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How can weight-loss app designers' best engage and support users? A qualitative investigation

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Abstract:	Objectives. This study explored young adults' experiences of using e-health internet-based computer or mobile phone applications (apps) and what they valued about those apps. Design and methods. A qualitative design was used. Semi-structured interviews were conducted with a community sample of 19 young adults who had used a publicly-available phone or internet-based application. Transcripts were analysed using thematic analysis. Results. Participants valued an attractive user interface. Structure, ease of use, personalised features and accessibility (including dual phone-computer access) were all important to participants and users indicated that continued use depended on these design features. Many believed that a focus on calorie counting was too limiting. Some users mentioned behaviour change strategies and known behaviour change techniques utilised by apps including; self-monitoring, goal setting and behavioural feedback. Only a few users reported positive changes in physical activity levels. Conclusions. Use of particular design features and application of evidence-based behaviour change techniques could optimise continued use and the effectiveness of internet/smart phone interventions.
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BJHP.14.0059

"How can weight-loss app designers' best engage and support users? A qualitative investigation"

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Thank you for your comments and the opportunity to revise and re-submit our paper. We have been able to respond positively to all your comments.

Our response to each comment (in red font) explains how we revised our paper, where necessary. We have highlighted changed text in the manuscript in red font and noted page numbers in our responses to each of the comments.

We hope that our revised paper will be suitable for publication in *British Journal of Health Psychology* and look forward to hearing from you.

Comments

1. Please add some further details about the data analysis conducted. It is not currently clear whether the themes were pre-determined and used as a basis for the analysis or if these were derived from the data. If they were predetermined - why?

We employed a topic guide to ensure that participants did not stray off topic or fail to address our research questions. The themes identified emerged from the data and were not predetermined – as described in our data analysis section. We have added a sentence in the second paragraph of the results section (p6) to clarify this point.

2. You refer to 'calorie counting' in the text on page 11. Please change this to e.g. self-monitoring of calorie intake.

We have now omitted ‘calorie counting’ in the text and replaced this with “calorie-intake monitoring” (p11, 12).

3. Please rephrase the second sentence which was added to the data collection section in this revision. It is currently poorly phrased.

We have now amended this sentence by dividing it into two simple sentences (p5).

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How can weight-loss app designers' best engage and support users? A qualitative investigation

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Statement of contribution

What is already known on this subject?

- E-health is increasingly used to deliver weight loss/control programs.
- Most e-health programs have not been founded on evidence-based designs and it is unclear what features and functions users find useful or not so useful.

What does this study add?

- Weight loss app users valued structure, ease of use, personalised features and accessibility.
- Goal setting and feedback on calorie intake/energy balance were the most widely used behaviour change techniques.
- Designers should consider an extensive food database, a food scanner, and provision of diaries.

How can weight-loss app designers' best engage and support users?

A qualitative investigation

Introduction

Weight reduction is a global health priority because being overweight or obese is associated with major health implications, including the development of preventable diseases such as cardiovascular disease and cancers which account for substantial proportions of premature mortality (Allender, Peto, Scarborough, Boxer, & Rayner, 2006; Whitlock *et al.*, 2009). Obesity prevalence and the health service resources devoted to its consequences are increasing (Butland *et al*., 2007). In the US, for example, 68% of adults are overweight or obese accounting for more than 20% of health care costs (Flegal, Carroll, Ogden, & Curtin, 2010). Similarly, in England, for example, 62% of adults are now overweight or obese (National Statistics, 2013).

Medications (e.g. use of orlistat) or bariatric surgery are suitable and effective for a small proportion of the obese population but such treatments are expensive and often accompanied by adverse side effects (Chaudhari, Crisostomo, Ganote, & Youngberg, 2013). Consequently, they tend to be treatments of last resort (Christensen, Kristensen, Bartels, Bliddal, & Astrup, 2007). Reversing population-level obesity trends depends on prompting widespread changes in diet and physical activity patterns (Hill & Peters, 1998; Jeffery, Wing, Sherwood, & Tate, 2003). Initiation and maintenance of such changes requires interventions based on an understanding of environmental, physiological, motivational and volitional processes regulating eating and exercise behaviour patterns (Kessler, 2009; Lench, Flores, & Bench, 2011).

