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Quality assessment of health behaviour change apps using a tool developed from NICE guidance

Running head: Applying NICE Guidance to health behavior change apps in the NHS apps Library

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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Quality assessment of health behaviour change apps using a tool developed from NICE guidance

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 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 hours 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, analyse 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

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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, with tables 2 and 3 containing the full set of questions used in the final tool.

3.2 Selecting the apps from the NHS Apps Library

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The NHS apps library contains 223 apps, 167 of which are on the Apple platform , 95 on Android, 7 on Windows, 2 on Blackberry, and 62 of which are mobile-compatible websites. Apps submitted by developers are assessed by the library's clinical assurance team (consisting of doctors, nurses and safety specialists). **On their website, the NHS Apps library states the review process ensures that apps "are relevant to people living in England, comply with data protection laws and comply with trusted sources of information, such as NHS Choices" [21].** Any apps deemed to have the potential to cause harm require further development before they would be considered for inclusion. To ascertain which apps to assess, each app was coded according to purpose. Figure 1 illustrates this process in more detail, including the nature of the excluded apps and provides further descriptive details of the final set of aps included in the analysis including platform and cost. In the 24 cases where apps were available on more than one platform (21 were available on 2 platforms, and 3 were available on 3 platforms) the content was identical. The majority of the apps were free (75.5%), and of those that were paid for, costs were relatively low. One exception was an app aimed at building effectiveness and resilience for the workplace which cost £96 for three months access.

3.3 Performance of the app quality assessment tool

The raters found the tool provided a systematic but time consuming method with which to assess the quality of health behavior change apps (approximately 30 minutes per app). The level of inter-rater agreement was generally high with some exceptions (see Tables 2 and 3). Agreement was low for the question "Does the app focus on initiation of behavior change?" as one rater answered 'yes' only if the focus on initiation was made explicit in the app description. There was a lower level of agreement for question 7, where one rater assumed that apps developed for the 'Change4Life' brand and 'NHS Choices' brand had had health professional involvement, whereas the other rater did not make this assumption. Inter-rater agreement was lower for the question "Is there a publically available manual?". One rater interpreted this to mean a manual aimed at health professionals, whereas the other interpreted it to mean a description of the app. Inter-rater agreement was also low for the question on data protection as one rater answered 'yes' only if the app description made this explicit. These discrepancies were resolved in discussions with a third rater.

3.4 Application of the app quality assessment tool

3.4.1 Theme 1: Purpose of the app

Table 2 shows the results pertaining to the questions on app purpose. The purpose of all the apps was clear, but in two cases the target behavior was not clearly specified. The likely outcomes were

specified for most of the apps, although this was unclear in some cases. The majority of the apps focused on the initiation of behavior change, although for several apps this was not obvious.

3.4.2 Theme 2: Planning and development

In only two cases was it apparent that the app had been developed in collaboration with the target group, and only three of the app descriptions specified that piloting had taken place (Table 2). Twenty six of the apps had been developed in collaboration with health professionals, but for the remaining apps there was insufficient information to ascertain if this was the case.

3.4.3 Theme 3: Usability

With regards to app usability (Table 2), there was insufficient information to ascertain if any of the apps incorporated any special features for those with specific needs (such as the ability to change font size or have text read out loud). Six of the apps were 'Information Standards' certified.

3.4.4 Theme 4: Initial Assessment and Tailoring

Regarding assessment and tailoring (Table 2), most of the apps did collect behavioral data, and although the assessment was subjective, it was felt that all apps were aimed at the right level for the target audience. Only one app assessed users capability to change. Eleven of the apps took some aspects of users' physical, economic and social environment into account. Only one app assessed users motivation to change by asking users to list their motivations for quitting under the headings 'family', 'health' and 'money'. Twenty-six tailored the intervention based on participant responses. There was insufficient information to ascertain if any of the apps targeted users based on a consideration of times in their life when they might be more open to change. Only eleven of the apps carried out a baseline health assessment. Most of these were self-rated assessments, but 'Drinks Meter' did use a recognized alcohol screening test developed by the WHO [24]. Around half of apps employed tailoring based on user progress (either self-rated or objective measures).

3.4.5 Theme 5: Behavior change techniques (BCT)

With respect to BCT employed, sixteen apps were linked to activities at the population, community or organizational level (Table 2). Sixteen of the apps encouraged users to make environmental changes to support behavior change, and all but one of the apps used a recognized BCT, even if this was just 'shaping knowledge' in the form of information provision. The most popular technique was enablement of self-monitoring (n=41). Over half provided users with feedback on their behavior or its outcomes, and around a third signposted users to relevant services. Twenty one apps facilitated

access to social support, and six facilitated access to professional support. Twenty four apps encouraged users to agree goals and outcomes, and action plans were used in eighteen. Only one app employed the BCT of prioritising actions in their plans.

3.4.6 Theme 6: Behavioral maintenance and relapse prevention

Table 3 shows the results for questions regarding behavioral maintenance and relapse prevention. Overall, the apps were not as focussed on maintaining change as they were on initiating it. Twenty one of the apps targeted the maintenance of behavioral change and six addressed relapse. None of the apps encouraged users to consider the achievement of initial goals and then go on to set further ones. Six of the apps had systems in place to try and ensure that feedback and monitoring continued for at least one year and sixteen explicitly encouraged the development of routines.

3.4.7 Theme 7: Evaluation

Table 3 shows the results for questions about app evaluation. Over half of the apps collected some form of outcome data, but in almost all cases there was insufficient information to ascertain what sort of evaluation processes apps had been subjected to or if there were any plans to do this. As far as we could ascertain, only two apps ('Drink Meter' and 'Drugs Meter') used validated measures of behavior.

3.4.8 Theme 8: Documentation

Table 4 illustrates that documentation was lacking in many cases. Although all the apps had a clear description of purpose and content, only two ('Moodkit' and 'Calorie Counter Pro') had a publically available manual. This is perhaps not surprising as apps by their nature should run themselves without needing an operator. The evidence base used was described for fifteen of the apps and the mechanism of action was described at least in rough terms for over half. In thirty six cases it was clear which BCT had been employed, although no acknowledgement was made of the BCT taxonomy [9]. Sixteen of the apps described how they focused on maintenance. There was insufficient evidence to ascertain if documentation would be updated along with app updates. In twenty four cases there was a clear rationale for the BCT employed.

3.4.9 Theme 9: Data protection

By nature of inclusion in the NHS Apps library, all the apps met data protection requirements.

4. Discussion and Conclusion

4.1 Discussion

This paper represents the first attempt to apply the NICE behavior change guidance to a sample of mobile apps aimed at health behavior change. The tool was developed to address concerns regarding quality control through a qualitative analysis of the NICE BCG, discussions around relevant aspects to include, and piloting of questions. The tool could be applied by app developers to help ensure their products follow the suggestions in the NICE BCG, by standards organizations wishing to further develop app quality assessment procedures, and by researchers wishing to advance the utility of mobile health apps in clinical settings. The tool helped identify distinctions between the apps, using a framework of nine themes consisting of; purpose, planning, usability, assessment and tailoring, behavior change techniques, maintenance and relapse prevention, evaluation, documentation, and data protection. Overall, the purpose of the apps was clear but there was little evidence for planning and development with the target group or piloting of the apps. There was also a lack of consideration for formal assessment of app usability and evaluation of efficacy of the apps. The apps were generally good at focusing on the initiation of behavior change and around half showed some evidence of tailoring. Despite this there was less of a focus on maintenance and relapse prevention. While all but one of the apps used a recognized BCT, none specifically referred to any specific BCT taxonomy [5-9]. Documentation was poor, with only a small number of apps providing adequate descriptions of the theory behind the behavior change techniques employed.

