randomized controlled trial of SuperBetter, a smartphone-based/Internet-based self-help tool to reduce depressive symptoms. *Games for health journal*, *4*(3), 235-246.
37. Santana, L., & Fontenelle, L. F. (2011). A review of studies concerning treatment adherence of patients with anxiety disorders. *Patient preference and adherence*, *5*, 427-439.
38. Bandura, A. (2004). Health promotion by social cognitive means. *Health education & behaviour*, *31*(2), 143-164.
39. Stacey, F. G., James, E. L., Chapman, K., Courneya, K. S., & Lubans, D. R. (2015). A systematic review and meta-analysis of social cognitive theory-based physical activity and/or nutrition behaviour change interventions for cancer survivors. *Journal of Cancer Survivorship*, *9*(2), 305-338.
40. Benna, s. (2015, July 29). The best times to post on Facebook, Instagram, and Twitter. Retrieved from <http://uk.businessinsider.com/best-times-to-post-on-facebook-instagram-twitter-2015-7#>
41. Krebs, P., & Duncan, D. T. (2015). Health app use among US mobile phone owners: a national survey. *JMIR mHealth and uHealth*, *3*(4).

42. Clark-Carter, D. (2004). *Quantitative psychological research: The complete student's companion*. Psychology Press.
43. Faul, F., Erdfelder, E., Lang, A. & Buchner, A. (2007). G\*Power 3: A flexible statistical power analysis program for the social, behavioural, and biomedical sciences [electronic version]. *Behaviour Research Methods*, 39(2), 175-191
44. Wilhelmsen, M., Lillevoll, K., Risør, M. B., Høifødt, R., Johansen, M. L., Waterloo, K., & Kolstrup, N. (2013). Motivation to persist with internet-based cognitive behavioural treatment using blended care: a qualitative study. *BMC psychiatry*, 13(1), 1.
45. Wootton, B. M., Titov, N., Dear, B. F., Spence, J., & Kemp, A. (2011). The acceptability of Internet-based treatment and characteristics of an adult sample with obsessive compulsive disorder: An Internet survey. *PLoS One*, 6(6), e20548.
46. Waller, R., & Gilbody, S. (2009). Barriers to the uptake of computerized cognitive behavioural therapy: a systematic review of the quantitative and qualitative evidence. *Psychological medicine*, 39(05), 705-712.
47. Berry, N., Lobban, F., Emsley, R., & Bucci, S. (2016). Acceptability of Interventions Delivered Online and Through Mobile Phones for People Who Experience Severe Mental Health Problems: A Systematic Review. *Journal of medical Internet research*, 18(5), e121.
48. Wentzel, J., van der Vaart, R., Bohlmeijer, E. T., & van Gemert-Pijnen, J. E. (2016). Mixing Online and Face-to-Face Therapy: How to Benefit from Blended Care in Mental Health Care. *JMIR mental health*, 3(1).

49. Farrer, L. M., Griffiths, K. M., Christensen, H., Mackinnon, A. J., & Batterham, P. J. (2014). Predictors of adherence and outcome in internet-based cognitive behaviour therapy delivered in a telephone counselling setting. *Cognitive therapy and research*, 38(3), 358-367.
50. Gilbody, S., Littlewood, E., Hewitt, C., Brierley, G., Tharmanathan, P., Araya, R., & Kessler, D. (2015). Computerised cognitive behaviour therapy (cCBT) as treatment for depression in primary care (REEACT trial): large scale pragmatic randomised controlled trial. *Bmj*, 351, h5627.
51. Riper, H., Van Ballegooijen, W., Kooistra, L., De Wit, J., & Donker, T. (2013). Preventie & eMental-health. Onderzoek dat leidt, technologie die verleidt, preventie die bereikt en beklijft. Amsterdam: Vrije Universiteit Amsterdam.
52. Bossen, D., Kloek, C., Snippe, H. W., Dekker, J., de Bakker, D., & Veenhof, C. (2016). A Blended Intervention for Patients with Knee and Hip Osteoarthritis in the Physical Therapy Practice: Development and a Pilot Study. *JMIR research protocols*, 5(1).
53. Kooistra, L. C., Ruwaard, J., Wiersma, J. E., van Oppen, P., van der Vaart, R., van Gemert-Pijnen, J. E., & Riper, H. (2016). Development and initial evaluation of blended cognitive behavioural treatment for major depression in routine specialized mental health care. *Internet Interventions*, 4, 61-71.
54. Kenter, R. M., van de Ven, P. M., Cuijpers, P., Koole, G., Niamat, S., Gerrits, R. S., & van Straten, A. (2015). Costs and effects of Internet cognitive behavioural treatment blended with face-to-face treatment: Results from a naturalistic study. *Internet Interventions*, 2(1), 77-83.

55. Volker, D., Zijlstra-Vlasveld, M. C., Anema, J. R., Beekman, A. T., Brouwers, E. P., Emons, W. H., ... & van der Feltz-Cornelis, C. M. (2015). Effectiveness of a blended web-based intervention on return to work for sick-listed employees with common mental disorders: Results of a cluster randomized controlled trial. *Journal of medical Internet research*, *17*(5).
56. Van der Vaart, R., Drossaert, C. H., de Heus, M., Taal, E., & van de Laar, M. A. (2013). Measuring actual eHealth literacy among patients with rheumatic diseases: a qualitative analysis of problems encountered using Health 1.0 and Health 2.0 applications. *Journal of medical Internet research*, *15*(2), e27.
57. Atkinson, R., & Flint, J. (2001). Accessing hidden and hard-to-reach populations: Snowball research strategies. *Social research update*, *33*(1), 1-4.
58. Jansen, F., van Uden-Kraan, C. F., van Zwieten, V., Witte, B. I., & Verdonck-de Leeuw, I. M. (2015). Cancer survivors' perceived need for supportive care and their attitude towards self-management and eHealth. *Supportive Care in Cancer*, *23*(6), 1679-1688.

## **Chapter 3 Journal Article**

**Using an online survey and real-time Twitter  
Sentiment Analysis to understand online mental  
health information and support-seeking activity.**



## 3.1 Abstract

**Background:** Given the increasing range of mental health information available across multiple platforms, it is important to continually update our understanding of the public's perception, engagement and use of mental health information online.

**Objective:** The overall aim of this study is to contribute to the body of knowledge about the use and perception of online mental health resources, incorporating both traditional and digital methodologies.

**Methods:** Two hundred and sixteen adults completed a UK based online survey exploring use and perception of online health information and mobile health (mHealth) interventions.

Additionally, Twitter Sentiment Analysis of four popular online health resources was executed and sentiment assigned by the study's researcher was compared with an online software (Umigon). 432 individual tweets from May 2016 were downloaded and analysed.

**Results:** The study found that a large proportion of the public use the internet to search for information on mental health, with half citing it as their primary source for mental health information. The online survey found that the quality of mental health information available on the internet was rated favourably, compared to mobile applications. Overall, the sentiment towards specific online mental health resources was positive, but only a limited number of original tweets provided this information.

**Conclusion:** The findings of this study suggest that online mental health resources are widely used and popular. The findings also suggest that it is important for these resources to be continually evaluated, using mixed methodology incorporating both traditional and contemporary digital methodologies. However, it is also important to note that this sample still rated face-to-face interventions as their preferred method of MH service delivery. It may therefore be important to develop online self-help resources that will sit alongside face-to-face interventions and increase the efficiency and quality of service for service users.

**Keywords**

Mental health, Help-seeking, Technology, Internet, mHealth, social media, Twitter, online.

## 3.2 Introduction

The internet has revolutionised the way the public accesses health related information online [1]. It is estimated that approximately 80% of internet users worldwide search for information on the symptoms and treatment of various health conditions [2]. Seekers of online health information differ from offline counterparts by education, income, and age [3]. For example online users are more affluent and well-educated [4]. For younger users, immediacy of information, anonymity and accessibility are clear benefits of seeking health information online [5]. However the absence of quality filters on online web-based information, can leave them vulnerable to absorbing inaccurate or poor quality health information [5].

More specifically, information on mental health is also commonly accessed online, by those with a psychiatric diagnosis, their significant others and carers [6, 7, 8]. Mental health information can include straightforward mental health and psycho-educational information, self-help resources, computerised cognitive behavioural therapy (CBT), e-counselling and the signposting to other relevant supporting organisations [9]. Internet interventions enable users to self-manage their mental health conditions [10] and may be particularly beneficial to individuals with milder presentations, those waiting to receive psychological therapy [11] and particularly those who may otherwise be reluctant to seek help [12]. It has also been shown that families and friends often seek online information and support for: concerns about the individual's health care; young children's welfare; and the impacts on their own health [13]. The advantages of mental health information websites are that they are: convenient, anonymous, interactive, updatable and tailored to geographical location. Furthermore, the internet allows users to seek help or receive

information about their problems, without incurring potential barriers such as stigma or lack of knowledge [9]. One study demonstrated that mental health information and vignettes can potentially reduce stigma [14]. Some users with a psychiatric diagnosis will also seek support through online forums due to benefits of anonymity, social support and fear of stigmatisation [15].

The Internet also allows up-to-date health information and interventions to be disseminated more effectively and quickly than traditional methods [16]. For example Bader & Strickman-Stein [17] suggest that a multimedia format is preferred by users to traditional paperback booklets. There is some evidence to suggest that the use of mental health information on the internet is an effective intervention in itself. Christensen *et al.* [18] conducted a randomised controlled trial (RCT) to compare online CBT from MoodGYM ([www.moodgym.anu.edu.au](http://www.moodgym.anu.edu.au)), with psycho-education from BluePages ([www.bluepages.anu.edu.au](http://www.bluepages.anu.edu.au)) and a control group who received telephone calls to discuss lifestyle and environmental factors associated with depression. Their analysis showed that both online CBT and psycho-education reduced symptoms of depression, producing moderate effect sizes (0.6 and 0.5). Interestingly the more severe the symptoms of depression, the greater the effect sizes (0.9 and 0.75). The study also highlighted that mental health information websites improved mental health literacy [18]. Further to this, Naslund *et al.* [19] proposes that in the future, peer to peer connections online should be promoted for those with a psychiatric diagnosis. This will allow them to connect with others in similar situations, sharing personal stories and effective coping strategies. This could further effectively challenge stigma and increase interaction with effective online interventions for mental and physical wellbeing.

At present, there is growing pressure on health organisations to find more effective ways of delivering health interventions. With the internet being increasingly used to seek information and help on mental health issues, it is vital that sites are routinely evaluated for their effectiveness [10]. Several reviews have assessed the quality of mental health information online. Reavley *et al.* [20] deemed the quality of resources as generally poor but noted that the quality of information specifically regarding affective disorders was improving. However, a more recent review by Grohol *et al.* [21] found that 67.5% of popular mental health websites were rated as good or high quality, using an adapted instrument combining a mental health website checklist and readability measures. Specifically, information on schizophrenia and bi polar disorder were rated highly [21]. This was further highlighted by Guada & Venable [22] who found websites for schizophrenia having in general, comprehensive information and useful features, particularly those that are for-profit. In contrast, Grohol *et al.* [21] found that information on anxiety and phobia were generally rated as poor. However, this research focused on the 20 most popular resources identified by a Google search. As such it is conceivable that the information on anxiety and phobia is poor within these resources, but this perhaps does not generalise to other resources that are available. Furthermore, a survey of online activity in relation to health highlighted that users place high levels of confidence in information found online [23]. However, health professionals find that this confidence is often misplaced [23]. It is therefore imperative that researchers continually evaluate the popular features of websites, to keep resources comprehensible, up-to-date and user friendly [21]. For example, De Choudhury *et al.* [23] suggest the use of credibility indicators for health information websites, such as verified labels on social media.

Current effectiveness studies focus largely on the uptake and engagement with online resources [24]. Research has also assessed the effectiveness of existing online interventions using randomised controlled trials [24]. While uptake and engagement should not be overlooked when evaluating website information, a more detailed understanding of how, when and why people access mental health information may inform the development of higher quality resources.

It is important to consider, that current traditional methodologies for conducting evidence based research may not always be suitable in reviewing a continually changing environment, such as the internet. Often digital innovation and technology change too fast to be able to best make use of traditional, slower, evaluation methods [25]. Combining new digital types of methodology with more traditional approaches, may allow the traditional findings to be validated by real time digital qualitative information.

Traditionally, focus groups were the most effective way to gather rich qualitative information and consumer surveys were the preferred method to study customers' demands and expectations. However, this method has potential bias, as responders are more reluctant to express opinions or attitudes which are considered unpopular [21]. More recently, Twitter Sentiment Analysis (TSA) has been used to identify customers' sentiments on consumer products [26]. TSA allows researchers to search for a particular resource, charity or username on Twitter, and extract generated tweets [27]. Twitter is a free social networking service that allows registered members to broadcast short posts called tweets. Tweets, are limited to 140 characters. These tweets can be analysed using TSA to provide an insight into users' feelings on that particular resource [27]. TSA can reduce any potential bias in responses gathered from traditional methods because the

researcher does not ask any direct questions of the consumer [26]. Mental health websites are often promoted using Twitter and this method has potential to quickly explore public opinion of the currently available mental health websites. If public opinions are positive in sentiment, then developers know that their products/ resources are popular, whereas quickly obtained negative feedback can highlight drawbacks and therefore lead to improvements in the quality of the resource [28]. One study used TSA to gauge overall opinion of digital healthcare, in which 82% of tweets were positive in sentiment [29]. However, the accuracy and usefulness of such a tool has not been clearly evaluated within a mental health context.

### **3.2.1 Study Aims**

Given the increasing range of mental health information available across multiple platforms, it is important to continually update our understanding of the public's engagement with such resources and the strategies used for searching for mental health information online.

The overall aim of this study is to contribute to the body of knowledge about the use and perception of online mental health resources. There are several key questions to be addressed by the research:

1. What search strategies are used when seeking information about physical and mental health problems?
2. What are the most commonly searched for mental health problems?

3. What are the features and resources of mental health websites the public find most helpful?
4. What is the public's perception of the overall quality of the mental health resources currently available?
5. What do the public report are barriers to using online mental health resources?
6. Does the sample use private or public social media to discuss problems of a personal nature?
7. What mental health resources would the public be most likely to recommend to others within their network?

### **3.3 Methods**

#### **3.3.1 Overview**

The study has utilised two methodologies in order to address the research questions. The online survey will provide the majority of data to address the research questions. The TSA will provide additional qualitative data for relevant research questions. Both the online survey and TSA methodologies are outlined below.

#### **3.3.2 Sample and Recruitment**

##### **Online Survey Sample and Recruitment**

An online survey (<https://kwiksurveys.com/>) was developed to address the aims outlined in the introduction. The survey was opened between December 2015 and February 2016.



Two hundred and sixteen participants over the age of 18, based within the UK completed the survey. Further details of the sample and recruitment strategy are reported in the first research article within the thesis (Chapter 2).

### **Twitter Sentiment Analysis sample and selection**

The resources selected for the TSA was based on a Google search engine query within Scotland, for 'mental health'. The top 4 sites in April 2016 which had an active twitter account were selected for the research. The study captured tweets on various twitter usernames linked with particular mental health websites utilised in the UK: The Mental Health Foundation (@mentalhealth) is a UK based charity that provides information and support for mental health problems; @MindCharity, is an English and Welsh based charity that offers information and advice to people with mental health problems; @NHS Inform provides health and care information including mental health information for the people of Scotland and @CharitySANE is a UK mental health charity that provides support and resources for anyone affected with mental health problems. A total number of 2566 tweets were extracted via the Twitter application programming interface (API) [30] in May 2016. The Twitter search API is not an exhaustive source of tweets, as not all tweets are indexed or made available. The Twitter API limits the number of tweets that can be extracted. Therefore, the extracted tweets are primarily a subset of all tweets of the searched resource. The total extracted sample consisted of 2566 tweets. The majority of the tweets were retweets (2134) and were not included in the analysis. A total of 432 original tweets remained to be assigned sentiment. There are 118 tweets from @mentalhealth, 209 tweets from @MindCharity, 23 from @NHSInform and 82 from @SANEcharity.

### **3.3.3 Ethics**

This study received ethical approval from The University of Edinburgh, Department of Clinical and Health Psychology Ethics Research Panel.

### **3.3.4 Procedure**

#### **Online Survey Procedure**

Participants were directed to the online survey (<https://kwiksurveys.com/>) from various sources including a mental health website, social media and email recruitment. Further details of the procedure for the online survey are reported in the first research article (Chapter 2). All users were presented with the aims of the study, an information sheet pertaining to the purpose of the study (appendix 5) and provided consent by continuing with the survey. The survey took participants an average of 24 minutes to complete.

#### **Twitter Sentiment Analysis Procedure**

For the TSA, the researchers had to register their personal Twitter account with the Twitter API [30] developer's tool. These details were then linked with the Umigon software [31] for the extraction of tweets from particular user names. Each user name was inputted individually into the software. The data was then extracted to an excel database for further analysis. Once the tweet was extracted, the usernames of the original tweeter were deleted. All retweets were then deleted from the original dataset.

### **3.3.5 Data Sources**

#### **3.3.5.1 Online Survey Measures**

The research team developed the survey questions on the internet use by utilising previous surveys from within the literature [24, 32] and consulting with those with expertise in the field and field-tested items among NHS staff.

##### **Internet use, interests and technology**

Participants were asked to select from a number of common options, their current internet use (location, time spent, common activities, social media and communication) and the range of technologies owned (eg. mobile phone, tablet, laptop etc.).

##### **Help seeking online**

The respondents were asked whether they have talked about personal problems online in a public setting and private setting ('yes/no'). Respondents were asked whether the public settings were moderated ('yes/no'). Respondents were then asked whether the interactions were harmful or helpful on a five-point Likert scale (1-'Very Harmful' to 5='Very Helpful'). Finally, respondents were asked how likely they were to use public and private settings to discuss personal problems in the future on a five-point Likert scale (1-'Very unlikely' to 5='Very likely').

##### **Physical Health Information**

Respondents were asked whether they had searched for information on a physical health problem ('yes/no') and how they would begin. Respondents were asked whether the

information helped them deal more effectively with the problem on a five-point Likert scale (1-‘Made it a lot worse’ to 5=‘Helped a lot’). They were then asked how likely they would be to share the information found with: health professionals; close friends; mental health professionals and online discussion/support groups, on a 6 point Likert scale (1=Never to 6=Very likely).

### **Mental Health Information**

Respondents were asked whether they had searched for information on a mental health problem (‘yes/no’) and how they would begin. Respondents were asked whether they found the information they required (Not at all/ Somewhat/ Very much), then whether the information helped them deal more effectively with the problem on a five-point Likert scale (1-‘Made it a lot worse’ to 5=‘Helped a lot’). They were questioned whether the internet was their primary resource for information on mental health (‘yes/no’). Respondents were asked to select what mental health problems they had searched (Anxiety, Depression, Stress etc.) and about the expected time taken to find the answer on a 5-point Likert scale (1=‘A lot less time than I expected’ to 5= ‘A lot time more than I expected’.) Respondents were questioned whether the information was understandable on a 5 point Likert scale (‘1= ‘Too Basic’ to 5= ‘Too Complicated’). They were asked to rate how likely they would suggest to a friend or relative various mental health support (eg. Speaking to family/ friends, GP) on a five-point Likert scale (1-‘Very unlikely’ to 5=‘Very likely’). Finally, users were asked to select from a list, barriers to accessing mental or physical health information online (eg. fees, registering).

## **Quality of Mental Health Information and Mental Health Mobile applications**

A set of questions was developed based on respondents' experience of mental health websites and mobile applications. Respondents were asked to rate the quality of the two resources on a 5 point Likert scale (1= 'Unacceptable' to 5= 'Very High Quality') and the user could also rate they had too little experience to comment. They were asked to rate various attributes of mental health websites (eg. Quality of content, Layout) on a 5 point Likert scale (1= 'Poor' to 'Excellent') and usefulness of certain features for website and mobile applications (eg. guided self-help, Downloadable materials) on a 4 point Likert scale (1= 'Not useful' to 4= 'Extremely useful').