Research has suggested that face-to-face behaviour change interventions are effective for inducing short term weight loss. Moreover, specific change strategies that maximise changes to diet and/or physical activity have been identified (Greaves *et al*., 2011). Such programmes can, however, be expensive to implement (Munoz & Mendelson, 2005) and,

unfortunately, people who successfully lose weight often regain one third of the lost weight back within the same year and return to their baseline weight within 3 to 5 years (Dansinger, Tatsioni, Wong, Chung, & Balk, 2007; Katan, 2009). Thus, there is a need for ongoing interventions that continue to target daily lifestyle choices over time.

E-health refers to the proliferation of health information and health intervention applications delivered through third generation information technology systems including mobile phone applications and internet programs of devices such as computers, net books, smart phones, tablets and other digital devices. Such applications (or "apps") provide an attractive, low cost, self-delivered way to prompt and support users to change their own behaviour, with minimal or no professional contact. They can employ a range of interactive behaviour change techniques (Bennett *et al*., 2010; Gabriele, Carpenter, Tate, & Fisher, 2011; Rothert *et al*., 2006; Wieland *et al*., 2012) and may be used continually over years if they engage users. For example, smartphone apps can provide personal tailoring of information, 24-hour availability to self-monitoring statistics, anonymity, online social support networks and affordability. E-health interventions have been found to be effective in facilitating change across a range of health behaviours including weight loss and diabetes self-management (e.g. Gabriele *et al*., 2011; Munoz *et al*., 2006; Tang, Abraham, Greaves & Yates, 2014; Wieland *et al*., 2012).

Research into e-health weight management is at an early stage with most evaluation studies focusing on efficacy rather than identifying specific intervention content that successfully facilitates weight loss and weight maintenance (Wieland *et al*., 2012). So the question of what characteristics, features and behaviour change techniques are likely to engage users and encourage continued and effective use remains largely unanswered. Specific, desirable features for users of smartphone, physical activity apps have been identified using a survey and interviews with a sample of 15 sedentary adults (Rabin & Bock, 2011). These included including the automatic tracking of physical activity, tracking progress

of physical activity goals, an integrated music feature, a user friendly interface, goal-setting and problem-solving elements. However, apps which focus on fitness or performance are often not suitable for people who want to lose and maintain weight. For these users, the relationship between diet and physical activity must be considered to manage energy balance and to develop sustainable lifestyle changes.

Pagoto, Schneider, Jojic, DeBiasse and Mann (2013) rated 30 popular mobile weight-loss apps for inclusion of 20 behaviour change strategies included in an evidence-based diabetes weight-loss program ("The Diabetes Prevention Program", DPP research group). Disappointingly most apps included few or none of these change strategies. Weight loss and dietary goal setting were found in most apps (90-93%). However, the vast majority of apps provided no physical activity goals. Monitoring calorie intake and expenditure to change calorie balance was the next most popular strategy (identified in 86.7% of apps). While 10 other behavioural strategies (including benefits of healthy diet and physical activity, food substitutions, food pyramid, portion control, problem solving) were present in a few apps, 7 behavioural strategies were not identified in any of the apps. Pagoto *et al* concluded that popular freely-available weight loss apps use only a small proportion of evidence-based behavioural strategies and that designers should include more of these strategies to overcome motivational challenges.