4.1.2 Study Limitations

The study has a number of limitations, such as the limited number of apps on which the assessment tool was piloted and the time taken for it to be applied (although this was not systematically measured).

4.1.3 Limitations of the assessment tool

We considered the potential benefit of adding an unclear category to the assessment tool such as that used in the Cochrane risk of bias assessment [25]. Given that the tool contained a relatively large number of questions, we felt that adding a third outcome category might make it somewhat unwieldy, but future versions might consider this in conjunction with a reduction in the number of questions. The fact that there were some differential interpretations between raters on a number of questions suggests further piloting and discussion was required. A user manual has been developed retrospectively to help clarify what exactly is meant by the questions in the tool (Appendix 2). **This manual may require further piloting and refinement and the authors would welcome the opportunity for future collaborations.**

4.1.4 Alternative approaches

There are a number of alternative approaches to app quality assessment in development. In the UK, the National Information Board (NIB) is developing a four stage process for app endorsement which will ultimately replace the NHS Health Apps Library [26]. The first stage will consist of an audited online self-assessment process that app developers will be required to work through before their apps are considered for endorsement. The second stage will consist of 'community evaluation', using a community of professionals, commissioners and end users. Stage 3 will consist of a more formal assessment of a smaller number of higher quality apps identified in stages one and two. Finally it is envisaged that Stage 4 will consist of an independent impact evaluation, examining efficacy and cost effectiveness. This four stage process will ultimately result in a smaller number of apps being recommended by the NHS than the current system where a large number of apps meeting minimal requirements are included in the library. The app assessment tool we have described in this paper could be adapted to inform the content of the first 3 stages suggested in the proposed NIB approach for app endorsement. This four stage approach could also be informed by the Template for Intervention Description and Replication (TIDieR) checklist [27] which seeks to improve the completeness and reporting of interventions. **The TIDieR checklist was not specifically designed with mobile apps in mind, and while some of the items (such as who delivered the intervention) might not be relevant for this type of intervention, its use would ensure clarity of the content of the apps. "For example, future versions of the tool could address item 5 of the TIDieR checklist ('Who Provided') by including a question relating to how the app is delivered in Theme 8 – App documentation. This question should specify that if the app is to be delivered by a third party, their expertise, background and training should be specified. Item 6 of the TIDieR checklist ('How') could be incorporated into Theme 3 – App useability, by including a question relating to what platforms and devices the app is compatible with, and Theme 7 – App evaluation, by including a question asking if the device on which the app was delivered will be recorded. Item 7 of the TIDieR checklist ('Where') could also be incorporated into Theme 7 – App evaluation, by refining question 43, i.e. 'Does the app collect data on the location in which the app was accessed?' Item 8 of the TIDieR checklist ('When and how') could also be incorporated by further refining question 43 to ascertain if the app recorded how many times it was accessed by an individual user, and the time and duration of these interactions.**

4.2 Conclusion

This paper has demonstrated that the NICE (2014) guidance for behavior change interventions can be usefully adapted to form the basis of a quality assessment of mobile apps. The adaptation employed here has provided a structure such a quality analysis and uncovered interesting insights into the nature of apps aimed at health behavior change.

3.2 Practice Implications

We hope the tool described here will help lay the groundwork for further development of an app quality assessment framework. Although the tool is unlikely to be used by busy clinicians in its current form, it may help stimulate further dialogue between clicans, app developers, patients, and regulatory bodies. Future work could focus on refining this tool to include user and expert

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opinions, perhaps by incorporating it into the four-stage endorsement process suggested by the NIB. It is hoped that such endeavours will help improve the quality of health behavior change apps available for patients, increase clinician confidence in recommending these apps, clarify a standard for developers to aim for, and help policy makers incorporate such interventions into the wider healthcare service.

5. Acknowledgements

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Figure 1: Selection of apps from the NHS Apps library and details of the final sample of apps
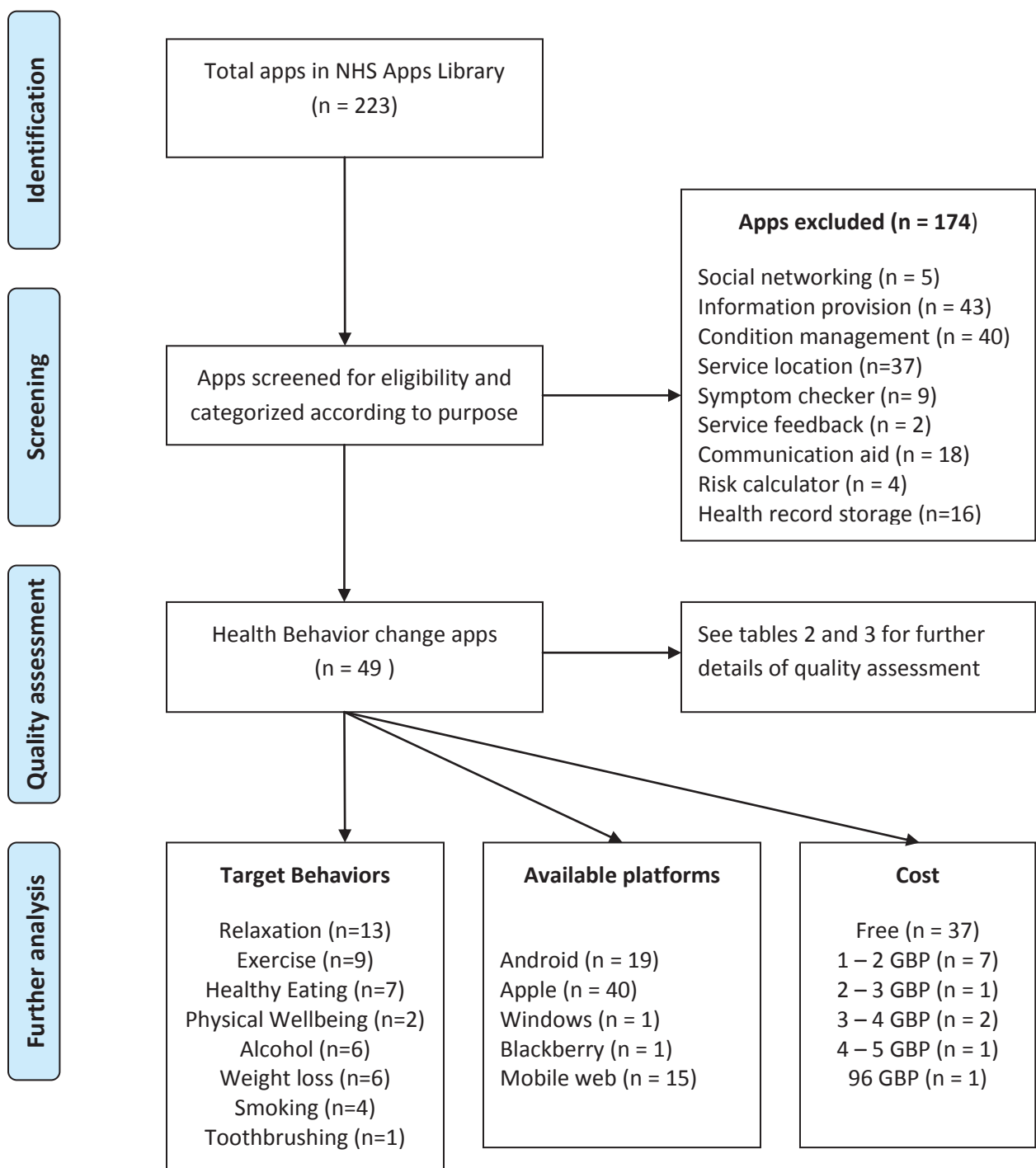
Table 1: Themes relating to app quality extracted from NICE guidance

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?

Table 2: App purpose, planning and development, usability, tailoring, and behavior change technique

Question	Yes (N)	Yes (%)	% Agreement
Theme 1: App Purpose			
1. Is the purpose of the app clear?	49	100.0	100.0
2. Is the target behavior clearly specified?	47	95.9	93.8
3. Are the likely outcomes clearly specified?	43	87.8	75.0
4. Does the app focus on initiation of behavior change?	38	77.6	10.3
Theme 2: Planning and development			
5. Developed in collaboration with target group?	2	4.1	97.9
6. Was the app piloted?	3	6.1	95.9
7. Were health professionals involved in development?	26	53.1	66.7
Theme 3: App usability			
8. Special features for those with specific needs?	0	0.0	100.0
9. Is the app "Information Standards" certified?	6	12.2	100.0
Theme 4: Initial assessment and tailoring			
10. Does the app collect behavioral data?	37	75.5	87.5
11. Aimed at the right level for the target population?	49	100.0	100.0
12. Assess capability to change?	1	2.0	100.0
13. Take account of users' environment?	11	22.4	91.7
14. Assess users' motivation to change?	1	2.0	100.0
15. Tailored intervention based on responses?	26	53.1	83.3
16. Consider times when users more open to change?	0	0.0	100.0
17. Carry out a relevant baseline health assessment?	11	22.4	95.8
18. Is tailoring based on user progress?	12	24.5	87.5
Theme 5: Behavior change technique employed			
19. Links to complementary activities?	16	32.7	83.3
20. Encourage users to make environmental changes?	16	32.7	95.9
21. Use of one or more recognized BCT?	48	98.0	95.9
22. Does the app facilitate access to social support?	21	42.9	91.7
23. Does app facilitate access to professional support?	6	12.2	95.8
24. Does the app signpost to relevant services?	16	32.7	83.3
25. Encourage users to agree goals and outcomes?	24	49.0	97.9
26. Encourage users to develop action plans?	18	36.7	97.9
27. Encourage users to prioritize actions in their plans?	1	2.0	100.0
28. Encourage and support self-monitoring?	41	83.7	100.0
29. Provide feedback on behavior and its outcomes?	29	59.2	83.4

Table 3: Behavioral maintenance, relapse prevention, app evaluation and documentation

Question	Yes (N)	Yes (%)	% Agreement
Theme 6: Behavioral maintenance and relapse prevention			
30. Includes focus on maintenance of behavior?	21	42.9	89.5
31. Includes techniques to address relapse?	6	12.2	97.9
32. Consider achievement and future goals and plans?	0	0.0	97.9
33. Regular feedback and monitoring for at least 1 year?	6	12.2	100.0
34. Encourage development of routines?	16	32.7	97.9
Theme 7: App evaluation			
35. Does the app collect outcome data?	29	59.2	97.9
36. Are novel BCTs employed by app to be evaluated?	0	0.0	100.0
37. Collected data available to relevant bodies?	0	0.0	100.0
38. Will the efficacy of the app be evaluated?	3	6.1	97.9
39. Will intervention fidelity be evaluated?	1	2.0	97.9
40. Will the impact on health inequalities be assessed?	0	0.0	100.0
41. Likely to cause harm?	0	0.0	100.0
42. Validated assessment tool to measure behavior?	2	4.0	97.9
43. Uptake and reach of the app assessed?	0	0.0	100.0
44. Adaption of existing data collection systems?	0	0.0	100.0
45. Evaluation by independent body?	0	0.0	97.9
46. Evaluation planned prior to release of app?	1	2.0	97.9
47. Specialist input for evaluation?	1	2.0	97.9
48. Is a description of the evaluation design available?	2	4.1	100.0
49. Does the evaluation use qualitative tools?	1	2.0	97.9
50. Process and outcomes using objective measures?	2	4.1	100.0
51. Establishment of routine data collection?	0	0.0	100.0
52. Adequate sample sizes for evaluation ensured?	2	4.1	97.9
53. Will outcomes be assessed for over 1 year?	0	0.0	100.0
Theme 8: App documentation			
54. Detailed description of the app publicly available?	49	100.0	95.8
55. Publicly available manual?	2	4.1	37.5
56. Is the evidence base used described?	15	30.6	89.6
57. Is the mechanism of action described?	29	59.2	100.0
58. Is it clear which BCT was employed?	36	73.5	91.7
59. Description how the app addresses maintenance?	16	32.7	89.6
60. Documentation updated along with app updates?	0	0.0	100.0
61. Clear rational for the BCT employed?	24	49.0	89.6
Theme 9: Data protection			
62. Does app comply with data protection standards?	49	100.0	33.3

Appendix 1: Eliciting questions from the NICE 2014 Behaviour Change Guidance

This appendix provides a detailed summary of the process that went into generating the original set of questions from the 2014 NICE Behaviour change guidance.

Each original NICE recommendation is presented first, followed by a brief discussion and the questions that arose from consideration of that recommendation. Sections of the recommendation that seem particularly relevant are in bold. Duplicate questions were then removed and ordered into themes. Two independent raters piloted the questions and met to discuss how the tool could be refined further. This resulted in the final set of questions ordered into the set of themes in Table 3.

Recommendation 1: Develop a local behaviour change policy and strategy

National and local policy makers and commissioners of behaviour change services and their partners (see Who should take action?) should:

- Ensure policies and strategies aim to improve everyone's health and wellbeing.

- Use health equity audit to ensure health inequalities will not increase, and if possible will decrease as a result of the local behaviour change strategy and related programmes and interventions. (See NICE's local government briefing on health inequalities and population health for information about health equity audit.)

- Develop a commissioning strategy, linked to relevant policies, for an evidence-based behaviour change programme of population, community, organisational and individual-level behaviour change interventions. For example, see NICE guidance on alcohol and obesity. Also note that Behaviour change: the principles for effective interventions (NICE public health guidance 6, 2007) **recommends delivering individual interventions in tandem with complementary activities at the population, community and organisational levels.**

- **Work with the local community to develop the strategy** (see Community engagement, NICE public health guidance 9).

- Ensure the strategy, and any related policies, are sustainable and meet local needs, identified through joint strategic needs assessments (JSNAs) and other local data.

- **Identify the behaviours the strategy will address, and the outcomes it aims to achieve.** Bear in mind that some interventions and programmes can address more than 1 behaviour (for example, sexual behaviour and alcohol consumption).

- Ensure the content, scale and intensity of each intervention is proportionate to the level of social, economic or environmental disadvantage someone faces and the support they need (proportionate universalism).

- Identify a leader within each local authority area, for example, the director of public health or an elected member of cabinet, to address specific behaviours (such as smoking and physical activity).

Recommendation 1 focused on the development of a local behaviour change policy and strategy. It is possible that a behaviour change app could be designed to fulfil a local need and thus be used within a specific area, but an assessment of this does not seem directly relevant to a measurement of app quality. Despite this, an examination of the points within this recommendation revealed that a number of topics could indeed be relevant to app development and implementation. For example, the recommendation that individual interventions are delivered in tandem with complementary activities at the population, community and organisational levels brought to mind the approach of a popular commercial weight loss programme. The app associated with the programme is used as part of an international approach which also includes population level aspects (products available in supermarkets) and community activities (weekly meetings where members get together to be weighed, discuss difficulties they have encountered, receive social support and advice on how to overcome obstacles to weight loss). Therefore, one question which could be included in a quality assessment framework for health behaviour change apps is;

- **Is the app linked to complementary activities at the population, community or organizational level?**

Working with the local community to develop the strategy could also be relevant to assessment of app quality if 'community' is used in a broader sense of the term. It is important that interventions including apps have some input from those it is aimed at, so the question this guideline elicited was;

- **Has the app been developed in collaboration with the target group?**

The next suggestion felt to be relevant was that pertaining to identifying the behaviour(s) in question and the outcomes being aimed for. This was translated into the following questions;

- **Is the purpose of the app clear?**
- **Is the target behaviour clearly specified?**
- **Are the intended outcomes clearly specified?**

Recommendation 2: Ensure organisation policies, strategies, resources and training all support behaviour change

- Directors in national and local organisations whose employees deliver behaviour change interventions should ensure policies, strategies and resources are in place to provide behaviour change support for staff, as well as service users. This support could take the form of behaviour change services for staff. Or it could involve **creating environments that support health-promoting behaviour** (for examples, see NICE guidance on smoking and physical activity).

- National and local organisations whose employees deliver behaviour change interventions should review job descriptions and person specifications to check that they include behaviour change knowledge and skills (or competencies), if they are a specific part of someone's job (see recommendation 9).

- Managers of health, wellbeing and social care services should determine which staff in contact with the public are best placed to deliver different levels of a behaviour change intervention (see recommendation 9). They should ensure those staff have the knowledge and skills (or competencies) needed to assess behaviours and individual needs (see recommendation 8) and to deliver the intervention.

- Employers should ensure staff are aware of the importance of being supportive, motivating people and showing them empathy (see recommendation 12).

- Directors and managers should ensure staff receive behaviour change training and supervision related to their roles and responsibilities (see recommendation 9). They should also be offered ongoing professional development on behaviour change theories, methods and skills (see recommendation 12).

- Mentors and supervisors with relevant training and experience (see recommendations 11 and 12) should support staff who are delivering behaviour change interventions. This includes helping them to set their own goals, providing constructive feedback on their practice and encouraging them to be aware of their duty of care. It also involves making them aware of the likely perceptions and expectations of those taking part in behaviour change interventions and programmes.

This recommendation is aimed at national and local organisations whose employees deliver behaviour change interventions and seems less relevant to the assessment of app quality. One of the suggestions however mentions "creating environments that support health-promoting behaviour" and it was felt this could be applied to app quality with the question;

- **Does the app encourage users to make changes to their environment that will help promote the health behaviour?**

Recommendation 3 is aimed at commissioners of behaviour change services and their partners and is concerned with ensuring that those implementing an intervention are willing to share details of that intervention and related data. A number of the suggestions within this recommendation could be relevant to the quality assessment of an app. For example the suggestion that interventions focus

on both initiation and maintenance of behaviour change is also very relevant to apps, and so gave rise to the following questions;

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Recommendation 3: Commission interventions from services willing to share intervention details and data

Commissioners of behaviour change services and their partners (see Who should take action?) should:

- Only commission behaviour change interventions and programmes that meet the recommendations in this guidance and in Behaviour change: the principles for effective interventions (NICE public health guidance 6) .

- **Ensure behaviour change interventions aim to both initiate and maintain change**. Interventions **should include techniques to address relapse and recognise that it is common**.

- Commission **interventions that are proven to be effective at changing and maintaining behaviour change**. (See recommendation 4; also see NICE guidance on alcohol, diet, physical activity, sexual behaviour and smoking.)

- Specify in service specifications that providers:

    - **make a detailed description of the intervention publicly available** (see recommendation 6)

    - collate accurate, standardised and comparable routine data on behaviours that affect health and wellbeing. (For example, behaviours covered by the Public Health Outcomes Framework.)

- Commission interventions from providers who **agree to make their evaluation and monitoring data available** to commissioners and local and national organisations. (The aim is to aid the design, delivery and monitoring of service processes and outcomes.) For example, data could be collected on:

    - process assessment and quality assurance

    - health outcomes

</div>

- **Does the app include a component that focuses on initiation of change?**
- **Does the app include a component that focuses on maintenance of change?**

Likewise an acknowledgement that relapse is common, and techniques to address this would be desirable features of an app;

- **Does the app recognise that relapse is common?**
- **Does the app include techniques to address relapse?**

The need to base interventions on proven techniques is also relevant;

- **Does the app employ one or more recognized behaviour change techniques (BCTs)?**

It would also be useful if app designers could provide further information about the app;

- **Is a detailed description of the app publicly available?**

Finally, recommendation 3 suggests that intervention providers should make their evaluation and monitoring data available. This raised questions about evaluation generally and how this might be achieved;

- **Does the app collect behavioural data?**
- **Does the app collect outcome data?**
- **Will the data collected by the app be made available to relevant bodies?**
- **Will the efficacy of the app be evaluated?**

Recommendation 4 is concerned with the quality and efficacy of interventions. Again the question of evaluation arises from this recommendation, along with a number of related issues such as fidelity,

piloting, and data protection. The questions that have arisen from an examination of these suggestions are listed below.

Recommendation 4: Commission high quality, effective behaviour change interventions

National and local policy makers, commissioners of behaviour change services and their partners (see Who should take action?) should:

- Find out whether behaviour change interventions and programmes that are already in place are effective, cost effective and **apply evidence-based principles**. (See Behaviour change: the principles for effective interventions, NICE public health guidance 6).

- Ensure that, when commissioning behaviour change interventions and programmes:
  - **Evaluation plans** tailored for the intervention and target behaviours **are built in from the outset**.
  - Resources (staff, time and funds) are allocated for independent evaluation of the short-, medium- and long-term outcomes.
  - A quality assurance process is in place to **assess whether the intervention was delivered as planned (intervention fidelity), achieves the target behaviour change and health and wellbeing outcomes, and reduces health inequalities**. (The frequency of quality assurance checks should be specified.)
  - There are quality assurance checks if an intervention has already been shown to be effective.
  - **All information** on intervention processes and outcomes **is recorded in a form that can be made available if needed (for example, on a secure database).**

- **Commission and evaluate a pilot** if it is not clear whether an intervention shown to be effective for a specific behaviour, population or setting can be applied to other behaviours, settings or populations (see recommendation 16).

- Commission an intervention for which there is no evidence of effectiveness only if it is accompanied by an adequately powered and controlled evaluation that measures relevant outcomes (see recommendation 16).

- **Stop running interventions or programmes if there is good evidence to suggest they are not effective or are harmful**.

- **Does the app employ one or more recognized behaviour change techniques (BCTs)?**
- **Will the efficacy of the app be evaluated?**
- **Will intervention fidelity be evaluated?**
- **Does the app address health inequalities?**
- **Will the data collected by the app be made available to relevant bodies?**
- **Does the app comply with data protection laws?**
- **Was the app piloted?**
- **Does the app have the potential to cause harm?**

Recommendation 5 raises some issues that have already been covered, such as collaboration with the target group;

- **Has the app been developed in collaboration with the target group?**

but also raises the question of whether or not researchers have been involved in development, prompting a more wide ranging question;

- **Has the app received input from health professionals?**

Recommendation 5 mentions equitable access, which gives rise to a question regarding useability;

- **Does the app have any special features for those with specific needs? (e.g text to speech)**

and again the question of evidence is raised;

Recommendation 5: Plan behaviour change interventions and programmes taking local needs into account

Commissioners and providers of behaviour change services, and intervention designers (see Who should take action?) should:

- **Work together and with other key stakeholders** (for example, people who use services, communities and **researchers**) to select priority areas for interventions, based on local need. They should also identify suitable interventions that are acceptable to the target audiences.
- Take into account the local social and cultural contexts to ensure **equitable access for everyone** who needs help and make best use of existing resources and skills.
- **Base behaviour change interventions and programmes on evidence of effectiveness** (see recommendations 6 and 7).
- Take into account:
  - **the objectives of the intervention or programme**
  - **evaluation plans (see recommendations 4 and 16)**
  - **the target population** (including characteristics such as socioeconomic status)
  - whether there is a need to **offer tailored interventions** for specific subgroups (for example, see Preventing type 2 diabetes: risk identification and interventions for individuals at high risk, NICE public health guidance 38)
  - intervention characteristics: content, **assessment of participants,** mode of delivery, intensity and duration of the intervention, who will deliver it, where and when
  - the training needs of those delivering the intervention or programme
  - the **quality of the behavioural support** provided by those delivering the intervention or programme
  - availability of, and **access to, services once the intervention has finished**
  - **follow up and support to maintain the new behaviour**
  - **plans to monitor and measure intervention fidelity.**

- **Does the app employ one or more recognized behaviour change techniques (BCTs)?**

Recommendation 5 suggests a number of factors are taken into account, such as the objective of the intervention;

- **Is the purpose of the app clear?**

evaluation plans;

- **Will the efficacy of the app be evaluated?**

the target population;

- **Is the app aimed at the right level for the target population? (e.g. reading age)**

and the issue of tailoring;

- **Does the app tailor the intervention based on participant responses?**

How well an app can tailor an intervention depends on the quality of data that the tailoring is based upon. This is touched upon when assessment of participants is mentioned and is a topic that arises again in a later recommendation;

- **Is tailoring based upon an initial assessment of users?**

This recommendation mentions the quality of behavioural support provided. In the context of an app this could be access to support through a social network but also text, e-mail or telephone support;

- **Does the app provide some mode of social support?**

The issue of access to services at the end of the intervention when applied to apps could be as simple as signposting users to relevant local services;

- **Does the app provide signposting to relevant services?**

The topic of maintenance was previously raised in Recommendation 3 and appears again here;

- **Does the app include a component that focuses on maintenance of change?**

And the issue of fidelity appears again also;

- **Will intervention fidelity be evaluated?**

Recommendation 6 covers many of the topics highlighted by previous recommendations but focuses especially on documentation.

Recommendation 6: Develop acceptable, practical and sustainable behaviour change interventions and programmes

Commissioners of behaviour change services and intervention designers (see Who should take action?) should:

Work together and with other key stakeholders (for example, people who use services, communities and researchers) to develop (co-produce) behaviour change interventions and programmes that are acceptable, practical and sustainable. This should also **reduce duplication between services**.

- Develop interventions that:
  - are **evidence-based**
  - have **clear objectives** that have been developed and agreed with stakeholders
  - identify the core skills, knowledge and experience (competencies) needed to deliver the intervention (including for the specific behaviour change techniques used)
  - provide details of the training needed (including learning outcomes) for practitioners
  - **include a monitoring and evaluation plan** developed according to agreed objectives.
- Before implementing a behaviour-change intervention, describe in detail the principles it is based on. **Put these details in a manual. This should include**:
  - **clearly stated objectives** on what the intervention will deliver
  - **the evidence base used** (such as from NICE guidance on a specific topic)
  - **an explanation of how the intervention works** (mechanism of action), for example, by targeting capability, opportunity and motivation.
- **Ensure manuals also include a detailed description of the intervention** including:
  - resources, setting or context, activities, processes and outcomes (including a pictorial description of the relationship between these variables, such as a conceptual map or logic model)
  - intervention characteristics (see recommendation 5)
  - a **clear definition of the behaviour change techniques used** so that each component can be replicated (for example, by using a taxonomy)
  - details of how to tailor the intervention to meet individual needs (see recommendation 8)
  - **plans to address long-term maintenance** of behaviour change and relapse
  - implementation details: who will deliver what, to whom, when and how.
- **Make the manual publicly available**, for example, on a website (provide copyright details and 'training before use' requirements). If there are changes to an intervention during delivery, or after evaluation, **ensure the manual is updated** accordingly.

The topic of collaboration with stakeholders and researchers is again raised and this has given rise to questions already seen;

- **Has the app been developed in collaboration with the target group?**
- **Has the app received input from health professionals?**

further questions pertaining to evidence;

- **Does the app employ one or more recognized behaviour change techniques (BCTs)?**

and evaluation have arisen before;

- **Will the efficacy of the app be evaluated?**

The next set of suggestions relate to the availability of a manual – something not usually seen with mobile apps. These suggestions prompted the following questions;

- **Is there a publicly available manual for the app?**
- **Does this manual contain;**
  - **Clearly stated objective for the app?**
  - **The evidence base used?**
  - **A description of the mechanism of action?**
  - **A clear definition of the BCT used?**
  - **How the app addresses long term maintenance?**
- **Will this manual be updated along with app updates?**

Recommendation 7: Use proven behaviour change techniques when designing interventions

Providers of behaviour change interventions and programmes and intervention designers should:

- Design behaviour change interventions to **include techniques that have been shown to be effective at changing behaviour**. These techniques are described in principle 4 of Behaviour change: the principles for effective interventions (NICE public health guidance 6) and include:
  - **Goals and planning. Work with the client to:**
    - **agree goals for behaviour and the resulting outcomes**
    - **develop action plans and prioritise actions**
    - **develop coping plans to prevent and manage relapses**
    - **consider achievement of outcomes and further goals and plans.**
  - **Feedback and monitoring (for example, regular weight assessment for weight management interventions):**
    - **encourage and support self-monitoring of behaviour and its outcomes and**
    - **provide feedback on behaviour and its outcomes.**
  - **Social support. If appropriate advise on, and arrange for, friends, relatives, colleagues or 'buddies' to provide practical help, emotional support, praise or reward.**

- Ensure the techniques used match the service user's needs (see recommendation 8).

- Consider using other evidence-based behaviour change techniques that may also be effective. See NICE guidance on alcohol, diet, physical activity, sexual behaviour and smoking for details of specific techniques.

- **Clearly define and provide a rationale for all behaviour change techniques that have been included.**

- **Ensure novel techniques – or those for which the evidence base is limited – are evaluated (see recommendation 16).**

- Consider delivering an intervention remotely (or providing remote follow-up) if there is evidence that this is an effective way of changing behaviour. For example, use the telephone, text messaging, apps or the internet.

Recommendation 7 focuses on the use of evidence based techniques. One question that has arisen several times is;

- **Does the app employ one or more recognized behaviour change techniques (BCTs)?**

The suggestions within this recommendation go into more detail about the types of BCTs that could be employed, but the following questions are perhaps less about app quality and more about technique;

- **Does the app focus on goals and planning? For example does it encourage users to…**
  - o **Agree goals for behaviour and the resulting outcomes?**
  - o **Develop action plans and prioritise actions?**
  - o **Develop coping plans to prevent and manage relapse?**
  - o **Consider achievement of outcomes and further goals and plans?**
- **Does the app focus on feedback and monitoring? For example does it…**
  - o **Encourage and support self-monitoring of behaviour and its outcomes?**
  - o **Provide feedback on behaviour and its outcomes?**
- **Does the app facilitate access to social support?**
- **Is there a clearly defined rationale for the BCT employed?**
- **Are novel BCT techniques employed by the app going to be evaluated?**

Recommendation 8: *Ensure interventions meet individual needs*

Providers of behaviour change programmes and interventions and trained behaviour change practitioners should:

- Ensure service users are given clear information on the behaviour change interventions and services available and how to use them. If necessary, they should help people to access the services.
- Ensure services are **acceptable to, and meet, service users' needs**. This includes **any needs in relation to a disability or another 'protected characteristic' in relation to equity.**
- **Recognise the times when people may be more open to change**, such as when recovering from a behaviour-related condition (for example, following diagnosis of cardiovascular disease) or when becoming a parent. Also recognise when offering a behaviour change intervention may not be appropriate due to personal circumstances.

Trained behaviour change practitioners (see recommendations 12 and 13) should:

- Before starting an intervention:
  - **Assess participants' health in relation to the behaviour and the type of actions needed**. For example, they should **ensure the level and type of physical activity recommended is appropriate**, bearing in mind the person's physical health. (As an example, see Weight management before, during and after pregnancy, NICE public health guidance 27.)
  - Ensure the intensity of the intervention matches the person's need for support to change their behaviour.
  - **Discuss what the likely impact will be** if the participant makes changes to their behaviour (in terms of their health and wellbeing and the health and wellbeing of those they are in contact with).

- **Plan at what point before, during and after a behaviour change intervention a review will be undertaken to assess progress towards goals and then tailor the intervention and follow-up support accordingly.**

- **Tailor interventions to meet participants' needs by assessing and then addressing:**
  - People's behaviour: **if available, use a validated assessment tool appropriate for the specific population or setting.** For example, alcohol screening tools used in prisons are different from those used in accident and emergency departments.
  - Participants' **physical and psychological capability to make change.**
  - The context in which they live and work (that is, their **physical, economic and social environment).**
  - **How motivated they are to change**: if many behaviours need to be changed, assess which one – or ones – the person is most motivated to tackle (see Capability, opportunity and motivation).
  - **Any specific needs with regards to sexual orientation, gender identity, gender, culture,faith or any type of disability.**

Recommendation 8 goes into some more depth on this topic giving rise to the following questions;

- **Does the app;**
    - o **Consider times when people may be more open to change?**
    - o **Carry out a relevant baseline health assessment?**
    - o **Ensure recommended activities are appropriate? (e.g. based on baseline health)**
    - o **Discuss what the likely outcomes will be?**

Recommendation 8 also goes into some more depth on the idea of a progress review. This is similar to questions that have arisen before, namely;

- **Does the app include a component that focuses on maintenance of change?**
- **Does the app encourage users to consider achievement of outcomes and further goals and plans?**
- **Does the app provide feedback on behaviour and its outcomes?**

The issue of tailoring has arisen previously, but this suggestion focuses on the tailoring of follow up. These questions have also arisen before;

- **Does the app tailor the intervention based on participant responses?**
- **Is tailoring based upon an initial assessment of users?**

but tailoring follow up is a slightly different issue;

- **Does the app employ tailoring based upon user progress?**

The final set of suggestions within this recommendation goes into the topic of tailoring in even more depth, suggesting for example that tailoring should be based on a validated assessment tool;

- **Does the app use a validated assessment tool used to measure behaviour?**
- **Does the app assess users physical and psychological capability to change?**
- **Does the app take account of the users physical, economic and social environment?**
- **Does the app assess users motivation to change?**

The issue of specific needs has arisen before;

- **Does the app have any special features for those with specific needs? (e.g text to speech)**

Recommendation 9 contains the suggestions that HCPs in direct contact with the general public should deliver opportunistic BCTs and as such this recommendation seems less directly relevant to app quality assessment. Other suggestions regarding the duration and intensity of interventions to be delivered to those with whom HCPs have regular contact also seem less relevant to the quality assessment of apps.

Recommendation 9: Deliver very brief, brief, extended brief and high intensity behaviour change interventions and programmes

Commissioners and providers of behaviour change services should:

- Encourage health, wellbeing and social care staff (see Who should take action?) in direct contact with the general public to use a very brief intervention to motivate people to change behaviours that may damage their health. The interventions should also be used to inform people about services or interventions that can help them improve their general health and wellbeing.

- Encourage staff who regularly come into contact with people whose health and wellbeing could be at risk to provide them with a brief intervention. (The risk could be due to current behaviours, sociodemographic characteristics or family history.)

- Encourage behaviour change service providers and other health and social care staff dealing with the general public to provide an extended brief intervention to people they regularly see for 30 minutes or more who:
    - are involved in risky behaviours (for example higher risk drinking[1])
    - have a number of health problems
    - have been assessed as being at increased or higher risk of harm
    - have been successfully making changes to their behaviour but need more support to maintain that change
    - have found it difficult to change or have not benefited from a very brief or brief intervention.

- Encourage behaviour change service providers and practitioners to provide high intensity interventions (typically these last more than 30 minutes and are delivered over a number of sessions) for people they regularly work with who:
    - have been assessed as being at high risk of causing harm to their health and wellbeing (for example, adults with a BMI more than 40 – see Obesity, NICE clinical guideline 43) **and/or**
    - have a serious medical condition that needs specialist advice and monitoring (for example, people with type 2 diabetes or cardiovascular disease) **and/or**
    - have not benefited from lower-intensity interventions (for example, an extended brief intervention).

Recommendation 10: Ensure behaviour change is maintained for at least a year

Providers and practitioners involved with behaviour change programmes and interventions should help people maintain their behaviour change in the long term (more than 1 year) by ensuring they:

- **receive feedback and monitoring at regular intervals for a minimum of 1 year after they complete the intervention** (the aim is to make sure they can get help if they show any sign of relapse)
- **have well-rehearsed action plans (such as 'if–then' plans) that they can easily put into practice if they relapse**
- **have thought about how they can make changes to their own immediate physical environment to prevent a relapse**
- **have the social support they need to maintain changes are helped to develop routines that support the new behaviour** (note that small, manageable changes to daily routine are most likely to be maintained).

Recommendation 10 is concerned with maintenance. A question pertaining to feedback and monitoring has been raised previously;

- **Does the app focus on feedback and monitoring? For example does it...**
    - **Encourage and support self-monitoring of behaviour and its outcomes?**
    - **Provide feedback on behaviour and its outcomes?**

but this recommendation focuses specifically on the duration and so the following question arises;

- **Does the app provide regular feedback and monitoring for a minimum of one year?**

Questions pertaining to the prevention of relapse have also already arisen;

- **Does the app include techniques to address relapse?**

but again this recommendation goes into a little more detail suggesting we should consider;

- **Does the app encourage users to have well-rehearsed action plans (such as 'if–then' plans) that they can easily put into practice if they relapse?**

The issue of environmental changes has arisen previously, but this recommendation is looking specifically at how the environment could help prevent relapse and so gives rise to the question;

- **Does the app encourage users to make changes to their environment that will help prevent a relapse?**

The topic of social support was covered in previous recommendations and in this case we are encouraged to focus on how this might help maintain behaviour;

- **Does the app facilitate access to social support that may help to maintain the behaviour?**

An important topic that has not arisen in previous recommendations is that of routine;

- **Does the app encourage the development of routines that support the new behaviour?**

Recommendation 11 is mainly concerned with the training of HCPs and therefore does not seem directly relevant to a quality assessment of apps.