### **3.3.5.2 Twitter Sentiment Analysis software**

Umigon [31] a free, open source sentiment analysis tool, is available as a webpage. The software accesses the Twitter API developer tool [30], which allows individual tweets to be extracted for analysis as Twitter's privacy policy allows for the data mining of users' tweets via the Twitter API. Umigon [31] uses several processes to derive the sentiment of particular searched tweets. Initially, the software extracts all tweets from a chosen twitter username. It then detects the semantic features in the entire tweet. The tweet is deconstructed for the content to be compared to terms within a predefined lexicon. The lexicon contains a list of positive tones, negative tones, sentiment strength and negations. Overall there are 1066 items in the lexicon list for comparison [31]. The software then uses an algorithm to assign an overall sentiment for the tweet, either positive, negative or neutral.

### **3.3.6 Statistical Analysis**

#### **Online Survey statistical analysis**

The data from the online survey was exported to Excel, and then converted to SPSS 21 for statistical analyses. Descriptive statistics were obtained for all items. A series of Chi square were then performed to (1) investigate the relationship between use of social media when discussing personal problems, with age and education level and (2) to investigate the relationship between the types of resources recommended again with age and education level. Comparisons were deemed statistically significant if  $P < 0.05$ . Cramer's V was used to calculate effect size of any significant relationships. For larger contingency tables, where the assumption of expected frequencies being greater than 5 is violated, the likelihood ratio statistic was used to test the maximum likelihood of an effect [33]. To understand the nature of the relationship, the standardised residuals were calculated for each cell counts, 'if the value lies outside  $\pm 1.96$  then it is significant at  $p < 0.05$ , if it lies outside  $\pm 2.58$  then it is significant at  $p < 0.01$  and finally if it lies outside  $\pm 3.29$  then it is significant at  $p < 0.001$  [33].

#### **Twitter Sentiment Analysis statistical analysis**

The Umigon software [31] automatically assigns the sentiment of the extracted tweets. This data is then available to download into Excel. This was cleaned and then converted to SPSS 21 for statistical analysis. The reliability of the assigned sentiment, the extracted tweets were also rated by two independent researchers using the same scale as the Umigon software [31]: positive, neutral and negative. Between the two independent reviewers assigning sentiment to each individual tweet, inter-reviewer concordance was Kappa =

0.872, suggesting an excellent agreement [34]. Any discrepancies were resolved through discussion and an overall sentiment assigned. The reviewers' ratings were then compared to the original sentiment analysis carried out by the Umigon software [31], again using inter-rater concordance (Kappa).

The Umigon assigned sentiments were formally evaluated against the researcher assignments for each of the original tweets. When combining the classification across all four databases (appendix 7), inter-reviewer concordance between the Umigon software and the researcher was  $Kappa = 0.476$ , suggesting a weak agreement [33]. Due to the weak agreement and unreliability of the Umigon assigned sentiment it was agreed that only the researcher assigned sentiment would be used to collaborate the online survey findings.

### **3.3.7 Power**

#### **Online Survey power**

The power calculations for the online survey assumed power of 0.8 and an error value of 0.05. G-power 3 was used for all calculations [35]. For a Chi Square Goodness-of-fit tests, assuming the maximum degrees of freedom (Df) of 36, assuming a medium effect size, and a power of 0.8, G-power 3 [35] calculated a total sample size of 294 participants was required for the online survey.

### **3.3.8 Exclusion Criteria**

#### **Online Survey Exclusion Criteria**

Participants were excluded if they were under the age of 18, not a resident within the United Kingdom, did not speak English and could not provide informed consent. This exclusion criteria and age restriction were available on a consent form prior to completing the survey, by commencing with the survey, users acknowledged consent to participation. Data obtained from out with the UK and below the age range was deleted from the dataset prior to analysis.

#### **Twitter Sentiment Analysis Exclusion Criteria**

For the TSA, tweets were excluded if not written in English or if they were retweets.



## 3.4 Results

### 3.4.1 Online Survey Demographic

The demographic characteristics of those who completed the survey are outlined in detail in Chapter 2 of the thesis.

### 3.4.2 Online Survey- Recruited sample's internet and technology use

The survey asked participants about current internet and technology use. Overall, 64% of the sample reported using the internet at least 2 hours a day and over 75% using the internet 6 to 7 nights a week. As the assumption for the expected frequencies was violated, the likelihood ratio highlighted that there was likely a significant association between age category and amount of time spent on the internet each day ( $\chi^2(30, N = 215) = 63.254, p = .001$ ). The effect size for this finding, Cramer's  $V$  was moderate, .23. Studying the standardised residual scores, seemed to highlight that the younger age categories are likely to spend more time per day on the internet. Again, the assumption for expected frequencies was violated, however, there was no likely significant association between educational level and time spent of the internet each day, ( $\chi^2(36, N = 207) = 39.375, p = .321$ ). It appears that there is no likely relationship between age ( $\chi^2(36, N = 215) = 63.254, p = .123$ ), or education ( $\chi^2(12, N = 206) = 10.007, p = .615$ ) and the number of evenings per week spent on the internet.

Over 70% of the sample rated their expertise for searching for information on health conditions as good or excellent, however there was likely no significant relationship between age ( $\chi^2$  (15, N = 216) = 23.913,  $p = .067$ ) or Education ( $\chi^2$  (18, N = 207) = 26.535,  $p = .088$ ) and perceived internet expertise. Almost the entire sample reported that they use a mobile phone (97%), with high use of computers (laptops, 79%; desktop 41%) and Tablets (65%) (Table 1).

Table 1. Device use of entire sample

Device	n (%)
Mobile Phone	211 (97)
iPod/ Music Player	59 (27)
PlayStation	17 (8)
Xbox	17 (8)
Tablet e.g. iPad,	141 (65)
Desktop computer	90 (41)
Nintendo/ Wii	17 (8)
Laptop Computer	171 (79)
Smart TV	68 (31)
Responses	216

The most popular use of the internet was social media (78%) followed by online shopping (62%) and Entertainment (61%). In terms of social media, Facebook (93%) was the most popular followed by Twitter (43%).

### **3.4.3 What search strategies are used when seeking information about physical and mental health problems?**

#### **Online Survey**

Of the sample almost all (98%) had used the internet to search for information on a physical health problem in the past with the majority using the Google search engine to search directly for the problem. Others cited using a NHS website to search for symptoms, with only three other resource highlighted (WebMD, Medscape and Patient.co.uk). A large proportion (61%) highlighted that the internet helped a little with the problem and 20% highlighted it helped a lot. Of those who would search for information on physical health problems on the internet, 63% would be likely to share this information with a health professional, 84% with a close friend and 36% with an online discussion or support group.

The majority (82%) had used the internet to search for information on a mental health problem in the past for themselves or others. Again a large percentage use the Google search engine to search for the problem (56.5%). However, more people identified using a specialist website for further information about the problem. The majority of the sample did not have a specific website they found particularly helpful, however the websites commonly mentioned included Moodjuice, Mind, Pacifica, Moodcafe, Royal College of Psychiatry, PANDAS and WEDMD.

Of those who completed the questionnaire, about a quarter (24%) said they were looking for information for themselves, about a third for other people (35%) and another third for both, themselves and others.

### 3.4.4 What are the most commonly searched for mental health problems?

#### Online Survey

Information on anxiety (74%) and depression (73%) were the most widely searched mental health problems (Table 2). 76% of the sample felt that it took the amount of time they expected or less to find the information they required.

Table 2. Most commonly searched mental health problems

Condition	n (%)
Anxiety	157 (74)
Depression	154 (73)
Obsessive Compulsive Disorder	68 (32)
Anger	62 (29)
Bereavement	58 (27)
Eating Disorder	55 (26)
Postnatal Emotional Problems	40 (19)
Self-Harm	69 (33)
Trauma/ Abuse	53 (25)
Self Esteem	86 (41)
Stress	119 (56)
Bullying	24 (11)
Drug/ Alcohol Problems	49 (23)
None	15 (7)
Prefer not to say	6 (3)
Other	25 (12)
Total Responses	211

### **3.4.5 What are the features and resources of mental health websites the public find most helpful?**

#### **Online Survey**

Those that have used mental health information websites in the past were asked to identify the particular functions that they found most helpful. Information pages (39%), downloadable resources (25%) and search function (18%) were the most popular features identified (Table 3). When asked to rate particular features of the current mental health websites, there was some variability across each of the resources, however, mental health blogs and chat rooms were viewed as the least favourable features (Table 4).

Table 3. Most helpful features of mental health information websites.

	Information Pages n (%)	Other (Please Specify) n (%)	Downloadable resources n (%)	Search Function n (%)	Can be viewed on mobile or tablet n (%)	Recommended Websites n (%)	Real Life Stories n (%)	Anonymity n (%)
All Data	77 (39)	55 (28)	50 (25)	36 (18)	32 (16)	25 (13)	21 (11)	17 (9)
	Recommended Reading n (%)	Local Information n (%)	Question and Answer forum n (%)	Video content n (%)	Emergency or Crisis contacts n (%)	Interactive Learning n (%)	No Ads n (%)	Real Life Stories n (%)
	16 (8)	16 (8)	16 (8)	14 (7)	12 (6)	11 (6)	10 (5)	21 (11)

Table 4. Rating of particular features available on mental health information websites and mobile applications.

	Not Applicable n (%)	Not Useful n (%)	Neutral n (%)	Useful n (%)	Extremely Useful n (%)	Responses n (%)
<b>Facts about mental health problems</b>	20 (10)	4 (2)	31 (15)	<b>110 (53)</b>	41 (20)	206
<b>Sign Posting to other resources</b>	26 (13)	5 (2)	51 (25)	<b>75 (37)</b>	47 (23)	204
<b>Guided Self Help</b>	28 (14)	15 (7)	63 (31)	<b>77 (37)</b>	23 (11)	206
<b>Helpline information</b>	28 (14)	14 (7)	55 (27)	<b>80 (39)</b>	28 (14)	205
<b>Resources for Professionals</b>	41 (20)	18 (9)	34 (17)	<b>61 (30)</b>	52 (25)	206
<b>Ease of Use</b>	19 (9)	5 (2)	43 (21)	<b>94 (46)</b>	45 (22)	206
<b>Downloadable materials</b>	27 (13)	6 (3)	49 (24)	<b>73 (35)</b>	52 (25)	207
<b>Blogs</b>	47 (23)	44 (22)	<b>66 (33)</b>	39 (19)	7 (3)	203
<b>Chat rooms</b>	<b>67 (33)</b>	64 (31)	51 (25)	20 (10)	3 (1)	205
<b>True Stories</b>	36 (18)	17 (8)	54 (26)	<b>80 (39)</b>	18 (9)	205



A large share (62%) of those using the internet for mental health problems felt that the information they obtained somewhat met their need. About a quarter (23%) felt the internet very much met their needs, with very few (2%) saying the internet did not meet their needs at all. About half of the sample (51%) highlighted that the internet helped themselves or someone else a little with the problem and 20% highlighted that the internet helped a lot. The internet was the primary resource for information on mental health for just over half of the sample (54%).

### **3.4.6 What is the public's perception of the overall quality of the mental health resources currently available?**

#### **Online Survey**

The quality of mental health information available on the internet was rated favourably, with 31% rating the quality as high or above. The majority of the sample (41%) felt the quality was average and 12% felt it was below average. A proportion of the sample (16%) felt they did not have enough knowledge or experience of such sites to answer.

Overall, the ease, accessibility and quality of mental health websites were viewed favourably by about half of the sample, whereas about a fifth felt there was room for improvement (Table 5).



Table 5. Quality rating of attributes of Mental Health Websites.

	Poor	Fair	Neutral	Good	Excellent	Responses
<b>Accuracy of Information</b>	2 (1%)	21 (11%)	60 (30%)	<b>105</b> <b>(53%)</b>	9 (5%)	197
<b>Quality of Content</b>	3 (2%)	30 (15%)	56 (28%)	<b>93</b> <b>(47%)</b>	15 (8%)	197
<b>Quantity of Content</b>	4 (2%)	33 (17%)	54 (28%)	<b>96</b> <b>(49%)</b>	8 (4%)	195
<b>Ease of Navigation</b>	9 (5%)	27 (14%)	62 (31%)	<b>92</b> <b>(46%)</b>	8 (4%)	198
<b>Meeting my needs</b>	9 (5%)	28 (14%)	72 (37%)	<b>78</b> <b>(40%)</b>	8 (4%)	195
<b>Layout/Design</b>	11 (6%)	22 (11%)	76 (39%)	<b>79</b> <b>(41%)</b>	6 (3%)	194

### Twitter Sentiment Analysis

Consistent with our quantitative survey findings, the TSA highlighted that users were generally positive about the online resources. Table 6 outlines the categorisation of original tweets for those assigned as positive sentiment (n=123) by the researchers. Of the tweets assigned a positive sentiment, a large proportion (n=60) were positive about the resource. Promoting of the resource (n=28) and others promoting themselves or other services (n=27) accounted for the majority of the remaining positive sentiments. The remaining positive sentiments (n=8) were spread across four further categories (Table 6).

Table 6. Categories of positive sentiment from original tweets

@MentalHealth	Positive of Resource	19
	Promotion of Resource	15
	Personal/ Event Promotion	5
	Positive of Others	1
	<b>Total</b>	<b>40</b>
@MindCharity	Positive of Resource	26
	Promotion of Resource	9
	Personal/ Event Promotion	18
	Reply	1
	Minimal Information	3
	<b>Total</b>	<b>57</b>
@NHSInform	Positive of Resource	2
	Promotion of Resource	3
	Personal/ Event Promotion	1
	<b>Total</b>	<b>6</b>
@CharitySANE	Positive of Resource	13
	Promotion of Resource	1
	Personal/ Event Promotion	3
	Statement	1
	Minimal Information	1
	Positive of Others	1
	<b>Total</b>	<b>20</b>
<b>Total</b>	<b>Positive of Resource</b>	<b>60 (48.8%)</b>
	<b>Promotion of Resource</b>	<b>28 (22.7%)</b>
	<b>Personal/ Event Promotion</b>	<b>27 (22%)</b>
	<b>Reply</b>	<b>1 (0.7%)</b>
	<b>Minimal Information</b>	<b>4 (3.6%)</b>
	<b>Statement</b>	<b>1 (0.7%)</b>
	<b>Positive of Others</b>	<b>2 (1.5%)</b>
	<b>Total</b>	<b>123 (100%)</b>

A low proportion of the users expressed a negative sentiment to the resource. Table 7 outlines the categorisation of original tweets for those assigned as negative sentiment (n=80) by the researchers. A large proportion of the negative sentiments n = 46 (57.5%) were directed at other people or services. The resources drew negative sentiment on 13 occasions across the total sample (n=432). The remaining negative sentiments (n=21) were spread across six further categories (Table 7).

Table 7. Categories of negative sentiment from original tweets.

@MentalHealth	Negative of Resource	8
	Negative/ Criticism of Other Service or People	15
	Promotion of Resource	1
	Reply	1
	Total	25
@MindCharity	Negative of Resource	4
	Negative/ Criticism of Other Service or People	10
	Promotion of Resource	2
	Reply to another tweet	1
	Users Requiring Support	3
	Query	1
	Minimal Information	1
	Statement Regarding Mental Health	1
Total	23	
@NHS Inform	Negative/ Criticism of Other Service or People	1
	Total	1
@CharitySANE	Negative of Resource	1
	Negative/ Criticism of Other Service or People	20
	Reply to another tweet	7
	Positive of Resource	1
	Minimal Information	2
	Total	31
<b>Total</b>	<b>Negative of Resource</b>	<b>13 (16.25%)</b>
	<b>Negative/ Criticism of Other Service or People</b>	<b>46 (57.5%)</b>
	<b>Promotion of Resource</b>	<b>3 (3.75%)</b>
	<b>Reply to another tweet</b>	<b>9 (11.25%)</b>
	<b>Users Requiring Support</b>	<b>3 (3.75%)</b>
	<b>Query</b>	<b>1 (1.25%)</b>
	<b>Minimal Information</b>	<b>3 (3.75%)</b>
	<b>Statement Regarding Mental Health</b>	<b>1 (1.25%)</b>
	<b>Positive of Resource</b>	<b>1 (1.25%)</b>
<b>Total</b>	<b>80 (100%)</b>	

### 3.4.7 What do the public report are barriers to using online mental health resources?

#### Online Survey

The study also highlighted some of the potential barriers for accessing health information (Table 8). Approximately half (54%) of the respondents had concerns about what information is being collected, concerns about fraudulent websites (48%), potential costs (46%) and needing to register to sites to view available content (49%)

Table 8. Barriers selected for accessing mental health resources online or via smartphone

Barriers	N (%)
Concerns about who might be collecting information	99 (54%)
Concerns about accessing using public use device (e.g. library computer)	46 (25%)
Difficulties getting privacy at home	18 (10%)
Need to register to website	90 (49%)
Fees	84 (46%)
Concerns about fraudulent websites	87 (48%)
Fear of Judgement from other users	28 (15%)
Cost of available devices	18 (10%)
Cost of WIFI/ Broadband	7 (4%)
Lack of broadband availability	7 (4%)
Other	16 (9%)

### **3.4.8 Does the sample use private or public social media to discuss problems of a personal nature?**

#### **Online Survey**

The vast majority of the sample used the internet to contact other people. Half (52%) use direct communication (email, skype, Facebook messenger or chatrooms) while 44% post their views online using various types of social media or blogs/ forums. About a quarter of the sample reported that they have used an online public setting to talk about any personal problems. A chi-square test of independence was performed to examine the relation between using a public online setting to solve problems with age category and education level. The relationship between education and solving problem in the public setting was likely significant,  $\chi^2(6, N = 204) = 14.732, p = .022$ , however expected frequency assumptions were violated. The likely effect size for this finding, Cramer's  $V$  was moderate, .23. Studying the standardised residual scores, seemed to suggest that those with higher qualifications were less likely to discuss problems within a public setting. However, there was no significant relationship between age category and discussing personal problems in a public online setting  $\chi^2(5, N = 213) = 10.523, p = .117$ . Of those who had, the majority (69%) reflected that talking in this setting had been helpful. Of those that use such public social media or chat rooms, 45% stated they use environments that were moderated for inappropriate content, whereas 33% of the sample did not know whether the sites were moderated.

Further, chi-square tests of independence found there was likely a significant relationship between posting on social media and age. The younger the age category,

the less likely to recommend social media ( $\chi^2(15, N = 208) = 28.819, p = .017$ ) the likely effect size for this finding, Cramer's  $V$  was moderate, .22.

Chi square tests of independence also found a likely relationship between education level and posting on private online forums ( $\chi^2(24, N = 199) = 44.534, p = .007$ .) with the likely effect size for this finding, Cramer's  $V$  was moderate, .28. Those with fewer qualifications were more likely to recommend discussing problems within private forum online.

Further chi square test found a likely relationship between public social media ( $\chi^2(18, N = 199) = 32.389, p = .020$ .) the likely effect size for this finding, Cramer's  $V$  was moderate, .29. Those with fewer qualifications were more likely to recommend discussing problems within a public online setting.

A large proportion of the sample (65%) used a private setting (Facebook messenger, instant messenger, private chat room) to talk about personal problems. A chi-square test of independence examined the relationship between using a private online setting to solve problems with age category and education level. There was no likely significant relationship between education and using a private online setting to solve problems.  $\chi^2(6, N = 207) = 9.274, p = .159$ . However, there was a significant relationship with age category  $\chi^2(5, N = 216) = 22.113, p < .001$ , the likely effect size for this finding, Cramer's  $V$  was moderate, .32. Studying the standardised residual scores, seemed to suggest that highlight that those in the younger age category were more likely to discuss problems within a private online setting. Of those that used the private setting the majority (91%) found it helpful to talk in this way. Two of the responders provided further insight, highlighting they don't like using online forums

due to a written record of the message being recorded on such sites. Of the responders, the bulk (78%) were unlikely to use a public forum to discuss personal problems in the future, whereas over half (54%) would use an online private setting to discuss personal problems in the future.

### **Twitter Sentiment Analysis**

Consistent with our quantitative survey findings, the TSA extracted tweets (n=3) where users were discussing their own ongoing mental health issues, requesting immediate support (Table 7). Additionally, users discussed personal problems to positively promote various support services and resources. This highlights that a proportion of tweets to online mental health resources display people expressing personal problems within an open public setting.

### **3.4.9 What mental health supports would the public be most likely to recommend to others within their network?**

#### **Online Survey**

When suggesting mental health support available for friends, the majority would suggest attending a GP appointment or speaking to family or friends. Most would not suggest posting of public and private online resources (Table 9).

There was a likely relationship between age and recommending speaking to friends ( $\chi^2(20, N = 194) = 47.107, p < .001.$ ) the likely effect size for this finding, Cramer's  $V$  was moderate, .25. The younger age category was more likely to speak to friends.

Table 9. Likelihood of suggesting various support sources for mental health problems.

	Very Unlikely	Unlikely	Neutral	Likely	Very Likely	Responses	Weighted Average
Visiting GP	1 (0%)	3 (1%)	16 (8%)	71 (34%)	<b>118</b> (56%)	209	4.44 / 5
Speaking to friends	3 (1%)	9 (4%)	24 (12%)	<b>103</b> (50%)	67 (33%)	206	4.08 / 5
Speaking to family	4 (2%)	15 (7%)	28 (13%)	<b>99</b> (48%)	62 (30%)	208	3.96 / 5
Viewing mental health websites	2 (1%)	13 (6%)	39 (19%)	<b>109</b> (52%)	45 (22%)	208	3.88 / 5
Speaking to counsellor	12 (6%)	9 (4%)	32 (15%)	<b>104</b> (50%)	50 (24%)	207	3.83 / 5
Using telephone helplines	12 (6%)	36 (17%)	52 (25%)	<b>89</b> (43%)	19 (9%)	208	3.32 / 5
Using a Self Help Book	24 (12%)	33 (16%)	64 (31%)	<b>69</b> (33%)	18 (9%)	208	3.12 / 5
Using computer self-help programme	26 (13%)	31 (15%)	62 (30%)	<b>74</b> (36%)	15 (7%)	208	3.1 / 5
Using health related smartphone apps	22 (11%)	61 (30%)	<b>71</b> (34%)	45 (22%)	7 (3%)	206	2.78 / 5
Speaking to trusted community member	34 (16%)	<b>65</b> (31%)	58 (28%)	42 (20%)	9 (4%)	208	2.65 / 5
Visiting community centre	29 (14%)	<b>78</b> (38%)	61 (29%)	28 (13%)	12 (6%)	208	2.6 / 5
Speaking to religious figurehead	<b>78</b> (38%)	62 (30%)	35 (17%)	27 (13%)	5 (2%)	207	2.13 / 5
Posting on private on-line forums	<b>87</b> (42%)	53 (25%)	36 (17%)	29 (14%)	4 (2%)	209	2.09 / 5
Posting on Social Media (e.g. Facebook, Twitter)	<b>132</b> (63%)	47 (22%)	20 (10%)	10 (5%)	0 (0%)	209	1.56 / 5



## **3.5 Discussion**

### **3.5.1 Principal Results**

This study has contributed to the body of knowledge about seeking mental health information online. This study is unique in its combining of both traditional and novel methods of data collection and analysis to explore people's views and use of online mental health information websites.

### **3.5.2 What search strategies are used when seeking information about physical and mental health problems?**

This study analysed internet use for mental health information and support-seeking amongst a UK based population. The majority of participants were frequent internet users and reported that they searched for online information, particularly for physical health problems, but also for information on mental health. Contrary to previous research, a considerably higher proportion of the sample had used the internet to search for mental health information online [36, 37]. This could be because there is greater public awareness of mental health problems or more likely, the sampling methods used in this study have recruited those with a greater awareness of mental health.

Over two thirds of the sample said they were looking for information for others, with a third looking for themselves. The majority of the participants reflected that the internet helped a little with the problem. Perhaps unsurprisingly, the main source for searching for mental health information was via search engines, primarily Google. The majority of the sample didn't have a preferred mental health website. Best et al. [5] presented a conceptual model of online seeking. They suggested the safest path to

effective online help seeking was through professional services. This was the least likely path used by young people, in part due to the lack of existing professional resources and lack of awareness. This finding is reflected in the current adult sample, with few resources reported and the majority using search engines for health seeking. Therefore, it appears that it is still essential for public services to keep monitoring Google website rankings in order to make sure evidence based resources come within the top five hits in various geographical locations. It is also important that new evidence based resources boost their Google ranking, to ensure up-to-date evidence based resources are promoted especially as the difference of number of clicks between first position (32.5%) and tenth position (2.4%), is substantial [38].

### **3.5.3 What are the most commonly searched for mental health problems?**

In line with previous literature, the participants had searched primarily for information on depression, anxiety and stress [36, 39]. This highlights the importance of quality information and resources for these problems featuring highly on Google search pages.

### **3.5.4 What are features and resources of mental health websites the public find most helpful?**

The main features identified on mental health websites that are helpful were information pages, downloadable resources, and an integrated search function. This could perhaps be due to users desire to access trustworthy relevant information quickly easily and have resources available portably. This information highlights to developers of mental health information websites the importance of having accurate information pages, but also providing additional resources towards developing quality downloadable resources.

Additionally, mental health blogs and chat rooms were viewed least favourably, perhaps in part due to the perceived reliability and accuracy of advice provided on such forums.

### **3.5.5 What is the public's perception of the overall quality of mental health resources currently available?**

The study highlights that for some, the information available on mental health websites is perceived as too basic. This was not necessarily linked to education level. However, the quality of such websites is generally rated fairly positively, reflecting Grohol et al's [21] review into popular mental health websites. For comparative purposes, the overall quality of mental health mobile applications was perceived as much lower, however a limited number of participants had knowledge of such resources. The research into the quality of mental health mobile interventions is sparse, and recent developments have focused on developing quality rating scales for rating quality in the future [40].

The TSA also corroborates some of the findings from the online survey. The overall impression of online mental health resources/ website is generally positive. The positive promotion of the resources on twitter seems to reflect that the overall quality of resources is good. The resources that receive positive promotion on twitter, seem to be similar in type to those that the sample found most useful in the online survey i.e. facts about mental health problems, signposting to other resources and downloadable resources.

### **3.5.6 What do the public report are barriers to using online mental health resources?**

Health services need to be continually aware of the ongoing barriers for accessing health information. Participants reported concerns regarding how data is collected. Current and future resources should therefore be clear about how personal data is being collected and used. Furthermore, due to the comments regarding fraudulent websites, evidence based mental health information should be clearly recommended from a source that the public trust. It also appears that the stigma of using mental health resources may delay initial decisions to seek mental health information and put people off registering for such information [41]. Where possible, information needs to be freely available without the need to register and have minimal costs attached. Where a cost is applied, such resources should consider a free trial, to highlight the benefits of such evidence based resources.

### **3.5.7 Does the sample use private or public social media to discuss problems of a personal nature?**

Regarding health seeking behaviour, those that have gained higher level qualifications are less likely to share personal problems within a public setting. Those that use public settings, can find the public domain helpful and seem more likely to recommend such an intervention to friends. Public awareness campaigns should however continue to highlight to the general public that information discussed on a public forum is very difficult to completely remove, with no method of monitoring those that have viewed the information. The majority of the sample would use a private online setting and reported finding it helpful with such interactions likely to be with friends and informal.

However, the sample was unlikely to recommend similar private settings. This could potentially be due to the burden they feel they are imposing on the friend. However, this is out with the scope of the study and would require further research.

### **3.5.8 What mental health supports would the public be most likely to recommend to others in their network?**

The preference for receiving mental health information is still through face to face contact, whether through, GP, mental health professional or other health professional. This has been reflected in previous research which cites that face to face interventions are preferable to online resources [32]. However, the internet is still recognised as a helpful resource for receiving information and the first point of contact [36].

### **3.5.9 Methodology Critique & Implications**

Both of the utilised methodologies have benefits and shortcomings that should be considered in future research. The online survey was accessed primarily by social media which assumes a certain amount of computer literacy. The population is likely to have more exposure to various forms of technology, than if the sample was recruited using alternative methods, potentially introducing a certain level of bias towards technological interventions. Also, the sample was obtained using snowball sampling via Facebook, potential calling to question the generalisability of the results.

The TSA, as a tool, is not particularly robust. The lexicons used to evaluate the sentiment can often misinterpret the tweet as a particular sentiment, especially negative sentiment [42]. Riberio et al. [42] concluded that most sentiment analysis

tools seem to be biased towards classifying positive rather than negative tweets. Furthermore, within mental health research, certain words could cause the lexicon to misinterpret the tweet. For example, if an individual promotes a resource for depression or low mood, those words could lead to the program assigning a negative sentiment, rather than a neutral or positive sentiment. To obtain a very rough overall sentiment, the software could potentially be used, but with the understanding of the methodological limitations and sentiment accuracy. In addition, very few of the tweets can offer insight in potential improvements for the websites/resources themselves. However, the analysis can provide some insight into how a promoted resource is being received by the public in real time. Another potential major benefit of the methodology is the extraction of data into a usable workspace with minimal effort. This data could then be analysed using other methodological approaches.

### **3.5.10 Other Limitations**

Other limitations of the study include the overall demographic of the population. The majority of the sample was highly educated, with a large proportion under the age of 35 years. Jansen et al., [43] highlighted that there is a higher preference for e-health interventions among this particular population, therefore the group may be more accepting and have more exposure to online mental health resources. The sample is also heavily skewed in favour of those who have received higher education, therefore those that have not attended university are underrepresented. As education level is linked with socio economic status, which is also linked to increased risk factors for common mental health problems [44], this may also limit the generalisability of the results.

The statistical analysis in this study should be interpreted with caution. Some comparisons within the study are underpowered, particularly the comparisons with a high number of Df. Furthermore, this study had a number of violations in the assumptions of a Chi Square test. This could potentially result in the loss of statistical power [33]. In these circumstances the likelihood ratio was used to loosely interpret the findings. However, there is some suggestion that for larger contingency tables expected frequencies should not be below 1 [33] which was more in keeping with the current dataset.

An additional limitation with the sentiment analysis is that the linked Twitter API [30] only provides a snapshot of Tweets (1% to 10% of tweets) about a particular username and the methodology of how Twitter selects the sample still remains unclear so could potentially be biased in some way [45]. Another limitation of TSA is that it is not possible to target a specific population as the extraction process doesn't contain additional characteristics about the user at present, but could potentially do so in the future.

### **3.5.11 Study Strengths**

The study utilises a novel qualitative approach to evaluate public opinion of websites. In the future such methods could provide real time insight into public's use and opinions of mental health resources quickly and, with some development, effectively.

The data collection methods via online survey and TSA offered a cost effective recruitment strategy that increased the pool of applicants reached within a short time scale and for the online survey allowed a targeted approach to incorporate those within

certain geographical locations. The software selected for the sentiment analysis (Umigon) [31] was ranked highest within the context of social media sentiment analysis compared to 24 other sentiment analysis tools [42]. Previous research suggests that researchers and companies need to carefully select sentiment analysis methods, specifically for novel data sets [42]. It is important that prior to extensive detailed analysis, test experiments need to be conducted on the dataset to test suitability.

### **3.5.12 Future Research**

The generalisability of the findings could be improved by widening access to the questionnaire, possibly by using paper-copies or more widespread sampling. More detailed analysis of the particular features of websites that people find helpful could also be carried out. This could be achieved by analysing the public's use of mental health websites through Google analytics. Further investigation into the use of public versus private social media for personal problems, focusing on the benefits and drawbacks of the contact, could provide further understanding of the findings within this study about the helpfulness of such communication. Finally, future research could focus on using freely available 'big data' from various online sources such as Twitter and Google to compliment ongoing research within mental health. However, this should be done with caution until the accuracy of such techniques improves. It is important to continue to pair such novel approaches to data collection and analysis with more valid and reliable traditional methodologies to corroborate findings.



### **3.5.13 Conclusions**

The study highlighted that the internet still remains a highly valued resource for seeking health and mental health information, particularly for anxiety and depression, therefore it is essential to continue to develop and evaluate resources. Participants highlighted that information pages, downloadable resources and search function are the most popular features, that should be included as standard on online mental health information websites. For increased engagement with the resources barriers such as the collection of personal data, fraudulent websites, stigma and requiring to register needs to be addressed. TSA highlighted that mental health resources are perceived as generally positive by the public. Using TSA allows for real-time information regarding sentiment quickly and easily. However the accuracy of TSA still requires development and may not be particularly valid within mental health research at present. Overall, the findings of this study suggest that online mental health resources are widely used and popular. The findings suggest that it is important for these resources to be continually evaluated, using mixed methodology incorporating both traditional and contemporary digital methodologies. However, it is also important to note that this sample still rated face-to-face interventions as their preferred method of mental health service delivery. It may therefore be important to develop online self-help resources that will sit alongside face-to-face interventions and increase the efficiency and quality of service for service users.

### 3.6 Abbreviations

CBT	Cognitive Behavioural Therapy
TSA	Twitter Sentiment Analysis
NHS	National Health Service
RCT	Randomised Control Trial
CBT	Cognitive Behavioural Therapy

## 3.7 References

1. Tonsaker, T., Bartlett, G., & Trpkov, C. (2014). Health information on the Internet: gold mine or minefield?. *Canadian family physician Médecin de famille canadien*, 60(5), 407.
2. Kummervold, P. E., Chronaki, C. E., Lausen, B., Prokosch, H. U., Rasmussen, J., Santana, S., ... & Wangberg, S. C. (2008). eHealth trends in Europe 2005-2007: a population-based survey. *Journal of medical Internet research*, 10(4).
3. Fox, S. (2011). *The social life of health information, 2011*. Washington, DC: Pew Internet & American Life Project.
4. Hargittai, E. (2004). Internet access and use in context. *New Media & Society*, 6(1), 137-143.
5. Best, P., Gil-Rodriguez, E., Manktelow, R., & Taylor, B. J. (2016). Seeking Help from Everyone and No-One Conceptualizing the Online Help-Seeking Process Among Adolescent Males. *Qualitative health research*, DOI:1049732316648128.
6. Khazaal, Y., Chatton, A., Cochand, S., Hoch, A., Khankarli, M. B., Khan, R., & Zullino, D. F. (2008). Internet use by patients with psychiatric disorders in search for general and medical information. *Psychiatric Quarterly*, 79(4), 301-309.
7. Powell, J., & Clarke, A. (2006). Internet information-seeking in mental health Population survey. *The British Journal of Psychiatry*, 189(3), 273-277.
8. Ybarra, M. L., & Suman, M. (2006). Help seeking behaviour and the Internet: a national survey. *International journal of medical informatics*, 75(1), 29-41.
9. Oh, E., Jorm, A. F., & Wright, A. (2009). Perceived helpfulness of websites for mental health information. *Social psychiatry and psychiatric epidemiology*, 44(4), 293-299.
10. Griffiths, K. M., Nakane, Y., Christensen, H., Yoshioka, K., Jorm, A. F., & Nakane, H. (2006). Stigma in response to mental disorders: a comparison of Australia and Japan. *BMC psychiatry*, 6(1), 21.

11. Barlow, J. H., Ellard, D. R., Hainsworth, J. M., Jones, F. R., & Fisher, A. (2005). A review of self-management interventions for panic disorders, phobias and obsessive-compulsive disorders. *Acta Psychiatrica Scandinavica*, *111*(4), 272-285.
12. Gowen, L. K. (2013). Online Mental Health Information Seeking in Young Adults with Mental Health Challenges. *Journal of Technology in Human Services*, *31*(2), 97-111.
13. Stjernswärd, S. (2015). Relatives and friends queries on a psychologists “question and answer” forum online—authorship and contents. *Informatics for Health and Social Care*, *40*(2), 154-166.
14. Schomerus, G., Angermeyer, M. C., Baumeister, S. E., Stolzenburg, S., Link, B. G., & Phelan, J. C. (2016). An online intervention using information on the mental health-mental illness continuum to reduce stigma. *European Psychiatry*, *32*, 21-27.
15. Hjärthag, F. (2015). The forum as a friend: parental mental illness and communication on open Internet forums. *Social psychiatry and psychiatric epidemiology*, *50*(10), 1601-1607.
16. Christensen, H., & Petrie, K. (2013). Information technology as the key to accelerating advances in mental health care. *Australian and New Zealand Journal of Psychiatry*, *47*(2), 114-116.
17. Bader, J. L., & Strickman-Stein, N. (2003). Evaluation of new multimedia formats for cancer communications. *Journal of Medical Internet Research*, *5*(3).
18. Christensen, H., Griffiths, K. M., & Jorm, A. F. (2004). Delivering interventions for depression by using the internet: randomised controlled trial. *British Medical Journal*, *328*(7434), 265.
19. Naslund, J. A., Aschbrenner, K. A., Marsch, L. A., & Bartels, S. J. (2016). The future of mental health care: peer-to-peer support and social media. *Epidemiology and psychiatric sciences*, *25*(02), 113-122.

20. Reavley, N. J., & Jorm, A. F. (2011). The quality of mental disorder information websites: a review. *Patient education and counseling*, 85(2), e16-e25.
21. Grohol, J. M., Slimowicz, J., & Granda, R. (2014). The Quality of Mental Health Information Commonly Searched for on the Internet. *Cyberpsychology, Behaviour, and Social Networking*, 17(4), 216-221.
22. Guada, J., & Venable, V. (2011). A comprehensive analysis of the quality of online health-related information regarding schizophrenia. *Health & Social Work*, 36(1), 45-53.
23. De Choudhury, M., Morris, M. R., & White, R. W. (2014). Seeking and sharing health information online: comparing search engines and social media. In *Proceedings of the 32nd annual ACM conference on Human factors in computing systems* (pp. 1365-1376). ACM.
24. Ellis, L. A., Collin, P., Hurley, P. J., Davenport, T. A., Burns, J. M., & Hickie, I. B. (2013). Young men's attitudes and behaviour in relation to mental health and technology: implications for the development of online mental health services. *BMC psychiatry*, 13(1), 119.
25. Cotton, R., Irwin, J., Wilkins, A., & Young, C. (2014). *The Future's Digital: Mental Health and Technology*. Mental Health Network NHS Confederation.
26. Chamlerwat, W., Bhattarakosol, P., Rungkasiri, T., & Haruechaiyasak, C. (2012). Discovering Consumer Insight from Twitter via Sentiment Analysis. *J. UCS*, 18(8), 973-992.
27. La Rosa, A. (2013). *Harvesting the Twittersphere: Qualitative Research Methods Using Twitter*. Thesis, Honors College, Pace University
28. More, K., Deshmukh, T., Darekar, P., Shirbhate, R., & Scholar, U. G. (2016). Survey of Evaluating Public Opinion Variation on Twitter. *International Journal of Engineering Science*, 3532.

29. Afyouni, S., Fetit, A. E., & Arvanitis, T. N. (2015). Perspectives through Social Media Analysis. *Enabling Health Informatics Applications*, 213, 243.
30. Twitter Developer Platform - Twitter Developers. (n.d.). Retrieved November 25, 2015, from <https://dev.twitter.com/>
31. Clement, L. (2013). Umigon: Sentiment analysis on Tweets based on terms lists and heuristics.
32. Musiat, P., Goldstone, P., & Tarrrier, N. (2014). Understanding the acceptability of e-mental health-attitudes and expectations towards computerised self-help treatments for mental health problems. *BMC psychiatry*, 14(1), 1.
33. Field, A. (2009). *Discovering statistics using SPSS*. Sage publications.
34. Banerjee, M., Capozzoli, M., McSweeney, L., & Sinha, D. (1999). Beyond kappa: A review of interrater agreement measures. *Canadian journal of statistics*, 27(1), 3-23.
35. Faul, F., Erdfelder, E., Lang, A. & Buchner, A. (2007). G\*Power 3: A flexible statistical power analysis program for the social, behavioural, and biomedical sciences [electronic version]. *Behaviour Research Methods*, 39(2), 175-191
36. Montagni, I., Donisi, V., Tedeschi, F., Parizot, I., Motrico, E., & Horgan, A. (2016). Internet use for mental health information and support among European university students: The e-MentH project. *Digital Health*, 2, 2055207616653845.
37. Horgan, A., & Sweeney, J. (2010). Young students' use of the Internet for mental health information and support. *Journal of psychiatric and mental health nursing*, 17(2), 117-123.
38. The Value of Google Result Positioning. (n.d.) Retrieved, November 29, 2015. From <https://chitika.com/google-positioning-value>
39. Kauer, S. D., Mangan, C., & Sancu, L. (2014). Do online mental health services improve help-seeking for young people? A systematic review. *Journal of medical Internet research*, 16(3), e66.

40. Stoyanov, S. R., Hides, L., Kavanagh, D. J., Zelenko, O., Tjondronegoro, D., & Mani, M. (2015). Mobile app rating scale: a new tool for assessing the quality of health mobile apps. *JMIR mHealth and uHealth*, 3(1), e27.
41. Lannin, Daniel G., et al. "Does self-stigma reduce the probability of seeking mental health information?" *Journal of counseling psychology* 63.3 (2016): 351.
42. Ribeiro, F. N., Araújo, M., Gonçalves, P., Gonçalves, M. A., & Benevenuto, F. (2016). Sentibench-a benchmark comparison of state-of-the-practice sentiment analysis methods. *EPJ Data Science*, 5(1), 1-29.
43. Jansen, F., van Uden-Kraan, C. F., van Zwieten, V., Witte, B. I., & Verdonck-de Leeuw, I. M. (2015). Cancer survivors' perceived need for supportive care and their attitude towards self-management and eHealth. *Supportive Care in Cancer*, 23(6), 1679-1688.
44. Allen, J., Balfour, R., Bell, R., & Marmot, M. (2014). Social determinants of mental health. *International Review of Psychiatry*, 26(4), 392-407.
45. Scheffler, T. (2014). A German Twitter Snapshot. In *LREC* (pp. 2284-2289).

## Full References

- Adibi, S. (Ed.). (2015). *Mobile Health: A Technology Road Map* (Vol. 5). Springer.
- Afyouni, S., Fetit, A. E., & Arvanitis, T. N. (2015). Perspectives through Social Media Analysis. *Enabling Health Informatics Applications*, 213, 243.
- Ahmedani, B. K., Crotty, N., Abdulhak, M. M., & Ondersma, S. J. (2015). Pilot feasibility study of a brief, tailored mobile health intervention for depression among patients with chronic pain. *Behavioural Medicine*, 41(1), 25-32.
- Allen, J. K., Stephens, J., Dennison Himmelfarb, C. R., Stewart, K. J., & Hauck, S. (2013). Randomized controlled pilot study testing use of smartphone technology for obesity treatment. *Journal of obesity*, 2013.
- Allen, J., Balfour, R., Bell, R., & Marmot, M. (2014). Social determinants of mental health. *International Review of Psychiatry*, 26(4), 392-407.
- Andersson, G., & Cuijpers, P. (2009). Internet-based and other computerized psychological treatments for adult depression: a meta-analysis. *Cognitive behaviour therapy*, 38(4), 196-205.
- Andersson, G., Cuijpers, P., Carlbring, P., Riper, H., & Hedman, E. (2014). Guided Internet-based vs. face-to-face cognitive behaviour therapy for psychiatric and somatic disorders: a systematic review and meta-analysis. *World Psychiatry*, 13(3), 288-295.
- Andresen, E. M., Malmgren, J. A., Carter, W. B., & Patrick, D. L. (1994). Screening for Depression in Well Older Adults: *Evaluation of. Prev Med*, 10, 77-84.
- Andrews, G., Cuijpers, P., Craske, M. G., McEvoy, P., & Titov, N. (2010). Computer therapy for the anxiety and depressive disorders is effective, acceptable and practical health care: a meta-analysis. *PloS one*, 5(10), e13196.
- Atkinson, R., & Flint, J. (2001). Accessing hidden and hard-to-reach populations: Snowball research strategies. *Social research update*, 33(1), 1-4.



- Bader, J. L., & Strickman-Stein, N. (2003). Evaluation of new multimedia formats for cancer communications. *Journal of Medical Internet Research*, 5(3).
- Bandura, A. (2004). Health promotion by social cognitive means. *Health education & behaviour*, 31(2), 143-164.
- Banerjee, M., Capozzoli, M., McSweeney, L., & Sinha, D. (1999). Beyond kappa: A review of interrater agreement measures. *Canadian journal of statistics*, 27(1), 3-23.
- Barlow, J. H., Ellard, D. R., Hainsworth, J. M., Jones, F. R., & Fisher, A. (2005). A review of self-management interventions for panic disorders, phobias and obsessive-compulsive disorders. *Acta Psychiatrica Scandinavica*, 111(4), 272-285.
- Baron, J. S., Hirani, S., & Newman, S. P. (2016). A randomised, controlled trial of the effects of a mobile telehealth intervention on clinical and patient-reported outcomes in people with poorly controlled diabetes. *Journal of telemedicine and telecare*, doi:1357633X16631628.
- Beattie, A., Shaw, A., Kaur, S., & Kessler, D. (2009). Primary-care patients' expectations and experiences of online cognitive behavioural therapy for depression: a qualitative study. *Health Expectations*, 12(1), 45-59.
- Beck AT, Epstein N, Brown G, Steer RA (1988). "An inventory for measuring clinical anxiety: Psychometric properties". *Journal of Consulting and Clinical Psychology*. 56: 893–897. doi:10.1037/0022-006x.56.6.893
- Beck, A. T., Steer, R. A., & Carbin, M. G. (1988). Psychometric properties of the Beck Depression Inventory: Twenty-five years of evaluation. *Clinical psychology review*, 8(1), 77-100.
- Beck, A. T., Steer, R. A., & Brown, G. K. (1996). Beck depression inventory-II. *San Antonio*, 78(2), 490-8.

Benna, s. (2015, July 29). The best times to post on Facebook, Instagram, and Twitter. Retrieved from <http://uk.businessinsider.com/best-times-to-post-on-facebook-instagram-twitter-2015-7#>

Berry, N., Lobban, F., Emsley, R., & Bucci, S. (2016). Acceptability of Interventions Delivered Online and Through Mobile Phones for People Who Experience Severe Mental Health Problems: A Systematic Review. *Journal of medical Internet research, 18*(5), e121.

Best, P., Gil-Rodriguez, E., Manktelow, R., & Taylor, B. J. (2016). Seeking Help from Everyone and No-One Conceptualizing the Online Help-Seeking Process Among Adolescent Males. *Qualitative health research*, doi: 1049732316648128.

Birney, A. J., Gunn, R., Russell, J. K., & Ary, D. V. (2016). MoodHacker Mobile Web App with Email for Adults to Self-Manage Mild-to-Moderate Depression: Randomized Controlled Trial. *JMIR mHealth and uHealth, 4*(1).

Bossen, D., Kloek, C., Snippe, H. W., Dekker, J., de Bakker, D., & Veenhof, C. (2016). A Blended Intervention for Patients with Knee and Hip Osteoarthritis in the Physical Therapy Practice: Development and a Pilot Study. *JMIR research protocols, 5*(1).

Bryant Howren, M., Van Liew, J. R., & Christensen, A. J. (2013). Advances in patient adherence to medical treatment regimens: The emerging role of technology in adherence monitoring and management. *Social and Personality Psychology Compass, 7*(7), 427-443.

Burns, M. N., Begale, M., Duffecy, J., Gergle, D., Karr, C. J., Giangrande, E., & Mohr, D. C. (2011). Harnessing context sensing to develop a mobile intervention for depression. *Journal of medical Internet research, 13*(3), e55.

Carissoli, C., Villani, D., & Riva, G. (2015). Does a meditation protocol supported by a mobile application help people reduce stress? Suggestions from a controlled pragmatic trial. *Cyberpsychology, Behaviour, and Social Networking, 18*(1), 46-53.

- Chamlertwat, W., Bhattarakosol, P., Rungkasiri, T., & Haruechaiyasak, C. (2012). Discovering Consumer Insight from Twitter via Sentiment Analysis. *J. UCS, 18*(8), 973-992.
- Choi, J., hyeon Lee, J., Vittinghoff, E., & Fukuoka, Y. (2015). mHealth Physical Activity Intervention: A Randomized Pilot Study in Physically Inactive Pregnant Women. *Maternal and child health journal, 1*-11.
- Christensen, H., & Petrie, K. (2013). Information technology as the key to accelerating advances in mental health care. *Australian and New Zealand Journal of Psychiatry, 47*(2), 114-116.
- Christensen, H., Griffiths, K. M., & Farrer, L. (2009). Adherence in internet interventions for anxiety and depression: systematic review. *Journal of medical Internet research, 11*(2), e13.
- Christensen, H., Griffiths, K. M., & Jorm, A. F. (2004). Delivering interventions for depression by using the internet: randomised controlled trial. *British Medical Journal, 328*(7434),265.
- Christensen, H., Griffiths, K. M., Korten, A. E., Brittliffe, K., & Groves, C. (2004). A comparison of changes in anxiety and depression symptoms of spontaneous users and trial participants of a cognitive behaviour therapy website. *J Med Internet Res, 6*(4), e46.
- Clark-Carter, D. (2004). *Quantitative psychological research: The complete student's companion*. Psychology Press.
- Cleland, J., Caldow, J., & Ryan, D. (2007). A qualitative study of the attitudes of patients and staff to the use of mobile phone technology for recording and gathering asthma data. *Journal of telemedicine and telecare, 13*(2), 85-89.
- Clement, L. (2013). Umigon: Sentiment analysis on Tweets based on terms lists and heuristics.

- Cohen, J. (1988). *Statistical Power Analysis for the Behavioural Sciences*. 2nd edn. Hillsdale, New Jersey: L.
- Conroy, D. E., Yang, C. H., & Maher, J. P. (2014). Behaviour change techniques in top-ranked mobile apps for physical activity. *American journal of preventive medicine*, *46*(6), 649-652.
- Corrigan, P. (2004). How stigma interferes with mental health care. *American psychologist*, *59*(7), 614.
- Cotton, R., Irwin, J., Wilkins, A., & Young, C. (2014). The Future's Digital: Mental Health and Technology. Mental Health Network NHS Confederation.
- Cuijpers, P., Donker, T., van Straten, A., Li, J., & Andersson, G. (2010). Is guided self-help as effective as face-to-face psychotherapy for depression and anxiety disorders? A systematic review and meta-analysis of comparative outcome studies. *Psychological medicine*, *40*(12), 1943-1957.
- Cuijpers, P., Marks, I. M., van Straten, A., Cavanagh, K., Gega, L., & Andersson, G. (2009). Computer-aided psychotherapy for anxiety disorders: a meta-analytic review. *Cognitive behaviour therapy*, *38*(2), 66-82.
- Dagöo, J., Asplund, R. P., Bsenko, H. A., Hjerling, S., Holmberg, A., Westh, S., ... & Andersson, G. (2014). Cognitive behaviour therapy versus interpersonal psychotherapy for social anxiety disorder delivered via smartphone and computer: A randomized controlled trial. *Journal of anxiety disorders*, *28*(4), 410-417.
- De Choudhury, M., Morris, M. R., & White, R. W. (2014). Seeking and sharing health information online: comparing search engines and social media. In Proceedings of the 32nd annual ACM conference on Human factors in computing systems (pp. 1365-1376). ACM.
- Déglise, C., Suggs, L. S., & Odermatt, P. (2012). SMS for disease control in developing countries: a systematic review of mobile health applications. *Journal of Telemedicine and Telecare*, *18*(5), 273-281.

Dennis, T. A., & O'Toole, L. J. (2014). Mental health on the go effects of a gamified attention-bias modification mobile application in trait-anxious adults. *Clinical Psychological Science*, doi:2167702614522228.

Depp, C. A., Ceglowski, J., Wang, V. C., Yaghouti, F., Mausbach, B. T., Thompson, W. K., & Granholm, E. L. (2015). Augmenting psychoeducation with a mobile intervention for bipolar disorder: a randomized controlled trial. *Journal of affective disorders*, 174, 23-30.

Dicianno, B. E., Fairman, A. D., McCue, M., Parmanto, B., Yih, E., McCoy, A., ... & Brienza, D. M. (2015). Feasibility of Using Mobile Health to Promote Self-Management in Spina Bifida. *American journal of physical medicine & rehabilitation/Association of Academic Physiatrists*.

Donker, T., Blankers, M., Hedman, E., Ljotsson, B., Petrie, K., & Christensen, H. (2015). Economic evaluations of Internet interventions for mental health: a systematic review. *Psychological medicine*, 45(16), 3357-3376.

Donker, T., Petrie, K., Proudfoot, J., Clarke, J., Birch, M. R., & Christensen, H. (2013). Smartphones for smarter delivery of mental health programs: a systematic review. *Journal of medical Internet research*, 15(11)

Downs, S. H., & Black, N. (1998). The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non-randomised studies of health care interventions. *Journal of epidemiology and community health*, 52(6), 377-384.

Ellis, L. A., Collin, P., Hurley, P. J., Davenport, T. A., Burns, J. M., & Hickie, I. B. (2013). Young men's attitudes and behaviour in relation to mental health and technology: implications for the development of online mental health services. *BMC psychiatry*, 13(1), 119.

Fanning, J., Mullen, S. P., & McAuley, E. (2012). Increasing physical activity with mobile devices: a meta-analysis. *Journal of medical Internet research*, 14(6), e161.

Fantino, B., & Moore, N. (2009). The self-reported Montgomery-Åsberg depression rating scale is a useful evaluative tool in major depressive disorder. *BMC psychiatry*, 9(1), 26.

Farrer, L. M., Griffiths, K. M., Christensen, H., Mackinnon, A. J., & Batterham, P. J. (2014). Predictors of adherence and outcome in internet-based cognitive behaviour therapy delivered in a telephone counseling setting. *Cognitive therapy and research*, 38(3), 358-367.

Farvolden, P., Denisoff, E., Selby, P., Bagby, R. M., & Rudy, L. (2005). Usage and longitudinal effectiveness of a Web-based self-help cognitive behavioural therapy program for panic disorder. *Journal of medical Internet research*, 7(1), e7.

Faul, F., Erdfelder, E., Lang, A. & Buchner, A. (2007). G\*Power 3: A flexible statistical power analysis program for the social, behavioural, and biomedical sciences [electronic version]. *Behaviour Research Methods*, 39(2), 175-191

Faulstich, M. E., Carey, M. P., Ruggiero, L., Enyart, P., & Gresham, F. (1986). Assessment of depression in childhood and adolescence: An evaluation of the Center for Epidemiological Studies Depression Scale for Children (CES-DC). *The American journal of psychiatry*.

Faurholt-Jepsen, M., Frost, M., Ritz, C., Christensen, E. M., Jacoby, A. S., Mikkelsen, R. L., & Kessing, L. V. (2015). Daily electronic self-monitoring in bipolar disorder using smartphones—the MONARCA I trial: a randomized, placebo-controlled, single-blind, parallel group trial. *Psychological medicine*, 45(13), 2691-2704.

Field, A. (2009). *Discovering statistics using SPSS*. Sage publications.

Fineberg, N. A., Haddad, P. M., Carpenter, L., Gannon, B., Sharpe, R., Young, A. H., ... & Sahakian, B. J. (2013). The size, burden and cost of disorders of the brain in the UK. *Journal of Psychopharmacology*, 27(9), 761-770.

- Fjeldsoe, B. S., Marshall, A. L., & Miller, Y. D. (2009). Behaviour change interventions delivered by mobile telephone short-message service. *American journal of preventive medicine*, *36*(2), 165-173.
- Fox, S. (2011). *The social life of health information, 2011*. Washington, DC: Pew Internet & American Life Project.
- Free, C., Phillips, G., Galli, L., Watson, L., Felix, L., Edwards, P., & Haines, A. (2013). The effectiveness of mobile-health technology-based health behaviour change or disease management interventions for health care consumers: a systematic review. *PLoS med*, *10*(1), e1001362.
- Free, C., Whittaker, R., Knight, R., Abramsky, T., Rodgers, A., & Roberts, I. G. (2009). Txt2stop: a pilot randomised controlled trial of mobile phone-based smoking cessation support. *Tobacco control*, *18*(2), 88-91.
- Gilbody, S., Littlewood, E., Hewitt, C., Brierley, G., Tharmanathan, P., Araya, R., & Kessler, D. (2015). Computerised cognitive behaviour therapy (cCBT) as treatment for depression in primary care (REEACT trial): large scale pragmatic randomised controlled trial. *Bmj*, *351*, h5627.
- Glynn, L. G., Hayes, P. S., Casey, M., Glynn, F., Alvarez-Iglesias, A., Newell, J., ... & Murphy, A. W. (2014). Effectiveness of a smartphone application to promote physical activity in primary care: the SMART MOVE randomised controlled trial. *Br J Gen Pract*, *64*(624), e384-e391.
- Gowen, L. K. (2013). Online Mental Health Information Seeking in Young Adults with Mental Health Challenges. *Journal of Technology in Human Services*, *31*(2), 97-111.
- Griffiths, K. M., Nakane, Y., Christensen, H., Yoshioka, K., Jorm, A. F., & Nakane, H. (2006). Stigma in response to mental disorders: a comparison of Australia and Japan. *BMC psychiatry*, *6*(1), 21.

- Grohol, J. M., Slimowicz, J., & Granda, R. (2014). The Quality of Mental Health Information Commonly Searched for on the Internet. *Cyberpsychology, Behaviour, and Social Networking*, *17*(4), 216-221.
- Guada, J., & Venable, V. (2011). A comprehensive analysis of the quality of online health-related information regarding schizophrenia. *Health & Social Work*, *36*(1), 45-53.
- Hamilton, M. (1960). A rating scale for depression. *Journal of neurology, neurosurgery, and psychiatry*, *23*(1), 56.
- Hansen, M. M. (2015). A feasibility pilot study on the use of complementary therapies delivered via mobile technologies on Icelandic surgical patients' reports of anxiety, pain, and self-efficacy in healing. *BMC complementary and alternative medicine*, *15*(1), 1.
- Hargittai, E. (2004). Internet access and use in context. *New Media & Society*, *6*(1), 137-143.
- Haug, T., Nordgreen, T., Öst, L. G., & Havik, O. E. (2012). Self-help treatment of anxiety disorders: a meta-analysis and meta-regression of effects and potential moderators. *Clinical psychology review*, *32*(5), 425-445.
- Heimberg, R. G., Horner, K. J., Juster, H. R., Safren, S. A., Brown, E. J., Schneier, F. R., & Liebowitz, M. R. (1999). Psychometric properties of the Liebowitz social anxiety scale. *Psychological medicine*, *29*(1), 199-212.
- Henry, J. D., & Crawford, J. R. (2005). The short-form version of the Depression Anxiety Stress Scales (DASS-21): Construct validity and normative data in a large non-clinical sample. *British journal of clinical psychology*, *44*(2), 227-239.
- Higgins, J. P. (2016). Smartphone applications for patients' health and fitness. *The American journal of medicine*, *129*(1), 11-19.



- Hjärthag, F. (2015). The forum as a friend: parental mental illness and communication on open Internet forums. *Social psychiatry and psychiatric epidemiology*, 50(10), 1601-1607.
- Horgan, A., & Sweeney, J. (2010). Young students' use of the Internet for mental health information and support. *Journal of psychiatric and mental health nursing*, 17(2), 117-123.
- Horvath, T., Azman, H., Kennedy, G. E., & Rutherford, G. W. (2012). Mobile phone text messaging for promoting adherence to antiretroviral therapy in patients with HIV infection. *The Cochrane Library*.
- Howells, A., Ivtzan, I., & Eiroa-Orosa, F. J. (2014). Putting the 'app' in Happiness: A Randomised Controlled Trial of a Smartphone-Based Mindfulness Intervention to Enhance Wellbeing. *Journal of Happiness Studies*, 1-23.
- Jansen, F., van Uden-Kraan, C. F., van Zwieten, V., Witte, B. I., & Verdonck-de Leeuw, I. M. (2015). Cancer survivors' perceived need for supportive care and their attitude towards self-management and eHealth. *Supportive Care in Cancer*, 23(6), 1679-1688.
- Jenkins, B. N., Fortier, M. A., Kaplan, S. H., Mayes, L. C., & Kain, Z. N. (2014). Development of a short version of the modified Yale Preoperative Anxiety Scale. *Anesthesia & Analgesia*, 119(3), 643-650.
- Ji, L., Zhang, X., Fan, H., Han, M., Yang, H., Tang, L., ... & Li, D. (2015). drawMD APP-aided preoperative anesthesia education reduce parents anxiety and improve satisfaction. *Patient education and counseling*.
- Johnson, N., Bree, O., Lalley, E. E., Rettler, K., Grande, P., Gani, M. O., & Ahamed, S. I. (2014). Effect of a social script iPad application for children with autism going to imaging. *Journal of pediatric nursing*, 29(6), 651-659.
- Kanter, J. W., Mulick, P. S., Busch, A. M., Berlin, K. S., & Martell, C. R. (2007). The Behavioural activation for depression scale (BADSD): Psychometric properties and

factor structure. *Journal of Psychopathology and Behavioural Assessment*, 29, 191-202.