Developing an app is a complex process and a variety of design decisions contribute to effectiveness, including, for example, which features are most likely to engage users, what are the most effective behaviour change techniques that should be included, what delivery modes are likely to be most use (Abraham & Michie, 2008; Bartholomew, Parcel, Kok, Gottlieb, & Fernández, 2011). Ideally, app designers should combine evidence-based behaviour change techniques with formats, interfaces, features and tools that engage and sustain users' interest. In this study we investigated adults' experiences of e-health weight

loss interventions, focusing on what they found helpful and unhelpful in the apps they had used.

Research Questions

Our aim was to generate an in-depth understanding of users' experiences of weight loss or weight control apps and, in particular, to identify characteristics and features users found engaging and helpful in controlling weight. We were interested, for example, in identifying attention-grabbing, rewarding and motivating features and tools which designers could use to optimise engagement as well as identifying features that discourage ongoing use. Our interview schedule included questions which helped to direct discussion towards three main themes:

1. What motivates people to use weight loss apps and can apps bolster motivation?
2. Which app characteristics enhanced users' satisfaction and engagement?
3. What change processes do apps instigate to promote weight loss and maintenance?

Methods

Participants

English-speaking adults aged 18 to 40 years old were recruited in Exeter and Plymouth. We targeted this age range to ensure familiarity with internet applications and third generation software. We recruited adults who had experience of using an e-health weight loss, or weight loss maintenance app, or were willing to try out one of four publically-available, free apps over a 3 week period and then be interviewed about their experience. Participants who did not have their own favoured app were offered a choice of "My Fitness Pal" (http://www.myfitnesspal.com/), "Livestrong" (http://www.livestrong.com/), "Calorie Count" (http://caloriecount.about.com/) or "Spark People" (https://www.sparkpeople.com/).

Potential participants were invited by adverts, email or phone to participate in a semi-structured interview conducted in a quiet university room or a location convenient to themselves. Nineteen participants were recruited. Two, from a local cohort study who responded to invitation letters containing a brief study description and information on

involvement. Nine responded to adverts placed in free newspapers and notice boards in local gyms and clubs (Appendix A). Two responded to brochures handed out to the public (Appendix B), and six were recruited through discussion with the researchers. Two participants had studied psychology and could, therefore, have had prior knowledge of behaviour change strategies.

Data collection

Semi-structured interviews were conducted by two researchers trained by an experienced interviewer. One male doctoral researcher studying self-delivered interventions for weight control conducted 12 interviews. One female undergraduate student studying medical sciences conducted 7 interviews. Interviews lasted 30-60 minutes and were audio-taped, with permission. Interviews began with the researcher asking participants what app or website they had used and what their reasons were for using the program. Participants were then allowed to discuss openly about their experiences with weight loss app use. Interviewers used a topic guide drawn up in advance to ensure that interviewers addressed the study's research questions (Appendix C).

Data Analyses

Interviews were transcribed verbatim. Names of people and places were replaced by pseudonyms so transcripts (and quotations) were anonymised. A two-stage thematic analysis was undertaken (Abraham & Gardner, 2009; Bryman, 2001; Strauss & Corbin, 1998). Initial coding proceeded by assigning preliminary conceptual labels to extracts with further refinement of these labels as coding progressed and new insights emerged. The constant comparison method was used to identify instances to which similar conceptual labels should be assigned and to, iteratively, develop an understanding of the core properties of each concept as well as refining the labels attached to these. When this process was near completion, secondary coding was

undertaken to construct data-driven links between identified themes. When coding was complete, quotes that best illustrated categories and sub categories were identified. A subsample of nine transcripts was read by another researcher and coding comprehensiveness and organisation discussed with the initial coder. Following this the overall analyses of all transcripts were discussed among coders. Analyses were facilitated using NVivo software.

Results

Nine participants had used or were currently using an app and ten volunteered to use one of our recommended free apps. Nine participants were female and ten male and age ranged from 19 to 33 years old. One participant who had experience with using a weight loss app and agreed to an interview later dropped out for personal reasons.

Findings were arranged into three broad themes: Motivation to use apps and to lose weight; