



# Quality assessment of a sample of mobile app-based health behavior change interventions using a tool based on the National Institute of Health and Care Excellence behavior change guidance



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## ABSTRACT

**Objective:** To quality assess a sample of health behavior change apps from the NHS Apps Library using a rating tool based on the 2014 National Institute for Health and Care Excellence behavior change guidance (NICE BCG).

**Methods:** A qualitative analysis of the NICE BCG identified themes and questions for a quality assessment of health behavior change apps. These were refined by further discussion and piloting, and applied by two independent raters to a sample of NHS Library apps ( $N=49$ ). Disagreements were resolved following discussions with a third rater.

**Results:** Themes identified were; purpose, planning, usability, tailoring, behavior change technique (BCT), maintenance, evaluation, data security and documentation. Overall, purpose of the apps was clear, but evidence for collaboration with users or professionals was lacking. Usability information was poor and tailoring disappointing. Most used recognized BCTs but paid less attention to behavior maintenance than initiation. Information on app evaluation and documentation was sparse.

**Conclusions:** This study furthers the work of the NHS Apps Library, adapting the NICE (2014) behavior change guidance for quality assessment of behavior change apps.

**Practice implications:** This study helps lay the foundations for development of a quality assurance tool for mobile health apps aimed at health behavior change.

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## 1. Introduction

The World Health Organization (WHO) estimates that around 63% of deaths globally are a result of lifestyle related diseases [1]. The WHO estimates that by 2020, tobacco will account for 10% of all deaths worldwide [1]. Physical inactivity increases all-cause mortality risk by 20–30%, excessive alcohol use accounts for about 3.8% of deaths worldwide, and an unhealthy diet is linked to heart disease, stroke, diabetes, and cancer [1]. The leading four causes of death in England and Wales (Ischaemic Heart Disease, Cerebrovascular Disease, Cancer, and Chronic Respiratory Disease) are all strongly related to behavior [2]. Other health relevant behaviors include substance misuse, driving behaviors, oral hygiene, and

excessive sun exposure [3]. The deaths brought about by many of these health-relevant behaviors often occur as the end point of chronic illnesses at a huge cost to the NHS. Encouraging people to adopt healthier lifestyles, and supporting those who wish to do so, is a desirable goal.

Early papers on health behavior change were plagued by inadequate descriptions of the behavior change techniques (BCT) employed, making replication and evaluation difficult [4]. Researchers sought to address this problem by designing BCT taxonomies [5–8]. Michie et al's taxonomy of 93 BCTs allows us to identify and classify the wide range of techniques available and lays the ground work for future systematic reviews to evaluate which of these are most effective [9]. It is beyond the scope of this paper to discuss these in detail here, but reviews of the evidence [10] formed the basis of the National Institute for Health and Care Excellence (NICE) guidelines on approaches to health behavior change [11,12]. NICE is an independent organization, set up by the UK government in 1999 to help reduce variation in the availability and quality of NHS treatments and care. The NICE behavior change guidance resulted from a 2007 request from the UK Department of

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Health for guidance on the principles for effective behavior change and is considered further in this paper.

There are a range of media via which health behavior change interventions can be delivered. The advent of the home personal computer and the internet saw a growth of health behavior change interventions being delivered on websites [13]. In recent years, the increased capabilities of mobile phones and tablet computers has seen an explosion in the number of mobile applications or ‘apps’, many of which target health behavior change [14]. Ninety-three percent of UK adults have a mobile phone and 61% have a smartphone [15]. Ninety percent of those who own smartphone are in possession of it 24 h a day [16]. Mobile phone interventions have many advantages; they are relatively low cost, can be individually tailored in real time, can be combined with other traditional media, and can collect, analyze and relay data back to researchers [17]. They can also provide location data and information on proximity to others, and so could potentially text ex-smokers to warn them if they are at higher risk of smoking, based on their location or proximity to other smokers [18]. Smart phones can be used to estimate mode and speed of travel and thus can be used to track exercise without requiring an additional item of equipment [19].