Kauer, S. D., Mangan, C., & Sanci, L. (2014). Do online mental health services improve help-seeking for young people? A systematic review. *Journal of medical Internet research*, 16(3), e66.

Kay, M., Santos, J., & Takane, M. (2011). mHealth: New horizons for health through mobile technologies. *World Health Organization*, 66-71.

Kenter, R. M., van de Ven, P. M., Cuijpers, P., Koole, G., Niamat, S., Gerrits, R. S., & van Straten, A. (2015). Costs and effects of Internet cognitive behavioural treatment blended with face-to-face treatment: Results from a naturalistic study. *Internet Interventions*, 2(1), 77-83.

Khazaal, Y., Chatton, A., Cochand, S., Hoch, A., Khankarli, M. B., Khan, R., & Zullino, D. F. (2008). Internet use by patients with psychiatric disorders in search for general and medical information. *Psychiatric Quarterly*, 79(4), 301-309.

Kooistra, L. C., Ruwaard, J., Wiersma, J. E., van Oppen, P., van der Vaart, R., van Gemert-Pijnen, J. E., & Riper, H. (2016). Development and initial evaluation of blended cognitive behavioural treatment for major depression in routine specialized mental health care. *Internet Interventions*, 4, 61-71.

Krebs, P., & Duncan, D. T. (2015). Health app use among US mobile phone owners: a national survey. *JMIR mHealth and uHealth*, 3(4).

Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The phq-9. *Journal of general internal medicine*, 16(9), 606-613.

Kummervold, P. E., Chronaki, C. E., Lausen, B., Prokosch, H. U., Rasmussen, J., Santana, S., ... & Wangberg, S. C. (2008). eHealth trends in Europe 2005-2007: a population-based survey. *Journal of medical Internet research*, 10(4).

- La Rosa, A. (2013). Harvesting the Twittersphere: Qualitative Research Methods Using Twitter. Thesis, Honors College, Pace University
- Lannin, Daniel G., et al. "Does self-stigma reduce the probability of seeking mental health information?" *Journal of counseling psychology* 63.3 (2016): 351.
- Lappalainen, P., Kaipainen, K., Lappalainen, R., Hoffrén, H., Myllymäki, T., Kinnunen, M. L., ... & Korhonen, I. (2013). Feasibility of a personal health technology-based psychological intervention for men with stress and mood problems: randomized controlled pilot trial. *JMIR Research Protocols*, 2(1), e1.
- Lemyre, L., & Tessier, R. (1988). Mesure de Stress Psychologique (MSP): Se sentir stressé-e. *Canadian Journal of Behavioural Science/Revue canadienne des sciences du comportement*, 20(3), 302.
- Lewis, C., Pearce, J., & Bisson, J. I. (2012). Efficacy, cost-effectiveness and acceptability of self-help interventions for anxiety disorders: systematic review. *The British journal of psychiatry*, 200(1), 15-21.
- Liddell, A., Adshead, S., & Burgess, E. (2008). Technology in the NHS. Transforming the patient's experience of care. *London: King's Fund*.
- Lieberman, G., & Naylor, M. R. (2012). Interactive voice response technology for symptom monitoring and as an adjunct to the treatment of chronic pain. *Translational behavioural medicine*, 2(1), 93-101.
- Ly, K. H., Dahl, J., Carlbring, P., & Andersson, G. (2012). Development and initial evaluation of a smartphone application based on acceptance and commitment therapy. *Springer Plus*, 1(1), 1-11.
- Ly, K. H., Topooco, N., Cederlund, H., Wallin, A., Bergström, J., Molander, O., ... & Andersson, G. (2015). Smartphone-supported versus full behavioural activation for depression: a randomised controlled trial. *PloS one*, 10(5), e0126559.
- Ly, K. H., Trüschel, A., Jarl, L., Magnusson, S., Windahl, T., Johansson, R., ... & Andersson, G. (2014). Behavioural activation versus mindfulness-based guided self-

help treatment administered through a smartphone application: a randomised controlled trial. *BMJ open*, 4(1), e003440.

Mani, M., Kavanagh, D. J., Hides, L., & Stoyanov, S. R. (2015). Review and evaluation of mindfulness-based iPhone apps. *JMIR mHealth and uHealth*, 3(3).

Mariani, A. W., & Pêgo-Fernandes, P. M. (2012). Telemedicine: a technological revolution. *Sao Paulo Medical Journal*, 130(5), 277-278.

Marteau, T. M., & Bekker, H. (1992). The development of a six-item short-form of the state scale of the Spielberger State—Trait Anxiety Inventory (STAI). *British Journal of Clinical Psychology*, 31(3), 301-306.

Martínez-Pérez, B., de la Torre-Díez, I., & López-Coronado, M. (2013). Mobile health applications for the most prevalent conditions by the World Health Organization: review and analysis. *Journal of medical Internet research*, 15(6).

MHealth App Developer Economics 2015 - research2guidance. (n.d.). Retrieved November 25, 2015, from

<http://www.bing.com/cr?IG=595ABB01254346AD9E921920EC165698&CID=0C89021CCEDA612D0C43093BCFDC60C0&rd=1&h=qzez5Qn55HYZ-WKQnsiyCKk3tButwDtbWHXRUSGcYYM&v=1&r=http%3a%2f%2fwww.research2guidance.com%2fwp-content%2fuploads%2f2015%2f11%2fr2g-mHealth-App-Developer-Economics-2015-Preview.pdf&p=DevEx,5065.1>

Moerman, N., van Dam, F. S., Muller, M. J., & Oosting, H. (1996). The Amsterdam preoperative anxiety and information scale (APAIS). *Anesthesia & Analgesia*, 82(3), 445-451.

Montagni, I., Donisi, V., Tedeschi, F., Parizot, I., Motrico, E., & Horgan, A. (2016). Internet use for mental health information and support among European university students: The e-MentH project. *Digital Health*, 2, doi: 2055207616653845.

More, K., Deshmukh, T., Darekar, P., Shirbhate, R., & Scholar, U. G. (2016). Survey of Evaluating Public Opinion Variation on Twitter. *International Journal of Engineering Science*, 3532.

Morris, M. E., & Aguilera, A. (2012). Mobile, social, and wearable computing and the evolution of psychological practice. *Professional Psychology: Research and Practice*, 43(6), 622.

Musiat, P., Goldstone, P., & Tarriner, N. (2014). Understanding the acceptability of e-mental health-attitudes and expectations towards computerised self-help treatments for mental health problems. *BMC psychiatry*, 14(1), 1.

Naslund, J. A., Aschbrenner, K. A., Marsch, L. A., & Bartels, S. J. (2016). The future of mental health care: peer-to-peer support and social media. *Epidemiology and psychiatric sciences*, 25(02), 113-122.

Nicholas, J., Larsen, M. E., Proudfoot, J., & Christensen, H. (2015). Mobile apps for bipolar disorder: a systematic review of features and content quality. *Journal of medical Internet research*, 17(8).

Oh, E., Jorm, A. F., & Wright, A. (2009). Perceived helpfulness of websites for mental health information. *Social psychiatry and psychiatric epidemiology*, 44(4), 293-299.

Olthuis, J. V., Watt, M. C., Bailey, K., Hayden, J. A., & Stewart, S. H. (2015). Therapist-supported internet cognitive-behavioural therapy for anxiety disorders in adults. *BJPsych Advances*, 21(5), 290-290.

Payne, H. E., Lister, C., West, J. H., & Bernhardt, J. M. (2015). Behavioural functionality of mobile apps in health interventions: a systematic review of the literature. *JMIR mHealth and uHealth*, 3(1).

Possemato, K., Kuhn, E., Johnson, E., Hoffman, J. E., Owen, J. E., Kanuri, N., ... & Brooks, E. (2016). Using PTSD Coach in primary care with and without clinician support: a pilot randomized controlled trial. *General hospital psychiatry*, 38, 94-98.

- Powell, J., & Clarke, A. (2006). Internet information-seeking in mental health Population survey. *The British Journal of Psychiatry*, 189(3), 273-277.
- Price, M., Yuen, E. K., Goetter, E. M., Herbert, J. D., Forman, E. M., Acierno, R., & Ruggiero, K. J. (2014). mHealth: a mechanism to deliver more accessible, more effective mental health care. *Clinical psychology & psychotherapy*, 21(5), 427-436.
- Quinn, C. C., Shardell, M. D., Terrin, M. L., Barr, E. A., Ballew, S. H., & Gruber-Baldini, A. L. (2011). Cluster-randomized trial of a mobile phone personalized behavioural intervention for blood glucose control. *Diabetes care*, DC\_110366.
- Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied psychological measurement*, 1(3), 385-401.
- Reavley, N. J., & Jorm, A. F. (2011). The quality of mental disorder information websites: a review. *Patient education and counseling*, 85(2), e16-e25.
- Reger, M. A., & Gahm, G. A. (2009). A meta-analysis of the effects of internet-and computer-based cognitive-behavioural treatments for anxiety. *Journal of clinical psychology*, 65(1), 53-75.
- Ribeiro, F. N., Araújo, M., Gonçalves, P., Gonçalves, M. A., & Benevenuto, F. (2016). Sentibench-a benchmark comparison of state-of-the-practice sentiment analysis methods. *EPJ Data Science*, 5(1), 1-29.
- Riper, H., Van Ballegooijen, W., Kooistra, L., De Wit, J., & Donker, T. (2013). Preventie & eMental-health. Onderzoek dat leidt, technologie die verleidt, preventie die bereikt en beklift. Amsterdam: Vrije Universiteit Amsterdam.
- Rizvi, S. L., Dimeff, L. A., Skutch, J., Carroll, D., & Linehan, M. M. (2011). A pilot study of the DBT coach: an interactive mobile phone application for individuals with borderline personality disorder and substance use disorder. *Behaviour Therapy*, 42(4), 589-600.
- Roepke, A. M., Jaffee, S. R., Riffle, O. M., McGonigal, J., Broome, R., & Maxwell, B. (2015). Randomized controlled trial of SuperBetter, a smartphone-based/Internet-

based self-help tool to reduce depressive symptoms. *Games for health journal*, 4(3), 235-246.

Romijn, G., Riper, H., Kok, R., Donker, T., Goorden, M., van Roijen, L. H., & Koning, J. (2015). Cost-effectiveness of blended vs. face-to-face cognitive behavioural therapy for severe anxiety disorders: study protocol of a randomized controlled trial. *BMC psychiatry*, 15(1), 1.

Rothwell, P. M. (2005). External validity of randomised controlled trials: “to whom do the results of this trial apply?”. *The Lancet*, 365(9453), 82-93.

Santana, L., & Fontenelle, L. F. (2011). A review of studies concerning treatment adherence of patients with anxiety disorders. *Patient preference and adherence*, 5, 427-439.

Scheffler, T. (2014). A German Twitter Snapshot. In *LREC* (pp. 2284-2289).

Schomerus, G., Angermeyer, M. C., Baumeister, S. E., Stolzenburg, S., Link, B. G., & Phelan, J. C. (2016). An online intervention using information on the mental health-mental illness continuum to reduce stigma. *European Psychiatry*, 32, 21-27.

Shen, N., Levitan, M. J., Johnson, A., Bender, J. L., Hamilton-Page, M., Jadad, A. A. R., & Wiljer, D. (2015). Finding a depression app: A review and content analysis of the depression app marketplace. *JMIR mHealth and uHealth*, 3(1), e16.

Shintani, N., Li, S., & Ellis, R. (2013). Comprehension-Based Versus Production-Based Grammar Instruction: A Meta-Analysis of Comparative Studies. *Language learning*, 63(2), 296-329.

So, M., Yamaguchi, S., Hashimoto, S., Sado, M., Furukawa, T. A., & McCrone, P. (2013). Is computerised CBT really helpful for adult depression? -A meta-analytic re-evaluation of CCBT for adult depression in terms of clinical implementation and methodological validity. *BMC psychiatry*, 13(1), 1.

- Spek, V., Cuijpers, P. I. M., Nyklíček, I., Riper, H., Keyzer, J., & Pop, V. (2007). Internet-based cognitive behaviour therapy for symptoms of depression and anxiety: a meta-analysis. *Psychological medicine*, 37(03), 319-328.
- Spielberger, C. D. (1989). *State-Trait Anxiety Inventory: Bibliography (2nd ed.)*. Palo Alto, CA: Consulting Psychologists Press
- Spitzer, R. L., Kroenke, K., Williams, J. B., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of internal medicine*, 166(10), 1092-1097.
- Stacey, F. G., James, E. L., Chapman, K., Courneya, K. S., & Lubans, D. R. (2015). A systematic review and meta-analysis of social cognitive theory-based physical activity and/or nutrition behaviour change interventions for cancer survivors. *Journal of Cancer Survivorship*, 9(2), 305-338.
- Stjernswärd, S. (2015). Relatives and friends queries on a psychologists “question and answer” forum online—authorship and contents. *Informatics for Health and Social Care*, 40(2), 154-166.
- Stone et al. (2016) Chapter One, Do Guided psychological or health and wellbeing mobile applications improve symptoms of anxiety or depression? A Systematic Review. Thesis Submission.
- Stoyanov, S. R., Hides, L., Kavanagh, D. J., Zelenko, O., Tjondronegoro, D., & Mani, M. (2015). Mobile app rating scale: a new tool for assessing the quality of health mobile apps. *JMIR mHealth and uHealth*, 3(1), e27.
- Tan, L., Wang, M. J., Modini, M., Joyce, S., Mykletun, A., Christensen, H., & Harvey, S. B. (2014). Preventing the development of depression at work: a systematic review and meta-analysis of universal interventions in the workplace. *BMC medicine*, 12(1), 1.
- The Value of Google Result Positioning. (n.d.) Retrieved, November 29, 2015. From <https://chitika.com/google-positioning-value>



Tonsaker, T., Bartlett, G., & Trpkov, C. (2014). Health information on the Internet: gold mine or minefield? *Canadian family physician Médecin de famille canadien*, 60(5), 407.

Twitter Developer Platform - Twitter Developers. (n.d.). Retrieved November 25, 2015, from <https://dev.twitter.com/>

Van der Vaart, R., Drossaert, C. H., de Heus, M., Taal, E., & van de Laar, M. A. (2013). Measuring actual eHealth literacy among patients with rheumatic diseases: a qualitative analysis of problems encountered using Health 1.0 and Health 2.0 applications. *Journal of medical Internet research*, 15(2), e27.

Varnfield, M., Karunanithi, M., Lee, C. K., Honeyman, E., Arnold, D., Ding, H., ... & Walters, D. L. (2014). Smartphone-based home care model improved use of cardiac rehabilitation in post myocardial infarction patients: results from a randomised controlled trial. *Heart*, heartjnl-2014.

Volker, D., Zijlstra-Vlasveld, M. C., Anema, J. R., Beekman, A. T., Brouwers, E. P., Emons, W. H., ... & van der Feltz-Cornelis, C. M. (2015). Effectiveness of a blended web-based intervention on return to work for sick-listed employees with common mental disorders: Results of a cluster randomized controlled trial. *Journal of medical Internet research*, 17(5).

Waller, R., & Gilbody, S. (2009). Barriers to the uptake of computerized cognitive behavioural therapy: a systematic review of the quantitative and qualitative evidence. *Psychological medicine*, 39(05), 705-712.

Wallin, E. E. K., Mattsson, S., & Olsson, E. M. G. (2016). The Preference for Internet-Based Psychological Interventions by Individuals Without Past or Current Use of Mental Health Treatment Delivered Online: A Survey Study with Mixed-Methods Analysis. *JMIR Mental Health*, 3(2), e25.

Watts, S., Mackenzie, A., Thomas, C., Griskaitis, A., Mewton, L., Williams, A., & Andrews, G. (2013). CBT for depression: a pilot RCT comparing mobile phone vs. computer. *BMC psychiatry*, 13(1), 1.

Wentzel, J., van der Vaart, R., Bohlmeijer, E. T., & van Gemert-Pijnen, J. E. (2016). Mixing Online and Face-to-Face Therapy: How to Benefit from Blended Care in Mental Health Care. *JMIR mental health*, 3(1).

Wilhelmsen, M., Lillevoll, K., Risør, M. B., Høifødt, R., Johansen, M. L., Waterloo, K., & Kolstrup, N. (2013). Motivation to persist with internet-based cognitive behavioural treatment using blended care: a qualitative study. *BMC psychiatry*, 13(1), 1.

Wootton, B. M., Titov, N., Dear, B. F., Spence, J., & Kemp, A. (2011). The acceptability of Internet-based treatment and characteristics of an adult sample with obsessive compulsive disorder: An Internet survey. *PLoS One*, 6(6), e20548.

Worthen-Chaudhari, L., Logan, K., McGonigal, J., Yeates, K., & Mysiw, W. J. (2015). Concussion Symptoms in Adolescents Are Alleviated Through Use of a Gamified Health App. *Archives of Physical Medicine and Rehabilitation*, 96(12), e8.

Ybarra, M. L., & Suman, M. (2006). Help seeking behaviour and the Internet: a national survey. *International journal of medical informatics*, 75(1), 29-41.

Zigmond, A. S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta psychiatrica scandinavica*, 67(6), 361-370.

# Appendix 1 Downs and Black Quality Criteria Checklist

## Downs and Black 1998 Quality Criteria Checklist

Study \_\_\_\_\_ Year \_\_\_\_\_

Total Score \_\_\_\_\_ out of 28

### Checklist for measuring study quality

#### Reporting

1. Is the hypothesis/aim/objective of the study clearly described?

Yes =1	
No =0	
Page No.	

2. Are the main outcomes to be measured clearly described in the Introduction or Methods section?

Yes =1	
No =0	
Page No.	

*If the main outcomes are first mentioned in the Results section, the question should be answered no.*

3. Are the characteristics of the patients included in the study clearly described ?

Yes =1	
No =0	
Page No.	

*In cohort studies and trials, inclusion and/or exclusion criteria should be given. In case-control studies, a case-definition and the source for controls should be given.*

4. Are the interventions of interest clearly described?

*Treatments and placebo (where relevant) that are to be compared should be clearly described.*

Yes =1	
No =0	
Page No.	

5. Are the distributions of principal confounders in each group of subjects to be compared clearly described?

*A list of principal confounders is provided.*

Yes =2	
Partially =1	
No =0	
Page No.	

6. Are the main findings of the study clearly described?

*Simple outcome data (including denominators and numerators) should be reported for all major findings so that the reader can check the major analyses and conclusions. (This question does not cover statistical tests which are considered below).*

Yes =1	
No =0	
Page No.	

7. Does the study provide estimates of the random variability in the data for the main outcomes?

*In non normally distributed data the inter-quartile range of results should be reported. In normally distributed data the standard error, standard deviation or confidence intervals should be reported. If the distribution of the data is not described, it must be assumed that the estimates used were appropriate and the question should be answered yes.*

Yes =1	
No =0	
Page No.	

8. Have all important adverse events that may be a consequence of the intervention been reported?

*This should be answered yes if the study demonstrates that there was a comprehensive attempt to measure adverse events. (A list of possible adverse events is provided).*

Yes =1	
No =0	
Page No.	

9. Have the characteristics of patients lost to follow-up been described?

*This should be answered yes where there were no losses to follow-up or where losses to follow-up were so small that findings would be unaffected by their inclusion. This should be answered no where a study does not report the number of patients lost to follow-up.*

Yes =1	
No =0	
Page No.	

10. Have actual probability values been reported (e.g. 0.035 rather than <0.05) for the main outcomes except where the probability value is less than 0.001?

Yes =1	
No =0	
Page No.	

## External validity

All the following criteria attempt to address the representativeness of the findings of the study and whether they may be generalised to the population from which the study subjects were derived.

11. Were the subjects asked to participate in the study representative of the entire population from which they were recruited?

*The study must identify the source population for patients and describe how the patients were selected. Patients would be representative if they comprised the entire source population, an unselected sample of consecutive patients, or a random sample. Random sampling is only feasible where a list of all members of the relevant population exists. Where a study does not report the proportion of the source population from which the patients are derived, the question should be answered as unable to determine.*

Yes =1	
No =0	
Unable to Determine=0	
Page No.	

12. Were those subjects who were prepared to participate representative of the entire population from which they were recruited?

*The proportion of those asked who agreed should be stated. Validation that the sample was representative would include demonstrating that the distribution of the main confounding factors was the same in the study sample and the source population.*

Yes =1	
No =0	
Unable to Determine=0	
Page No.	

13. Were the staff, places, and facilities where the patients were treated, representative of the treatment the majority of patients receive?

*For the question to be answered yes the study should demonstrate that the intervention was representative of that in use in the source population. The question should be answered no if, for example, the intervention was undertaken in a specialist centre unrepresentative of the hospitals most of the source population would attend.*

Yes =1	
No =0	
Unable to Determine=0	
Page No.	

## Internal validity - bias

14. Was an attempt made to blind study subjects to the intervention they have received ?

*For studies where the patients would have no way of knowing which intervention they received, this should be answered yes.*

Yes =1	
No =0	
Unable to Determine=0	
Page No.	

15. Was an attempt made to blind those measuring the main outcomes of the intervention?

Yes =1	
No =0	
Unable to Determine=0	
Page No.	

16. If any of the results of the study were based on “data dredging”, was this made clear?

*Any analyses that had not been planned at the outset of the study should be clearly indicated. If no retrospective unplanned subgroup analyses were reported, then answer yes.*

Yes =1	
No =0	
Unable to Determine=0	
Page No.	

17. In trials and cohort studies, do the analyses adjust for different lengths of follow-up of patients, or in case-control studies, is the time period between the intervention and outcome the same for cases and controls ?

*Where follow-up was the same for all study patients the answer should be yes. If different lengths of follow-up were adjusted for by, for example, survival analysis the answer should be yes. Studies where differences in follow-up are ignored should be answered no.*

Yes =1	
No =0	
Unable to Determine=0	
Page No.	

18. Were the statistical tests used to assess the main outcomes appropriate?

*The statistical techniques used must be appropriate to the data. For example nonparametric methods should be used for small sample sizes. Where little statistical analysis has been undertaken but where there is no evidence of bias, the question should be answered yes. If the distribution of the data (normal or not) is not described it must be assumed that the estimates used were appropriate and the question should be answered yes.*

Yes =1	
No =0	
Unable to Determine=0	
Page No.	

19. Was compliance with the intervention/s reliable?

*Where there was non compliance with the allocated treatment or where there was contamination of one group, the question should be answered no. For studies where the effect of any misclassification was likely to bias any association to the null, the question should be answered yes.*

Yes =1	
No =0	
Unable to Determine=0	
Page No.	

20. Were the main outcome measures used accurate (valid and reliable)?

*For studies where the outcome measures are clearly described, the question should be answered yes. For studies which refer to other work or that demonstrates the outcome measures are accurate, the question should be answered as yes.*

Yes =1	
No =0	
Unable to Determine=0	
Page No.	

#### Internal validity - confounding (selection bias)

21. Were the patients in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited from the same population?

*For example, patients for all comparison groups should be selected from the same hospital. The question should be answered unable to determine for cohort and case control studies where there is no information concerning the source of patients included in the study.*

Yes =1	
No =0	
Unable to Determine=0	
Page No.	

22. Were study subjects in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited over the same period of time?

*For a study which does not specify the time period over which patients were recruited, the question should be answered as unable to determine.*

Yes =1	
No =0	
Unable to Determine=0	
Page No.	

23. Were study subjects randomised to intervention groups?

*Studies which state that subjects were randomised should be answered yes except where method of randomisation would not ensure random allocation. For example alternate allocation would score no because it is predictable.*

Yes =1	
No =0	
Unable to Determine=0	
Page No.	

24. Was the randomised intervention assignment concealed from both patients and health care staff until recruitment was complete and irrevocable?

*All non-randomised studies should be answered no. If assignment was concealed from patients but not from staff, it should be answered no.*

Yes =1	
No =0	
Unable to Determine=0	
Page No.	

25. Was there adequate adjustment for confounding in the analyses from which the main findings were drawn?

*This question should be answered no for trials if: the main conclusions of the study were based on analyses of treatment rather than intention to treat; the distribution of known confounders in the different treatment groups was not described; or the distribution of known confounders differed between the treatment groups but was not taken into account in the analyses. In nonrandomised studies if the effect of the main confounders was not investigated or confounding was demonstrated but no adjustment was made in the final analyses the question should be answered as no.*

Yes =1	
No =0	
Unable to Determine=0	
Page No.	

26. Were losses of patients to follow-up taken into account?

*If the numbers of patients lost to follow-up are not reported, the question should be answered as unable to determine. If the proportion lost to follow-up was too small to affect the main findings, the question should be answered yes.*

Yes =1	
No =0	
Unable to Determine=0	
Page No.	

## Power

27. Did the study report a power calculation?

Yes =1	
No =0	
Unable to Determine=0	
Page No.	



## Appendix 2- Search Terms

### Medline EBSCO Host

(MH "Anxiety") OR "Anxi\*" OR (MH "Anxiety Disorders") OR (MH "Depression") OR "mood\*" OR (MH "Stress, Psychological") OR (MH "Affect") OR "Wellbeing" OR (MH "Happiness") OR "happiness" OR "wellbeing" OR "personal satisfaction" OR "psychological well\*" OR "psychological health" OR (MH "Health Promotion") OR "health promotion" OR (MH "Health Behavior") OR "Health Behaviour" OR (MH "Stress, Psychological") OR "Psychological Stress" OR (MH "Quality of Life") OR "Quality of Life" OR "Life Satisfaction" OR (MH "Physical Activity") OR (MH "Motor Activity") OR "Motor Activity" (MH "Exercise") OR "Exercise" OR "exercis\*" OR "physical activit\*" OR (MH "Sleep Disorders, Circadian Rhythm") OR "insomnia" OR (MH "Sleep") OR "sleep" OR "sleep disturbance"

AND

(MH "Mobile Applications") OR "App" OR "Google Play" OR "App Store" OR "Mobile Tablets" OR "Sony" OR "Samsung" OR "HTC" OR "Nokia" OR "Blackberry" OR (MH "Smartphone") OR "smartphone" OR "smart phone\*" OR "Android" OR "iphone" OR "ipad" OR "itunes" OR "iOS" OR "Operating Systems" OR "Windows" OR "mHealth" OR "mobile health" OR "m-health" OR "mobile technology" OR "mobile phone\*" OR (MH "Telemedicine") OR (MH "Cell Phones")

### PsycInfo EBSCO Host

(DE "Anxiety") OR (DE "Anxiety Disorders") OR (DE "State Trait Anxiety Inventory") OR "Anxi\*" OR (MH "Anxiety Disorders") OR (DE "Major Depression") OR (DE "Depression (Emotion)") OR (DE "Zungs Self Rating Depression Scale") OR (DE "Beck Depression Inventory") OR "mood\*" OR (DE "Stress") OR (DE "Stress Management") OR (DE "Psychological Stress") OR (DE "Happiness") OR "happiness" OR "wellbeing" OR "psychological well\*" OR "psychological health" OR (DE "Health Promotion") OR "health promotion" OR

(DE "Health Care Psychology") OR "Health Behaviour" OR "Psychological Stress"  
OR (DE "Quality of Life") OR "Quality of Life" OR "Life Satisfaction" OR (DE  
"Physical Activity") OR (DE "Active Living") OR "Motor Activity" (DE "Exercise")  
OR (DE "Aerobic Exercise") OR "Exercise" OR "exercis\*" OR "physical activit\*"  
OR (DE "insomnia") OR "insomnia" OR (DE "Sleep") OR "sleep" OR "sleep  
disturbance"

AND

"App" OR "Google Play" OR "App Store" OR "Mobile Tablets" OR "Sony" OR  
"Samsung" OR "HTC" OR "Nokia" OR "Blackberry" OR (MH "Smartphone") OR  
"smartphone" OR "smart phone\*" OR "Android" OR "iphone" OR "ipad" OR  
"itunes" OR "iOS" OR "Operating Systems" OR "Windows" OR "mHealth" OR  
"mobile health" OR "m-health" OR "mobile technology" OR "mobile phone\*" OR  
(MH "Telemedicine") OR (MH "Cell Phones") OR DE "Mobile Devices" OR DE  
"Cellular Phones" OR DE "Computer Applications" OR DE "Telemedicine"

### **Cinahl Plus EBSCO**

(MH "Anxiety") OR "Anxiety" OR (MH "Anxiety Disorders") OR "Anxi\*" OR  
(MH "Depression") OR "Depress\*" OR "Stress" OR "mood\*" OR (MH "Stress ")  
OR (MH "Affect") OR "Wellbeing" OR (MH "Psychological Well-Being") OR (MH  
"Happiness") OR "happiness" OR "wellbeing" OR (MH "personal satisfaction") OR  
"personal satisfaction" OR "psychological well\*" OR "psychological health" OR  
(MH "Health Promotion") OR "health promotion" OR (MH "Health Behavior") OR  
(MH "Stress, Psychological") OR "Psychological Stress" OR (MH "Quality of  
Life") OR "Quality of Life" OR "Life Satisfaction" OR (MH "Physical Activity")  
OR (MH "Motor Activity") OR "Motor Activity" (MH "Exercise") OR "Exercise"  
OR "exercis\*" OR "physical activit\*" OR (MH "Insomnia") OR "insomnia" OR  
(MH "Sleep") OR "sleep" OR "sleep disturbance"

AND

(MH "Mobile Applications") OR "App" OR "Google Play" OR "App Store" OR  
"Mobile Tablets" OR "Sony" OR "Samsung" OR "HTC" OR "Nokia" OR

"Blackberry"OR (MH "Smartphone") OR "smartphone" OR "smart phone\*" OR "Android" OR "iphone" OR "ipad" OR "itunes" OR "iOS" OR "Operating Systems" OR "Windows" OR "mHealth" OR (MH Telehealth) OR "mobile health" OR "m-health" OR Technology OR "mobile technology" OR "mobile phone\*" OR (MH "Cell Phones")

### **Cochrane Central Register of Controlled Trials**

"anxiety":ti,ab,kw or "anxiety disorder" or anxi\* or "depression":ti,ab,kw or "stress" or "mood change" or "affect" OR "well being":ti,ab,kw or psychological well\* or "happiness" or personal satisfaction or psychological health OR "health promotion":ti,ab,kw or Quality of life or physical health or "exercise"

AND

smartphone:ti,ab,kw or smart phone or mobile application or "application" or google play:ti,ab,kw or app store or tablets or sony and "Samsung" OR HTC:ti,ab,kw or Nokia or "android" or iphone or ipad OR itunes:ti,ab,kw or iOS or "blackberry" or operating systems or Windows OR "tele-health":ti,ab,kw or mHealth or mobile health or m-health or mobile technology OR mobile phone:ti,ab,kw

Publication Year from 2008 to 2016, in Trials

## Appendix 3 Data Extraction Table

authors	year	nt	nc	mt	sdt	mc	sdc	Reported Effect Sizes	Effect Sizes	outcome	comment	target_outcome	comparison	cont_cond	cont_grp	Outcome Priority
Ahmedani et al.	2015	64	64	12.4	5.1	10.2	6.2	No	-0.39	PHQ-9	CBT MI	Depression	PPC	PPC	Narrative	Primary
Baron, J. S., et al. (2016)	2016	45	36	8.94	6.58	11.5	6.4	Yes	0.38	CESD-10		Depression	GC	Passive		Secondary
Baron, J. S., et al. (2016)	2016	45	41	9.94	6.71	8.94	6.58	No	-0.15	CESD-10		depression	PPC	PPC		Secondary
Baron, J. S., et al. (2016)	2016	45	36	43.31	15.41	46.37	14.99	Yes	0.2	STAI-6		Anxiety	GC	Passive		Secondary
Baron, J. S., et al. (2016)	2016	45	41	43.8	15.51	43.31	15.41	No	-0.03	STAI-6		Anxiety	PPC	PPC		Secondary
Birney, A. J., et al. (2016).	2016	150	150	8.8	5.1	9.5	5	No	0.14	PHQ-9	MoodHacker	Depression	GC	Active	Email to online information	No Differentiation
Birney, A. J., et al. (2016).	2016	150	00	13.2	4.3	8.8	5.1	No	-0.93	PHQ-9	MoodHacker	Depression	PPC	PPC	PPC	No Differentiation
Birney, A. J., et al. (2016).	2016	150	00	27.5	10.1	25.7	9	No	-0.19	BADS	MoodHacker	Depression	GC	Active	Email to online info	No Differentiation
Birney, A. J., et al. (2016).	2016	150	00	21.3	7.4	27.5	10.1	No	0.7	BADS	MoodHacker	Depression	PPC	PPC	PPC	No Differentiation
Burns, M. N., et al. (2011).	2011	7	7	17.13	3.8	3.57	4.12	Yes	3.43	PHQ-9	Mobilelyze	Depression	PPC	PPC	PPC	Primary
Burns, M. N., et al. (2011).	2011	7	7	15.5	4.72	6.43	2.3	Yes	2.58	GAD-7	Mobilelyze	Anxiety	PPC	PPC	PPC	Secondary
Carissoli, C., et al. (2015)	2015	20	18	6.4	3	6.78	2.88	No	0.13	MSP	Meditation vs Music	Depressive anxiety	GC	Active	Music	No Differentiation
Carissoli, C., et al. (2015)	2015	20	18	6.4	3	NR	NR			MSP	Meditation vs WL	Depressive anxiety	GC	Passive	WL	No Differentiation
Carissoli, C., et al. (2015)	2015	20	20	6.25	2.24	6.4	3	No	0.06	MSP	Meditation	Depressive anxiety	PPC	PPC	PPC	No Differentiation
Choi, J., et al. (2015).	2015	14	15	8.8	2.7	11.1	6.9	No	0.43	CES-D	Trial App with Fitbit	Depression	GC	Active	Fitbit Only	Secondary
Choi, J., et al. (2015).	2015	14	14	9.8	6.7	8.8	2.7	No	-0.2	CES-D	Trial App with Fitbit	Depression	PPC	PPC	PPC	Secondary
Dagöo, J., et al. (2014)	2014	52	52	14.79	10.97	20.02	11.56	Yes	0.64	BAI	mCBT	Anxiety	GC	Active	MIPT	Secondary

Dagöö, J., et al. (2014)	20 14	52	52	19. 8	12. 12	20. 02	11. 56	Yes	-0.02	BAI	mIPT	Anxiety	PPC	PPC	PPC	Secondary
Dagöö, J., et al. (2014)	20 14	52	52	17. 3	9.2 5	14. 79	10. 97	Yes	0.25	BAI	mCBT	Anxiety	PPC	PPC	PPC	Secondary
Dagöö, J., et al. (2014)	20 14	52	52	10. 44	4.7 7	14. 62	4.7 7	Yes	0.88	MADR S-S	mCBT	Depression	GC	Active	MIPT	Secondary
Dagöö, J., et al. (2014)	20 14	52	52	14. 08	6.3	14. 62	4.7 7	Yes	-0.1	MADR S-S	mIPT	Depression	PPC	PPC	PPC	Secondary
Dagöö, J., et al. (2014)	20 14	52	52	11. 7	5.0 9	10. 44	4.7 7	Yes	0.26	MADR S-S	mCBT	Depression	PPC	PPC	PPC	Secondary
Dennis, T. A. and L. O'Toole (2014).	20 14	18	20	33. 11	9.7 4	37. 85	9.8 1	No	0.49	STAI	Short-ABMT	Anxiety	GC	Passive	Placebo	No Differentiation
Dennis, T. A. and L. O'Toole (2014).	20 14	18	18	36. 33	11. 64	33. 11	9.7 4	No	-0.3	STAI	Short-ABMT	Anxiety	PPC	PPC	PPC	No Differentiation
Dennis, T. A. and L. O'Toole (2014).	20 14	18	19	33. 11	9.7 4	39. 84	10. 49	No	0.66	STAI	Short-ABMT vs Long Training	Anxiety	GC	Active	Long Training	No Differentiation
Dennis, T. A. and L. O'Toole (2014).	20 14	19	19	39. 84	10. 49	39. 84	8.4 8	No	0	STAI	Long-ABMT	Anxiety	GC	Passive	Placebo	No Differentiation
Dennis, T. A. and L. O'Toole (2014).	20 14	19	19	41. 95	10. 21	39. 84	10. 49	No	-0.2	STAI	Long-ABMT	Anxiety	PPC	PPC	PPC	No Differentiation
Depp, C. A., et al. (2015).	20 15	41	41	8.7 7	6.9 9	7.5 8.7	7.5 6.9	Yes	-0.17	MADR S-S	PRISM app	Depression	GC	Active	Paper-Pencil	Primary
Depp, C. A., et al. (2015).	20 15	41	41	11. 7	9	8.7	6.9	Yes	-0.37	MADR S-S	PRISM app	Depression	PPC	PPC	PPC	Primary
Dicianno, B. E., et al. (2015).	20 15	13	10	4.8	6.4	9.4	16. 6	No	0.39	BDI-II	iMHERE	Depression	GC	Passive	TAU	No Differentiation
Dicianno, B. E., et al. (2015).	20 15	13	13	6.6	6.3	4.8	6.4	No	-0.28	BDI-II	iMHERE	Depression	PPC	PPC	PCC	No Differentiation
Faurholt et al.	20 15	33	34	NR	NR	NR	NR	No		HAMD -17	Diary monitoring	Depression	GC	Passive		Primary
Faurholt et al.	20 15	33	33	NR	NR	NR	NR	No		HAMD -17	Diary monitoring	Depression	PPC	Passive		Primary
Glynn, L., et al. (2014)	20 14	37	39	2	1.9	2.3	2.2	No	0.15	HADS	Pedometre	Depressive anxiety	GC	Active	Not told how to use app	Secondary
Glynn, L., et al. (2014)	20 14	45	37	3.5	2.5	2	1.9	No	-0.67	HADS	Pedometre	Depressive anxiety	PPC	PPC	PPC	Secondary
Hansen, M. M. (2015).	20 15	16	24	3.4 3	0.3 9	3.2 2	0.6	No	-0.4	SAI	NVWM	Anxiety	GC	Active	Audio Relaxation	No Differentiation

Hansen, M. M. (2015).	20 15	16	24	3.4 3	0.3 9	3.3 6	0.3 7	No	-0.19	SAI	NVWM	Anxiety	GC	Active	Music Intervention	No Differentiation
Hansen, M. M. (2015).	20 15	16	14	3.4 3	0.3 9	3.3 1	0.5 2	No	-0.26	SAI	NVWM	Anxiety	GC	Active	Nature Video without music	No Differentiation
Hansen, M. M. (2015).	20 15	16	18	3.4 3	0.3 9	3.2 1	0.6 9	No	0.39	SAI	NVWM	Anxiety	GC	Passive	Control	No Differentiation
Hansen, M. M. (2015).	20 15	16	16	3.3 7	0.3 5	3.4 3	0.3 9	No	0.16	SAI	NVWM	Anxiety	PPC	PPC	PPC	No Differentiation
Howells, A., et al. (2014).	20 14	57	64	10.05	9.1 3	13.39	9.5 9	No	0.36	CESD	Headspace	Depression	GC	Passive	Neutral App, Catch Notes	No Differentiation
Howells, A., et al. (2014).	20 14	57	57	14.09	11.58	10.05	9.1 3	No	-0.39	CESD	Headspace	Depression	PPC	PPC	PPC	No Differentiation
Ji, L., et al. (2016)	20 16	51	51	18.92	7.2 3	25.18	7.4 3	No	0.85	APAIS	drawMD App	Anxiety	GC	Active	Verbal Information	No Differentiation
Ji, L., et al. (2016)	20 16	51	51	NR	NR	18.92	7.2 3	No		APAIS	drawMD App	Anxiety	PPC	PPC	PPC	No Differentiation
Ji, L., et al. (2016)	20 16	51	51	30.1	8.7 8	36.25	12.9	No	0.56	SAI	drawMD App	Anxiety	GC	Active	Verbal Information	No Differentiation
Ji, L., et al. (2016)	20 16	51	51	NR	NR	30.1	8.7 8	No		SAI	drawMD App	Anxiety	PPC	PPC	PPC	No Differentiation
Ji, L., et al. (2016)	20 16	51	51	34.94	10.16	37.8	8.7 2	No	0.3	TAI	drawMD App	Anxiety	GC	Active	Verbal Information	No Differentiation
Ji, L., et al. (2016)	20 16	51	51	NR	NR	34.94	10.16	No		TAI	drawMD App	Anxiety	PPC	PPC	PPC	No Differentiation
Ji, L., et al. (2016)	20 16	51	51	40.5	20.57	36.19	17.72	No	-0.23	m-YPAS	drawMD App	Anxiety	GC	Active	Verbal Information	No Differentiation
Ji, L., et al. (2016)	20 16	51	51	25.83	4.0 8	40.5	20.57	No	0.99	m-YPAS	drawMD App	Anxiety	PPC	PPC	PPC	No Differentiation
Johnson, N., et al. (2014)	20 14	16	16	33.09	17.6	39.39	16.4	Yes	0.33	STAI	Social Story App	Anxiety	GC	Passive	TAU	Primary
Johnson, N., et al. (2014)	20 14	16	16	33.73	14.9	33.09	17.6	No	0.04	STAI	Social Story App	Anxiety	PPC	PPC	PPC	Primary
Lappalainen, P., et al. (2013)	20 13	11	12	6.1 8	3.3 1	9.3 3	7.1	Yes	0.57	BDI	3 Apps	Depression	GC	Passive	No intervention	Primary
Lappalainen, P., et al. (2013)	20 13	11	11	14.64	7.6 1	6.1 8	3.3	Yes	1.11	BDI	3 Apps	Depression	PPC	PPC	PPC	Primary
Ly, K., et al. (2015)	20 15	46	47	15.17	11.51	13.68	10.68	Yes	-0.13	BDI-II	Blended Treatment and App	Depression	GC	Active	Full BA	Primary