Recommendation 11: Commission training for all staff involved in helping to change people's behaviour

Commissioners, local education and training boards, and managers and supervisors (see Who should take action?) should:

- Commission training for relevant staff to meet the service specification for any behaviour change intervention or programme. This should:
  - cover all the various activities, from a very brief intervention offered when the opportunity arises to extended brief interventions
  - include assessment of people's behaviours and needs
  - address equity issues
  - provide the latest available evidence of effectiveness and describe how an intervention works (mechanism of action).
- Ensure training programmes on behaviour change provide:
  - evidence-based content (see recommendation 7)
  - evidence-based training methods
  - trainers with proven skills, knowledge and experience (competencies) in the particular area (see recommendation 12)
  - monitoring using relevant behaviour change competency frameworks or assessment.

Commissioners and local education and training boards should:

- Ensure training programmes consider:
  - where programmes and interventions will be delivered
  - training participants' characteristics (such as background)
  - whether behaviour change is part of participants' main role, integral to their role but not the main focus, or an additional task (see recommendation 9).
- Ensure training includes ongoing professional development on how to encourage behaviour change. This could include regular refresher training to maintain the quality of delivery of behaviour change interventions.
- Ensure training is evaluated in terms of outcomes (see recommendation 14) and process (for example, via participant feedback).

Recommendation 12 was aimed at providers of behaviour change training and so does not seem directly relevant to app quality assessment.

Recommendation 12: Provide training for behaviour change practitioners

Providers of behaviour change training should:

- Ensure training objectives include the range of knowledge and skills (competences) needed to deliver specific interventions.

- Ensure practitioners are trained to adopt a person-centred approach when assessing people's needs and planning and developing an intervention for them.

- Ensure behaviour change practitioners:

    - understand the factors that may affect behaviour change, including the psychological, social, cultural and economic factors (see recommendation 8)
    - are aware of behaviours that adversely affect people's health and wellbeing, and the benefits of prevention and management
    - can address health inequalities by tailoring interventions to people's specific needs, including their cultural, social and economic needs and other 'protected characteristics'
    - are able to assess people's needs and can help select appropriate evidence-based interventions
    - know how an intervention works (mechanism of action)
    - recognise the specific behaviour change techniques used in the intervention they will be delivering
    - understand how to access, and how to direct and refer people to, specialist support services (for example, they should know how people can get help to change their behaviour after hospitalisation, a routine GP appointment or an intervention)
    - understand local policy and demographics.

- Ensure behaviour change practitioners have the skills to:

    - assess people's behaviour using validated assessment tools and measures
    - communicate effectively, for example, by giving people health, wellbeing and other information, by using reflective listening and knowing how to show empathy
    - develop rapport and relationships with service users
    - develop a person's motivation to change by encouraging and enabling them to manage their own behaviour (see recommendation 7)
    - deliver the relevant behaviour change techniques
    - help prevent and manage relapses (see recommendation 10).

- Ensure behaviour change practitioners who provide interventions to groups can:

    - elicit group discussions
    - provide group tasks that promote interaction or bonding
    - encourage mutual support within the group.

- Give practitioners the opportunity to learn how to tailor interventions to meet the needs and preferences of different groups and to test this ability (both during and after training).

- Ensure trainers have adequate time and resources to assess participants' motivation, skills, confidence and knowledge when they are delivering interventions to particular groups.

Recommendation 13 is aimed at those who accredit or train HCPs and so again seemed less relevant to app quality assessment.

Recommendation 13: Provide training for health and social care practitioners

All those who train or accredit health and social care professionals (see Who should take action?) should:

- Ensure behaviour change knowledge, skills and delivery techniques comprise a formal element of initial training, work placements and ongoing continuous professional development for all those who deliver health and social care services. (See recommendation 12 for details of training content.)

- Ensure all health and social care professionals can, as a minimum, deliver a very brief intervention. (Training modules can be found online, for example, see the National Centre for Smoking Cessation and Training's very brief advice training module.)

Recommendation 14 is aimed at providers of behaviour change training and so seems less relevant to the assessment of app quality.

Recommendation 15 is concerned with the monitoring of behaviour change interventions and does seem relevant to a quality assessment of apps.

Questions that arise from this recommendation include;

• **Will the uptake and reach of the app be assessed?**
• **Will the impact of the app on health inequalities be assessed?**
• **Will the app measure behavioural outcomes in the short, medium and long term?**
• **Will intervention fidelity be evaluated?**
• **Does the app adapt existing electronic data collection systems on behaviour?**

Recommendation 16 pertains to the evaluation of behaviour change interventions. Some of the questions it elicits hove been covered before such as;

• **Is the purpose of the app clear?**
• **Will the efficacy of the app be evaluated?**

However this recommendation raises some details regarding the finer details of evaluation, such as;

- **Will the evaluation be carried out by an independent body?**
- **Has the evaluation been planned prior to app roll-out?**
- **Has specialist input been obtained for designing the evaluation?**

Recommendation 16: Evaluate behaviour change interventions

- Before introducing a new intervention, commissioners and providers of behaviour change interventions and researchers should **be clear about the objectives and how these will be measured and evaluated**. (Researchers could include practitioners and others, for more details see Who should take action?) See Medical Research Council guidance on the development, evaluation and implementation of complex interventions to improve health.

- Commissioners and providers should **ensure evaluation is carried out by a team of researchers or an organisation that has not been involved in delivering the intervention**.

- Researchers should work with commissioners and providers to **plan evaluation before the intervention takes place**. This may entail getting **specialist input** (for example, from the NIHR research design service).

- Researchers should use **objective, validated measures of outcome and process** if they are available. They should ensure the design makes it possible to provide new evidence of effectiveness and, ideally, cost effectiveness – and details on why it is effective (mechanism of action). See principles 7 and 8 in 'Behaviour change: the principles for effective interventions' (NICE public health guidance 6).

- Commissioners, providers and researchers should **ensure evaluation includes**:
  - **a description of the evaluation design**
  - **assessment of intervention fidelity**
  - **consistent use of valid, reliable measures (using the same tools to assess behaviours) before, during and following an intervention (that is, ensuring baseline and outcome measures match)**
  - **rigorous qualitative assessments to evaluate how well interventions will work in practice and how acceptable they are to services users and practitioners**
  - **assessment of processes and outcomes using both objective and self-reported measures**
  - **establishing and ensuring routine data collection**
  - **adequate sample sizes**
  - **assessment of long-term outcomes (more than 1 year).**

- Providers of existing interventions should **work with researchers to ensure they are rigorously evaluated**.

The issue of using validated measures for behaviour has been raised before;

- **Does the app use a validated assessment tool to measure behaviour?**

but this recommendation also suggests validated measures of outcome and process;

- **Does the app use a validated assessment tool to measure outcomes and process?**

If an evaluation has been planned, this recommendation goes into greater detail about what it should contain;

- **Does the evaluation include;**
  - **A description of the evaluation design?**
  - **Assessment of intervention fidelity?**
  - **Consistent use of valid reliable measures?**
  - **Rigorous qualitative assessments?**
  - **Assessment of processes and outcomes using both objective and self-reported measures?**
  - **The establishment of routine data collection?**
  - **Adequate sample sizes?**
  - **Assessment of outcomes > 1 year**
  - **Input from researchers to ensure rigorous evaluation?**

Recommendation 17 is aimed at national organizations and the support they provide for behaviour change interventions and as such does not seem relevant to a quality assessment of apps.