There are over 1.2 million apps available in both the Apple appstore and the Android market, and over 97,000 related to health and fitness [20]. These apps can be further categorised into those aimed at healthcare professionals (e.g., medical reference apps such as drug formularies), those aimed at patients with specific conditions, such as diabetes (e.g., apps which will inform users of the glycaemic index of certain foods), and those aimed at encouraging healthy behaviors (such as the NHS quit smoking app). Summarising all the health apps currently available is beyond the scope of this paper, but the NHS Apps Library [21] is a useful starting point as it has a peer review process to decide which apps merit inclusion.

There is limited evidence for the efficacy of apps for health behavior change. The most recent systematic review on this topic summarized the findings of 75 trials—59 of which were concerned with disease management and 26 that were aimed specifically at health behavior change [17]. They found that interventions employing text messages increased antiretroviral treatment adherence and significantly improved biochemically verified smoking cessation. There was also some evidence that apps encouraging self-monitoring of diet and exercise reduced waist circumference, and that electronic pedometers increased physical activity and diabetes control.

Despite their many advantages, the use of health behavior change apps have a number of associated problems. Smart phones are less commonly used amongst particular sections of the population, are vulnerable to vested interests, and need to be compatible across a wide range of platforms to maximise uptake. One issue of particular concern is quality control [22]. The NHS Apps Library has a peer review process ensuring included apps are

relevant to people living in England, use information from a verifiable source, comply with the Data Protection Act, and are clinically safe. In addition to these safeguards, it would be useful to have a quality control process for health behavior change apps that would enable potential users and healthcare professionals to ascertain how closely the app developers had considered the NICE behavior change guidance. The overall aim of this study was therefore to quality assess a sample of health behavior change apps using a rating tool based on the 2014 NICE behavior change guidance. Specific objectives were to: (a) develop a rating tool for health-behavior change apps, based on the 2014 NICE behavior change guidance; (b) assess the feasibility of applying the tool to a sample of apps from the NHS Apps Library; and (c) describe the results of applying the tool to this sample of apps.

## 2. Methods

The lead author analysed the NICE (2014) behavior change guidance to examine which aspects would be relevant for an app quality assessment process (see Appendix 1). Relevant aspects were agreed upon following discussions with the remaining authors. The suggestions in the NICE guidance were converted into questions (that could be answered yes/no) relevant to app quality assessment. Duplicate questions were removed and those remaining were arranged into themes (see Table 1). Two independent raters piloted the questions and met to discuss further refinements. The resulting questions are listed in Tables 2 and 3 (see Appendix 2 for the user manual). Following further discussions to clarify the purpose of the questions, and training in use of the Statistical Package for the Social Sciences (SPSS) [23], these questions were then applied to health behavior change apps in the NHS Apps Library by two independent researchers. Answers were entered into an SPSS database, and apps were coded using information gleaned from the app description in the library, on the app store and related websites. Percentage agreement between raters was calculated based on the sum of the percentage of answers to which both raters answered ‘yes’ and to which both raters answered ‘no’. Disagreements between raters were resolved by discussions with a third researcher.

## 3. Results

### 3.1. Themes in the NICE behavior change guidance

Nine themes emerged from the exercise to extract questions from the NICE guidance thought relevant to app quality assessment. These themes related to: (1) the purpose of the app, (2) planning and development of the app, (3) usability, (4) initial assessment and tailoring, (5) behavior change techniques employed, (6) behavioral maintenance and relapse prevention, (7) evaluation of the app, (8) documentation, and (9) data protection. Table 1 shows an example question for each theme,

**Table 1**  
Themes relating to app quality extracted from NICE guidance.

Theme	Example question
1. Purpose	Is the target behavior clearly specified?
2. Planning and development	Was the app developed in collaboration with target group?
3. Usability	Does the app have special features for specific needs?
4. Initial assessment and tailoring	Does the app assess users' motivation to change?
5. Behavior change technique	Does the app facilitate access to social support?
6. Maintenance & relapse prevention	Does the app include techniques to address relapse?
7. Evaluation	Will the efficacy of the app be evaluated?
8. Documentation	Is there a publicly available manual for the app?
9. Data Protection	Does the app comply with data protection standards?

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