Ly, K., et al. (2015)	20 15	46	46	28. 96	8.0 7	15. 17	11. 51	Yes	1.4	BDI-II	Blended Treatment and App	Depression	PPC	PPC	PPC	Primary
Ly, K., et al. (2015)	20 15	46	47	7.1 3	5.7 8	7.2 1	6.2 7	Yes	0.01	PHQ-9	Blended Treatment and App	Depression	GC	Active	Full BA	Secondary
Ly, K., et al. (2015)	20 15	46	46	15. 39	4.7 3	7.1 3	5.7 8	Yes	1.58	PHQ-9	Blended Treatment and App	Depression	PPC	PPC	PPC	Secondary
Ly, K., et al. (2015)	20 15	46	47	8.1 1	9.2 7	11. 34	9.0 2	Yes	0.36	BAI	Blended Treatment and App	Anxiety	GC	Active	Full BA	Secondary
Ly, K., et al. (2015)	20 15	46	46	15. 74	12. 11	8.1 1	9.2 7	Yes	0.72	BAI	Blended Treatment and App	Anxiety	PPC	PPC	PPC	Secondary
Ly, K., et al. (2014)	20 14	40	41	10. 89	5.9 2	12. 94	10. 18	Yes	0.25	BDI-II	BA App	Depression	GC	Active	Mindfulness App	Primary
Ly, K., et al. (2014)	20 14	40	40	23. 5	7.8 5	10. 89	5.9 2	Yes	1.83	BDI-II	BA App	Depression	PPC	PPC		Primary
Ly, K., et al. (2014)	20 14	41	41	24. 68	9.4 7	12. 94	10. 18	Yes	1.21	BDI-II	Mindfulness App	Depression	PPC	PPC		Primary
Ly, K., et al. (2014)	20 14	40	41	5.8 3	3.8 5	7.1 9	5.8 4	Yes	0.28	PHQ-9	BA App	Depression	GC	Active	Mindfulness App	Primary
Ly, K., et al. (2014)	20 14	40	40	12. 53	4.4 3	5.8 3	3.8 5	Yes	1.63	PHQ-9	BA App	Depression	PPC	PPC		Primary
Ly, K., et al. (2014)	20 14	41	41	13. 22	4.8 1	7.1 9	5.8 4	Yes	1.15	PHQ-9	Mindfulness App	Depression	PPC	PPC		Primary
Ly, K., et al. (2014)	20 14	40	41	8.8 1	5.7 7	9.2 2	7.6 8	Yes	0.06	BAI	BA App	Anxiety	GC	Active	Mindfulness App	Secondary
Ly, K., et al. (2014)	20 14	40	40	14. 6	9.0 9	8.8 1	5.7 7	Yes	0.76	BAI	BA App	Anxiety	PPC	PPC		Secondary
Ly, K., et al. (2014)	20 14	41	41	13. 51	9.3 1	9.2 2	7.6 8	Yes	0.51	BAI	Mindfulness App	Anxiety	PPC	PPC		Secondary
Ly, K. H., et al. (2012).	20 12	11	11	4.0 9	6.0 4	2.4 5	2.1 1	Yes	0.38	DASS-d	Values app	Depression	PPC	PPC	PPC	No Differentiation
Ly, K. H., et al. (2012).	20 12	11	11	2.4 5	5.5 6	1.3 6	2.2 9	Yes	0.27	ASS-a	Values app	Anxiety	PPC	PPC	PPC	No Differentiation
Possemato, K., et al. (2016)	20 16	10	10	8.7 8.3	8.3 9.4	9.4 5.5	5.5 5.5	Yes	0.09	PHQ-9	Self Managed PE Coach	Depression	GC	Active	Clinician Support	No Differentiation
Possemato, K., et al. (2016)	20 16	10	10	11. 3	9.7 8.7	8.7 8.3	8.3 8.3	Yes	0.27	PHQ-9	Self Managed PE Coach	Depression	PPC	PPC	PPC	No Differentiation
Possemato, K., et al. (2016)	20 16	10	10	11. 6	6.7 9.4	9.4 5.5	5.5 5.5	Yes	0.33	PHQ-9	Clinician Supported PE Coach	Depression	PPC	PPC	PPC	No Differentiation

Quinn, C., et al. (2011)	2011	56	51	7.9	1.7	8.5	1.8	No	0.34	PHQ-9	CPDS	Depression	GC	Passive	TAU	Secondary
Quinn, C., et al. (2011)	2011	62	56	9.9	2.1	7.9	1.7	No	-1.04	PHQ-9	CPDS	Depression	PPC	PPC	PPC	Secondary
Quinn, C., et al. (2011)	2011	21	51	7.9	1.4	8.5	1.8	No	0.35	PHQ-9	CPP	Depression	GC	Passive	TAU	Secondary
Quinn, C., et al. (2011)	2011	22	21	9	1.8	7.9	1.4	No	-0.68	PHQ-9	CPP	Depression	PPC	PPC	PPC	Secondary
Quinn, C., et al. (2011)	2011	21	51	7.7	1	8.5	1.8	No	0.5	PHQ-9	CO	Depression	GC	Passive	TAU	Secondary
Quinn, C., et al. (2011)	2011	23	21	9.3	1.8	7.7	1	No	-1.09	PHQ-9	CO	Depression	PPC	PPC	PPC	Secondary
Roepke	2015	93	97	23.55	13.73	19.06	10.3	No	-0.37	CES-D	CBT vs General Superbetter	Depression	GC	Active	General SuperBetter	Primary
Roepke	2015	93	93	23.55	13.73	27.36	10.63	No	0.31	CES-D	CBT vs WL	Depression	GC	Passive	WL	Primary
Roepke	2015	93	93	34.48	9.24	23.55	13.73	No	-0.93	CES-D	CBT	Depression	PPC	PPC	PPC	Primary
Roepke	2015	97	93	19.06	10.3	27.36	10.63	No	0.79	CES-D	SB	Depression	GC	Passive	WL	Primary
Roepke	2015	97	97	33.07	8.81	19.06	10.3	No	-1.46	CES-D	SB	Depression	PPC	PPC	PPC	Primary
Roepke	2015	93	97	8.2	6.01	6.94	4.09	No	-0.25	GAD-7	CBT vs General	Anxiety	GC	Active	General Superbetter	Secondary
Roepke	2015	93	93	8.2	6.01	9.86	5.39	No	0.29	GAD-7	CBT vs WL	Anxiety	GC	Passive	WL	Secondary
Roepke	2015	93	93	12.49	4.75	8.21	6.01	No	-0.79	GAD-7	CBT	Anxiety	PPC	PPC	PPC	Secondary
Roepke	2015	97	93	6.94	4.09	9.86	5.39	No	0.61	GAD-7	SB	Anxiety	GC	Passive	WL	Secondary
Roepke	2015	97	97	10.99	4.98	6.94	4.09	No	-0.89	GAD-7	SB	Anxiety	PPC	PPC	PPC	Secondary
Rizvi,S, et al (2011)	2011	22	22	25.91	9.9	20.32	10.51	Yes	0.55	BDI	DBT Coach	Depression	PPC	PPC	PPC	No Differentiation
Varnfield, M., et al. (2014)	2014	38	23	2.1	3.1	4.7	8.6	No	-0.4	DASS-d	CAP-CR	Depression	GC	Active	TCR	Secondary
Varnfield, M., et al. (2014)	2014	38	38	4.3	5.5	2.1	4	No	0.46	DASS-d	CAP-CR	Depression	PPC	PPC	PPC	Secondary



Varnfield, M., et al. (2014)	20 14	38	23	2.1	3.1	4.1	5.7	No	-0.43	DASS-a	CAP-CR	A Anxiety nxiety	GC	Active	TCR	Secondary
Varnfield, M., et al. (2014)	20 14	38	38	3.8	4.7	2.1	3.1	No	0.43	DASS-a	CAP-CR	Anxiety	PPC	PPC	PPC	Secondary
Watts, S., et al. (2013)	20 13	22	30	12. 53	3.2 6	13. 68	2.7 9	Yes	-0.37	BDI-II	CBT-Get Happy	Depression	GD	Active	Computer	No Differentiation
Watts, S., et al. (2013)	20 13	22	22	33. 46	2.9 5	12. 53	3.2 6	Yes	1.79	BDI-II	CBT-Get Happy	Depression	PPC	PPC	PPC	No Differentiation
Watts, S., et al. (2013)	20 13	22	30	6.5 5	1.5 1	7.2 1	1.2 6	Yes	-0.47	PHQ-9	CBT-Get Happy	Depression	GD	Active	Computer	No Differentiation
Watts, S., et al. (2013)	20 13	22	22	14. 65	1.3 7	6.5 5	1.5 1	Yes	1.41	PHQ-9	CBT-Get Happy	Depression	PPC	PPC	PPC	No Differentiation
Worthen-Chaudari	20 15	10	6	9.7	7	8.7	8	No	-0.14	CES-DC	SuperBetter	Depression	GC	Passive	Gamified Health App	Primary
Worthen-Chaudari	20 15	10	10	20. 2	10. 2	9.7	7	No	-1.2	CES-DC	SuperBetter	Depression	PPC	PPC	Gamified Health App	Primary

# Appendix 4 Online Survey

## Informed Consent

### Prize Draw

Your participation in this study is voluntary. Every participant that completes the questionnaire and provide their email address will be entered in a free prize draw to win £50 of amazon e-vouchers. The winner will be notified at the end of the questionnaire collection period.

### Purpose of the Study:

This is a study being conducted by Paul Stone a Trainee Clinical Psychologist studying at the University of Edinburgh and working for NHS Fife. The purpose of this study is to understand the public's perception on the usability and quality of current mental health resources online. We further seek to understand some of the characteristics of people who use online mental health information. This study is being supervised by Dr Emily Newman and Dr Ethel Quayle at the University of Edinburgh. This study is part of a Doctoral Thesis for the D.Clin. Psychol. University of Edinburgh/ NHS (Scotland) Training Programme. This Study has been approved by the University of Edinburgh research ethics committee.

You have been invited to partake in a questionnaire that will look at how current mental health information websites are used and how they can be improved to meet the needs of the consumer. The general research aim is to understand how people currently use online mental health resources, their interests and use of technology.

### What will be done?

You will complete a survey, which will take 20-30 minutes to complete. The survey asks questions about your internet use and use of technology. Other survey questions will address how you search for mental health information online and your overall perception of the information available.

We also will ask for some demographic information (e.g., age, marital status, education level, geographical region) so that we can accurately describe the general traits of the people who participate in the study.

After you complete the questionnaire, we will examine some of your questionnaire entries and will record information overall people's perceptions about mental health information available online.

### Benefits of this Study:

You will be contributing to knowledge about the utilisation of online mental health information and the current quality of the information available.

After we have finished data collection, we can also will provide you with more detailed information about the purposes of the study and the research findings.

### Risks or discomforts:

No risks or discomforts are anticipated from taking part in this study. If you feel uncomfortable with a question, you can skip that question or withdraw from the study altogether. If you decide to quit at any time before you have finished the questionnaire, your answers will NOT be recorded.

### Confidentiality:

Your responses will be kept completely confidential. We will NOT know your IP address when you respond to the Internet survey. We will ask you to include basic demographic information and provide an email address should you want further information about the survey or should you wish to take part in a future Focus Group. However, your email address will not be stored with data from your survey or data from your weblog. Instead, you will be assigned a participant number, and only the participant number will appear with your survey responses. Only the researcher will see your individual survey responses. The list of e-mail and weblog addresses of our participants will be stored electronically in a password protected folder; a hard copy will be stored in a locked filing cabinet.

After we have finished data collection and have sent you a copy of the results of the study, we will destroy the list of participants' e-mail addresses unless you have request to take part in a future focus group.

### Right to quit at any time:

Your participation is voluntary; you are free to withdraw your participation from this study at any time. If you do not want to continue, you can simply leave this website. If you do not click on the "submit" button at the end of the survey, your answers and participation will not be recorded. You also may choose to skip any questions that you do not wish to answer.

### How the findings will be used:

The results of the study will be used for scholarly purposes only. The results from the study will be presented in educational settings and at professional conferences, and the results might be published in a professional journal in the field of psychology.

### Contact information:

If you have questions about this study, please contact Paul Stone at paulstone@nhs.net or the Psychology Department, Lynebank Hospital, Dunfermline, KY114UW

Should you want to raise any concerns or complaints about the project please contact Dr Emily Newman, Project Supervisor at [Emily.Newman@ed.ac.uk](mailto:Emily.Newman@ed.ac.uk) or Dr Ethel Quayle, Project Supervisor at [Ethel.Quayle@ed.ac.uk](mailto:Ethel.Quayle@ed.ac.uk) or Clinical Psychology, School of Health and Social Science, The University of Edinburgh, Medical School, Teviot Place, Edinburgh, EH8 9AG.

By starting the questionnaire you acknowledge that you have read this information and agree to participate in this research, with the knowledge that you are free to withdraw your participation at any time without penalty.

# Information about you

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## 1 Your Ethnicity

- White
  - Mixed
  - Asian, Asian Scottish or Asian British
  - Black, Black Scottish or Black British
  - Other Ethnic Background
  - Not Disclosed
  - Not Known
  - Other (Please Specify)
- 

## 2 Your Gender

- Male
  - Female
  - Other Specific
  - Rather not say
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## 3 Your Age

- Under
- 18
- years
- old
- 18-24
- years
- old
- 25-34
- years
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- 35-44
- years
- old
- 45-54
- years
- old
- 55-64
- years
- old
- 65-74
- years
- old

4 Location (Which health board do you come under?)

- Highlands and Islands, Scotland
- Greater Glasgow and Clyde, Scotland
- Dumfries and Galloway, Scotland
- Other (Please Specify)
- Fife, Scotland
- Tayside, Scotland
- Ayrshire and Arran, Scotland
- Lothian, Scotland
- Grampian, Scotland
- England
- Forth Valley, Scotland
- Lanarkshire, Scotland
- Wales
- Northern Ireland
- Borders, Scotland
- Ireland

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5 Are you currently employed? (You can select multiple answers if applicable)

- Employed
- Self-employed
- Out of work looking for work
- Out of work but not currently looking for work
- Carer
- Student
- Retired
- Unable to work
- Voluntary Work
- Other (Please Specify)

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6 Education: What is the highest degree or level of school you have completed? If currently enrolled, highest degree received.

- No schooling completed
- Primary School
- Some secondary school, no qualifications
- Secondary School, GSCE/ Standard Grade
- Secondary School, A-Levels/ Highers
- Undergraduate Degree
- Trade/technical/vocational training
- Post Graduate Degree
- Other (Please Specify)

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7 What is your marital status?

- Single, never married
- Married or domestic partnership
- Widowed
- Divorced
- Separated
- Prefer Not to Say

# Internet Use

In this section we would like to know more information about how you currently use the internet.

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## 8 Where do you most commonly access the internet? (You can select multiple answers if applicable)

- Home
- Work
- Public Library
- Community Centre
- Place of Education eg. college, school, university
- Outside with Mobile Device
- Public Internet Cafe
- Other (Please Specify)

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## 9 How long would you spend using the internet a day?

- 0-10 mins
  - 10-30 mins
  - 30 mins -1 hour
  - 1-2 hours
  - 2-3 hours
  - 3-4 hours
  - 4-5 hours
  - 5 hours and over
- 

## 10 How often do you use the internet during the evening?

- Less than
  - once a week
  - 1 to 3 nights
  - a week 4-5
  - nights a
  - week
  - 6-7 nights a week
- 

## 11 How would you rate your Internet expertise when searching for information on health conditions?

- Poor
  - Fair
  - Good
  - Excellent
- 

## 12 How do you spend most of your time using the internet? (You can select multiple answers if applicable)

- Education
- Entertainment
- Communication with others (not including email)
- Wasting time
- Other (Please Specify)
- Shopping/gathering product information
- Work/Business
- Gathering information for personal needs
- Social Media

**13** Please tick all of the following you currently use.

- Twitter
- Google+
- Facebook
- Video Websites e.g. Youtube
- LinkedIn
- Forums (Chat Rooms)
- Pinterest
- Information Websites
- Other (Please Specify)

**14** Please tick all of the following you currently use.

- Mobile Phone
- Tablet e.g. Ipad, Smart TV
- Ipod/ Music Player
- Desktop computer
- Playstation
- Nintendo/ Wii
- Xbox
- Laptop Computer
- Other (Please Specify)

**15** In general, do you use the internet to contact other people?

- Yes (Direct communication to other person- email, Skype, Chat rooms, Messenger)
- Yes (Facebook, Twitter, google+ posting views online)
- No
- Prefer not to say

**16** Have you ever talked about personal problems on the internet with other people in a **public** setting (chat rooms, blogs, Facebook Posts or Twitter)?

- Yes
- No
- Prefer not to Say
- Additional Information (If you wish you can provide more information)

**17** (If you answered yes to Question 16) Did you find talking about personal problems in a **public** setting harmful, helpful or neither?

- Very Helpful
- Helpful
- Neither
- Harmful
- Very Harmful
- Prefer not to say
- N/A
- Additional Information (If you wish you can provide more information)





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# Physical Health

In this section we would like to know more about how you would use the internet if you were looking for information about physical health issues.

**22** Have you ever used the internet to find information for a physical health problem for yourself or someone else?

- Yes
- No
- Prefer not to say

**23** When searching for information about a physical health problem, how would you usually begin?

**24** Did the internet help you deal more effectively with the problem?

- Made it a lot worse
- Made it a little worse
- Neither
- Helps a little
- Helps a lot
- N/A

**25** To what extent would you discuss the information found on the internet with:

Never when urgent/ important	Very Unlikely	Unlikely	Likely	Very Likely	Very Likely only
Health professional	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Close friends	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mental health professional	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other health professionals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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**26** Did this information help you (or someone you know) to manage your (or their) difficulties?

- Yes
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No

Prefer not to say

N/A

27 How important is it for you that a treatment for physical health issues...

0 Not important at all Important	1	2	3	4	5	6 Very
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... can be accessed without long waiting periods?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... motivates you to get better?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
...helps with your problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... suits your learning style?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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... provides you feedback on your progress?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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**30** For some physical health issues, computerised treatments are available. In this treatment, the patient accesses self-help material on a computer, often in the form of weekly session. Some programs can include email contact or interactive components.

To what extent do you think a **computerised treatment** for physical health issues would meet your expectations with regard to ...