Recommendation 17: National support for behaviour change interventions and programmes

- National organisations that support the monitoring, collection and surveillance of routine data should work together to:
  - determine what routine data health, social care and voluntary organisations should record on health-related behaviours (such as smoking and alcohol)
  - collect these data to monitor the outcomes of activities to improve the public's health (include: behaviour change interventions; national, regional and local policies and initiatives; and communication campaigns)
  - track the prevalence of these behaviours over time, region and social group and report on findings
  - support local implementation of behaviour change interventions based on evidence of effectiveness.

- National organisations responsible for behaviour change training and curricula (see Who should take action?) should work together to:
  - provide a central repository for behaviour change training curricula
  - assess whether behaviour change competency frameworks and training curricula promote an evidence-based approach to behaviour change
  - provide guidance on the suitability of these frameworks and curricula in terms of who they are aimed at and whether their content is evidence based.

- National organisations responsible for research funding should ensure research related to behaviour change includes, as a minimum, details of:
  - intervention content and how it was delivered
  - who delivered the intervention
  - format (methods by which the intervention was administered)
  - where and when the intervention was delivered
  - recipients
  - intervention intensity and duration
  - intervention fidelity.

Appendix 2: User manual for the app quality assessment tool

The following questions should be answered yes/no on the basis of information that is publicly available for the app being quality assessed. Apps should be quality assessed by 2 independent raters and disagreements resolved through discussion with a third rater.

Theme 1: App Purpose

1. Is the purpose of the app clear? (e.g. to help users lose weight)

2. Is the target behavior clearly specified? (e.g. reducing calorie intake or increasing exercise)

3. Are the likely outcomes clearly specified? (e.g. weight loss)

4. Does the app focus on initiation of behavior change? (e.g. a focus on something that will enable users to change their current routine)

Theme 2: Planning and development

5. Developed in collaboration with target group? (e.g. discussion with potential users at the development stage)

6. Was the app piloted? (i.e. given to a set of users for evaluation before roll-out)

7. Were health professionals involved in development? (i.e. psychologists or doctors)

Theme 3: App usability

8. Special features for those with specific needs? (e.g. text to speech)

9. Is the app "Information Standards" certified? (see http://www.england.nhs.uk/tis/)

Theme 4: Initial assessment and tailoring

10. Does the app collect behavioral data? (e.g. through an e-pedometer)

11. Aimed at the right level for the target population? (i.e. by avoiding technical jargon)

12. Assess capability to change? (e.g. through assessing capability to engage in exercise)

13. Take account of users' environment? (e.g. by identifying high risk areas for the target behaviour)

14. Assess users' motivation to change? (e.g. through a self-rating questionnaire)

15. Tailored intervention based on responses? (e.g. making suggestions for outdoor activities to those expressing an interest in these)

16. Consider times when users more open to change? (e.g. by assessing 'stage of change').

17. Carry out a relevant baseline health assessment? (e.g. by asking about alcohol intake)

18. Is tailoring based on user progress? (e.g. by setting graded goals based on previous performance)

Theme 5: Behaviour change technique employed

19. Links to complementary activities? (E.g. local meetings for a weight loss app)

20. Encourage users to make environmental changes? (E.g. by removing triggers such as ashtrays)

21. Use of one or more recognized BCT? (E.g. by encouraging self-monitoring: see Michie et al., 2013 for a full list of behavior change techniques)

22. Does the app facilitate access to social support? (E.g. through an online discussion forum)

23. Does app facilitate access to professional support? (E.g. through an online chat feature)

24. Does the app signpost to relevant services? (E.g. local smoking cessation services)

25. Encourage users to agree goals and outcomes? (E.g. by setting a target weight)

26. Encourage users to develop action plans? (E.g. by considering where, when and with who?)

27. Encourage users to prioritize actions in their plans? (E.g. by ranking planned behaviors)

28. Encourage and support self-monitoring? (E.g. by tracking calorie intake)

29. Provide feedback on behavior and its outcomes? (E.g. by informing users of daily steps taken)

Theme 6: Behavioural maintenance and relapse prevention

30. Includes focus on maintenance of behaviour? (E.g. by highlighting longer term benefits)

31. Includes techniques to address relapse? (E.g. by avoiding fellow smokers in the first few weeks)

32. Consider achievement and future goals and plans? (E.g. by asking users to rank satisfaction with goals achieved and make new goals at regular intervals)

33. Regular feedback and monitoring for at least 1 year? (E.g. by automated e-mails)

34. Encourage development of routines? (E.g. by suggesting how to fit exercise into daily commute)

Theme 7: App evaluation

35. Does the app collect outcome data? (E.g. number of steps taken using e-pedometer)

36. Are novel BCTs employed by app to be evaluated? (i.e. BCTs not in Michie et al.'s 2013 taxonomy)

37. Collected data available to relevant bodies? (E.g. the Health & Social Care Information Centre in the UK)

38. Will the efficacy of the app be evaluated? (E.g. is there a published protocol for a planned trail available?)

39. Will intervention fidelity be evaluated? (i.e. if a trial is planned, does the protocol specify how intervention fidelity will be evaluated?)

40. Will the impact on health inequalities be assessed? (e.g. would any planned evaluation look at samples from different socioeconomic areas?)

41. Likely to cause harm? (e.g. by encouraging users to aim for a BMI below the healthy range)

42. Validated assessment tool to measure behaviour? (e.g. the World Health Organisation's 10 item Alcohol Use Disorder Identification Test)

43. Uptake and reach of the app assessed? (e.g. are usage and geographical statistics available?)

44. Adaption of existing data collection systems? (e.g. is the app built into a pre-existing one used for another purpose, such as appointment bookings?)

45. Evaluation by independent body? (i.e. will the app be evaluated by a body independent from the company that developed it?)

46. Evaluation planned prior to release of app? (i.e. has the app already been evaluated?)

47. Specialist input for evaluation? (e.g. was the evaluation informed by health professionals?)

48. Is a description of the evaluation design available? (e.g. a published protocol)

49. Does the evaluation use qualitative tools? (e.g. focus groups or interviews)

50. Process and outcomes using objective measures? (e.g. carbon monoxide detectors for smoking cessation)

51. Establishment of routine data collection? (i.e. will data continue to be collected following the evaluation?)

52. Adequate sample sizes for evaluation ensured? (e.g. if a published protocol exists, does it contain power calculations?)

53. Will outcomes be assessed for over 1 year? (i.e. If an evaluation is planned will the follow up be for at least one year?)

Theme 8: App documentation

54. Detailed description of the app publicly available? (i.e. is it possible to ascertain app content without downloading it?)

55. Publicly available manual? (i.e. a detailed description of the app and how it should be used)

56. Is the evidence base used described? (e.g. by reference to scientific studies)

57. Is the mechanism of action described? (e.g. by raising awareness of daily calorie intake)

58. Is it clear which BCT was employed? (e.g. self-monitoring – see Michie et al., 2013)

59. Description how the app addresses maintenance? (e.g. by encouraging attendance at local support groups)

60. Documentation updated along with app updates? (i.e. a clear commitment to ensure the manuals are updated with subsequent versions)

61. Clear rational for the BCT employed? (e.g. through reference to scientific studies)

Theme 9: Data protection

62. Does app comply with data protection standards? (in the case of the NHS apps library, this is already assured. Developers should be able to provide evidence that their app complies with the Data Protection Act, 1998. For further information, see; https://ico.org.uk/for-organisations/guide-to-data-protection/online-and-apps/)