0 Would not meet my expectations at all expectations 1 2 3 4 5 6 Would fully meet my

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... is free of charge for you?

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... providing you with feedback on your progress	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... motivating you to get better?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... can be accessed without long waiting periods?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... being credible?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**36** Self-help books are available for mental health problems and are designed to provide a step-by-step manual for getting better.

To what extent do you think a **self help book** for a mental health problem would meet your expectations with regard to

...	0	1	2	3	4	5	6
Would not meet my expectations at all						Would fully meet my expectations	
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... being free of charge?

**38** For some mental health problems, smartphone apps are available. These apps often provide information as well as tools and advice to overcome them.

To what extent do you think a **mental health app** would meet your expectations with regard to ...

0 Would not meet my expectations at all

1 2 3 4 5 6 Would fully meet my expectations

... motivating you to get better?

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... being free of charge?

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...helping with the problem?

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... being credible?

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39 Is there a specific website containing mental health information you find particularly helpful? (If not please answer No)

40 What particular function(s) of the website(s) helped you the most? (please select maximum of three answers) Please enter N/A in text box if not applicable)

- |                            |                          |                                   |                          |                              |                          |
|----------------------------|--------------------------|-----------------------------------|--------------------------|------------------------------|--------------------------|
| Local Group Information    | <input type="checkbox"/> | Pop up assistant                  | <input type="checkbox"/> | Audio Content                | <input type="checkbox"/> |
| Video content              | <input type="checkbox"/> | Information Pages                 | <input type="checkbox"/> | Apps Available               | <input type="checkbox"/> |
| Search Function            | <input type="checkbox"/> | Downloadable resources            | <input type="checkbox"/> | Recommended Websites         | <input type="checkbox"/> |
| Interactive Learning       | <input type="checkbox"/> | Recommended Reading               | <input type="checkbox"/> | Workbooks                    | <input type="checkbox"/> |
| Local Information          | <input type="checkbox"/> | Can be viewed on mobile or tablet | <input type="checkbox"/> | No Ads                       | <input type="checkbox"/> |
| Facebook and Twitter Links | <input type="checkbox"/> | Question and Answer forum         | <input type="checkbox"/> | Helplines                    | <input type="checkbox"/> |
| Real Life Stories          | <input type="checkbox"/> | Anonymity                         | <input type="checkbox"/> | Emergency or Crisis contacts | <input type="checkbox"/> |

Other (Please Specify)

41 By using the internet, did you get the kind of information you needed?

- Not at all
- Some what
- Very Much
- N/A

42 Did the internet help you or someone else deal more effectively with the problem?

- Made it alot worse
- Made it a little worse
- Neither
- Help a little
- Helped alot
- N/A

43 Did this information help you (or someone you know) to manage your (or their) difficulties?

- Yes
- No
- Prefer not to say
- N/A

44 Is the internet your primary resource for information on mental health?

- Yes
- No
- Prefer not to say

45 Are you looking for mental health information for yourself or others?

- Myself
- Others
- Prefer not to say
- Both

46 Please tick the problems you have search for information on.

- |                              |                          |             |                          |                   |                          |
|------------------------------|--------------------------|-------------|--------------------------|-------------------|--------------------------|
| Anxiety                      | <input type="checkbox"/> | Depression  | <input type="checkbox"/> | OCD               | <input type="checkbox"/> |
| Anger                        | <input type="checkbox"/> | Bereavement | <input type="checkbox"/> | Eating Disorder   | <input type="checkbox"/> |
| Postnatal Emotional Problems | <input type="checkbox"/> | Self Harm   | <input type="checkbox"/> | Trauma/ Abuse     | <input type="checkbox"/> |
| Self Esteem                  | <input type="checkbox"/> | Stress      | <input type="checkbox"/> | Bullying          | <input type="checkbox"/> |
| Drug/ Alcohol Problems       | <input type="checkbox"/> | None        | <input type="checkbox"/> | Prefer not to say | <input type="checkbox"/> |
| Other (Please Specify)       |                          |             |                          |                   |                          |

47 How much time does it take to find your answer?

- A lot less time than I expected
- Less time than I expected
- About the time I expected
- More time than I expected
- A lot time more than I expected
- N/A

48 What would be your current preference for receiving mental health information? (Please rank in order of preference, Favourite at the top)

To move options click and drag

- GP/Health Professional
- Mental Health Provider
- Voluntary Mental Health Service
- Family/ Friends
- Internet
- Library

49 Overall, is the information available on the internet, understandable and suitable for your needs?

- Too Basic
- Slightly Basic
- Just Right
- Slightly Complicated
- Too Complicated
- N/A



**50** Based on your experience, how would you rate the quality of UK based **mental health information websites**?

Very High Quality

High Quality

Average

Below Average

Unacceptable

Wouldn't know

**51** Based on your experience, how would you rate the quality of **mental health smartphone apps** available in the UK?

Very High Quality

High Quality

Average

Below Average

Unacceptable

N/A

Too little experience of apps to comment

**52** Please rate what features of the current mental health websites and apps you find most useful.

Not Applicable Not Useful Neutral Useful  
Extremely Useful

Fact sheets about mental health problems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sign Posting to other resources	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Guided Self Help	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Helpline information	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Resources for Professionals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ease of Use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Downloadable materials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Blogs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chat rooms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
True Stories	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**53** Please rate the following attributes of available UK based Mental Health Websites.

Poor		Fair Excellent	Neutral	Good	
Ease of Navigation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Accuracy of Information	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Meeting my needs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Quality of Content	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Layout/Design	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Quantity of Content	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**54** Please rate below how likely you would be to suggest the following to a friend who requires support for a mental health problem?

Very Unlikely		Unlikely Very Likely	Neutral	Likely	
Speaking to family	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Speaking to friends	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Viewing mental health websites	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Using health related smartphone apps	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Using telephone helplines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Visiting GP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Visiting community centre	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Speaking to trusted community member	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Speaking to religious figurehead	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Speaking to counsellor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Posting on Social Media (e.g. Facebook, Twitter)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Posting on private on-line forums	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Using a Self Help Book	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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**55** Are there any barriers to you accessing mental health or physical health information online or on a smartphone?

- Concerns about who might be collecting information
- Concerns about accessing using public use device (e.g. library computer)
- Difficulties getting privacy at home
- Need to register to website
- Fees
- Concerns about fraudulent websites
- Fear of Judgement from other users
- Cost of available devices
- Cost of WIFI/ Broadband
- Lack of broadband availability
- Other (Please Specify)

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## Prize Draw and Focus Groups

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- 56** If you would like to be entered into a prize draw for the chance to win £50 worth of Amazon Vouchers please enter your email address below. (your email address will not be linked to your answers)

Please note your email address will not be passed to third parties and will be deleted once the prize draw is made.

- 57** If you would like to take part in a focus group looking at how mental health websites could be improved please enter your email address and preferred location below.

Please note the locations of the Focus groups will be Dundee, Kirkcaldy, Edinburgh. However, if there is interest in another adjacent area this can be accommodated

### **58** Focus Group Location Preference

- Dundee
- Kirkcaldy
- Edinburgh
- N/A
- Other (Please Specify)

- 59** If you would like a summary of the research when completed please enter your email address below.

## Appendix 5- Ethical Approval



SCHOOL of HEALTH IN SOCIAL SCIENCE  
CLINICAL AND HEALTH PSYCHOLOGY

The University of Edinburgh  
Medical School  
Doorway 6, Teviot Place  
Edinburgh EH8 9AG

Telephone 0131 651 3969  
Fax 0131 650 3891  
Email [submitting.ethics@ed.ac.uk](mailto:submitting.ethics@ed.ac.uk)

Paul Stone  
Trainee Clinical Psychologist  
Department of Clinical and Health Psychology  
School of Health in Social Science  
University of Edinburgh

16 June 2015

Dear Paul,

### Application for Level 2 Approval

**Project Title:** Investigating the utilization of online mental health information in Scotland:  
A traditional and non-traditional approach

**Academic Supervisor:** Emily Newman / Ethel Quayle

Thank you for submitting the above research project for review by the Department of Clinical and Health Psychology Ethics Research Panel. I can confirm that the submission has been independently reviewed and was approved on the 15<sup>th</sup> June 2015.

Should there be any change to the research protocol it is important that you alert us to this as this may necessitate further review.

Yours sincerely,

Kirsty Gardner  
Administrator  
Clinical Psychology

## Appendix 6- Journal Guidelines

### Instructions for Authors of JMIR

#### Original Paper

Enter information for authors (including designations, affiliations, correspondence, contributions) in the online metadata form. Do not use periods after initials, and include degree designations and affiliations for all authors. Trial registration numbers are also filled in on the metadata forms online.

Title of Your Manuscript Should Describe the Intervention: Study Design

Abstract (Maximum 450 words)

Background:

Objective:

Methods:

Results: Be sure to include relevant statistics here, such as sample sizes, response rates, P values or Confidence Intervals. Be specific (by stating the value) rather than general (eg, "there were differences between the groups").

Conclusions:

Trial Registration: In accordance with ICMJE recommendations, RCTs must have been registered in a WHO accredited trial registry. Please mention the ClinicalTrials.gov registration identifier, the [International Standard Randomized Controlled Trial Number \(ISRCTN\)](#), or a comparable trial identifier at the end of the abstract ("Trial Registration: ClinicalTrials.gov NCT123456"), as well as when you first mention the trial in the manuscript. When mentioning related trials (e.g. in the Introduction or Methods section) the trial registration number should also be added in brackets. ICMJE member journals require, as a condition of consideration for publication, registration in a public trials registry at or before the onset of patient enrollment. This policy applies to any trial which started enrollment after July 1, 2005. JMIR authors must add an explanation to the methods section of their manuscript if a RCT meeting these criteria has not been registered. The JMIR editor reserves the right to reject any paper without trial registration without any further consideration or peer-review.

Keywords: Provide 3 to 10 keywords or short phrases separated with semicolons (;) that will assist indexers in cross-indexing the article and that may be published with the abstract. Terms from the medical subject headings (MeSH) list of Index Medicus should be used (see <http://www.nlm.nih.gov/mesh/MBrowser.html>). As well, keywords from [ACM's Computing Classification System](#) may be used if suitable MeSH terms are not available.

#### Introduction

This section can include background information such as theories, prior work, and hypotheses.



If this section is quite lengthy, use of subheadings are encouraged to break up the material logically. Subheadings should be consistent; therefore a subheading for the first part of the Methods section, for example, is also necessary (see below).

Generally, a typical paper contains between 3000 and 6000 words, but there are no rigorous restrictions. Papers should be written in accordance with the American Medical Association Manual of Style: A Guide for Authors and Editors. 9th ed. Baltimore, Md: Williams & Wilkins; 1998.

Please do not include URLs within the manuscript. A reference should be created for the URL and included in the reference list. Please use WebCite to capture the website as soon as possible, as they often expire after the intervention and become inaccessible.

## Methods

### Recruitment

Notice that the first subheading immediately follows the last heading. Subheadings under subheadings are also possible (see Statistical Analysis).

### Statistical Analysis

### Power

Notice that the next Heading Style (Heading Style 4 in this case) is used. Click on the different headings to see their Heading Style in the “Home” ribbon under “Styles”. Always have at least 2 of the same subheading level in a section.

## Data Exclusion

Try to avoid having only one sentence after a subheading. For example, describe the key findings of a Table that you refer to in that sentence.

## Results

### User Statistics

These are only examples of possible headings. Please feel free to use different headings to best describe your results.

## Evaluation Outcomes

Please make reference to your Textboxes (Textbox 1), Tables (Table 1), Figures (Figure 1), and Multimedia Appendices (Multimedia Appendix 1) in parenthesis. Please see the examples below for how they should be formatted. Please note the punctuation used in all components, including the caption/title, footnotes etc.

Figures and Multimedia Appendices are uploaded online, while Textboxes and Tables are not uploaded and remain in the body of the manuscript, appearing in the order they are mentioned after the first mention of each Table.

Textbox 1. The caption/title is placed here in a sentence format (capitalization of every word is unnecessary).

The formatting is actually a 1x1 Table, not an actual “textbox”. Textboxes have no footnotes.
--

Bullet points or numbered lists are allowed in textboxes.
---

Table 1. The table caption/title is placed here in a sentence format (capitalization of every word is unnecessary).a-e

	Main heading 1	Main heading 1	Main heading 1
	Main heading 2	Main heading 2	Main heading 2
Subheading			
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Subheading			
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Subheading			
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aNot all elements are necessary for every table, simply omit the irrelevant sections for your table and keep the formatting of the rest. For further details, please refer to the main Instructions for Authors of JMIR document.

bFootnotes are labeled in superscript lower case a-z. Other symbols are not used.

cAstericks (\*) can only be used if exact P values cannot be provided for a specific reason, and are listed after the superscript a-z footnotes.

dPlease be conscious of the overall width of the table. Tables will be automatically fitted/resized to the width of a US Letter Small page in portrait configuration during typesetting. Overcrowded Tables or Tables that are too crowded WILL look squished, and should be avoided if possible.

eLonger headings can be abridged within the Table, with a full explanation in a footnote.

Figure 1. Captions/titles are inserted online. Try to use Times New Roman for text within the Figure to match the font of the final typeset manuscript when possible. These should be .jpeg or .png files. Please prepare Figures with good resolution – Figures that are predominantly graphics/pictures should have dpi close to 300, while those that are text-dominant can have lower resolution (usually dpi 200). Try to use combinations of color and symbols/line styles to define and refer to different categories. This will help with readability if Figures are printed/viewed in black and white.

Discussion  
Principal Results  
Limitations  
Conclusions

#### Acknowledgements

Please include all authors' contributions, funding information, financial disclosure, role of sponsors, and other acknowledgements here. This description should include the involvement, if any, in review and approval of the manuscript for publication and the role of sponsors. Omit if not applicable.

#### Conflicts of Interest

Disclose any personal financial interests related to the subject matters discussed in the manuscript here. For example, authors who are owners or employees of Internet companies that market the services described in the manuscript will be disclosed here. If none, indicate with "none declared".

#### Abbreviations

JMIR: Journal of Medical Internet Research

RCT: randomized controlled trial

#### Multimedia Appendix 1

Multimedia appendices are supplementary files, such as a PowerPoint presentation of a conference talk about the study, additional screenshots of a website, mpeg/Quicktime video/audio files, Excel/Access/SAS/SPSS files containing original data (very long tables), and questionnaires. Do not include copyrighted material unless you obtained written permission from the copyright holder, which should be faxed to the editorial office in case of acceptance together with your Publication Agreement form.

The Multimedia Appendices must be uploaded online, accompanied by a caption. CONSORT-EHEALTH checklists are always uploaded as Multimedia Appendices. Although this is primarily intended for randomized trials, the section of the checklist describing how an intervention should be reported is also relevant for manuscripts with other evaluation designs.

Before submission, authors of RCTs must fill in the electronic CONSORT-EHEALTH questionnaire at <http://tinyurl.com/consort-ehealth-v1-6> with quotes from their manuscript (if you wish to comment on the importance of the items from the checklist for reporting, please also rate each item on a scale between 1-5). BEFORE you press submit, please generate a pdf of the form with your responses and upload this file as supplementary file entitled CONSORT-EHEALTH V1.6.

#### References

Number references using 1., 2., 3. etc (no square brackets) corresponding to the square bracketed references (eg, [1], [2,3], [4-7]) in the body of the manuscript. DO NOT use italics, periods after authors' initials, and periods after journal abbreviations.

DO use a semicolon (;) after a journal title before the year, put volume number in parenthesis, and use a colon (:) before the page numbers.  
Titles should be in sentence case (do NOT capitalize the first letter of every word).  
Do not use the footnotes tool to generate the reference list.  
Cite only published or accepted (“in print”) works. Submitted papers (not accepted) documents not widely available (personal emails, letters), or oral communications (unless they are published abstracts) should NOT be cited as references. Cite these in the main body of text as “personal communication by NAME, DATE” after obtaining permission from the communicator to quote his communication.  
Remove OLE elements from reference management softwares such as Endnote and Reference Manager. Select the entire document (Ctrl+A or Command A), remove field codes (Ctrl+Shift+F9 or Command+6). This is important for correct parsing of your reference list using RefCheck during copyediting. This is an automatic process, but please check for completeness and accuracy of parsed fields for each reference when prompted during copyediting steps after acceptance of your manuscript.  
Journal Articles (examples following): append the PubMed Identifier (PMID, eg, "PMID:1234567", where 1234567 is the PubMed identifier) or DOI (digital object identifier, eg, doi:10.1136/bmj.331.7529.1391) after each reference. Alternatively (as per our old instructions) you could append a [[Medline](#)] link after each reference, linking to the PubMed abstract of the article you are citing. You may check whether a DOI is correct using the DOI resolver at <http://dx.doi.org/>.  
International Committee of Medical Journal Editors. Uniform requirements for manuscripts submitted to biomedical journals. JAMA 1997;277:927-934.  
PMID:9062335  
International Committee of Medical Journal Editors. Uniform requirements for manuscripts submitted to biomedical journals. JAMA 1997;277:927-934. [[Medline](#)]  
Websites and Web articles (URLs) (example following) should be cited as "webcited@" references in the reference section at the end of the manuscript - do not include links to websites in the text. To webcite® a web reference means to take a snapshot of the cited document and to cite the archived copy (WebCite link) in addition to the original URL. JMIR now requires that authors use the [WebCite® technology \(www.webcitation.org\)](#) to archive cited web references first before they cite them. Do not cite uncached "live" webpages and websites in the article or reference section, unless archiving with WebCite has failed. Provide both the original URL and the WebCite link. Note that journal articles in electronic formats are journal articles, not a web reference.  
Fox S, Fallows D. 2003. Internet Health Resources.  
[http://www.pewinternet.org/pdfs/PIP\\_Health\\_Report\\_July\\_2003.pdf](http://www.pewinternet.org/pdfs/PIP_Health_Report_July_2003.pdf). Archived at:  
<http://www.webcitation.org/5I2STSU61>  
For books, please add the ISBN, if known (no blanks). (<http://isbndb.com/>; examples below)  
Iverson CL, Flanagan A, Fontanarosa PB, et al. American Medical Association Manual of Style: A Guide for Authors and Editors. 9th edition. Baltimore, Md: Williams & Wilkins; 1998. ISBN:0195176332

Phillips SJ, Whisnant JP. Hypertension and stroke. In: Laragh JH, Brenner BM, editors. Hypertension: pathophysiology, diagnosis, and management. 2nd ed. New York: Raven Press; 1995. p. 465-78.

Conference Proceedings (example below). If conference proceedings are available through Medline, please use the Medline citation.

Kimura J, Shibasaki H, editors. Recent advances in clinical neurophysiology. Proceedings of the 10th International Congress of EMG and Clinical Neurophysiology; 1995 Oct 15-19; Kyoto, Japan. Amsterdam: Elsevier; 1996

## Appendix 7

Comparison of researcher appraisal vs Umigon categorisation of tweet

User Name	No. of Original Tweets	Sentiment Classification	Clinician Rated Sentiment	Umigon Rated Sentiment	Kappa	Level of Agreement
@mentalhealth	118	Negative	<b>25 (21.2%)</b>	13 (11%)	0.378	Minimal
		Neutral	53 (44.9%)	66 (55.9%)		
		Positive	40 (33.9%)	39 (33.1%)		
@mindcharity	209	Negative	23 (11%)	24 (11.5%)	0.547	Weak
		Neutral	129 (61.7%)	119 (56.9%)		
		Positive	57 (27.3%)	66 (31.6%)		
@NHSInform	23	Negative	1 (4.3%)	3 (13%)	0.395	Minimal
		Neutral	16 (69.6%)	14 (60.9%)		
		Positive	6 (26.1%)	6 (26.1%)		
@SANECharity	82	Negative	31 (37.3%)	19 (22.9%)	0.465	Weak
		Neutral	31 (37.3%)	49 (59%)		
		Positive	20 (24.1%)	14 (16.9%)		
<b>Overall</b>	<b>432</b>	<b>Negative</b>	<b>80 (18.5%)</b>	<b>59 (13.7%)</b>	<b>0.476</b>	<b>Weak</b>
		<b>Neutral</b>	<b>229 (53.0%)</b>	<b>248 (57.4%)</b>		
		<b>Positive</b>	<b>123 (28.5%)</b>	<b>125 (28.9%)</b>		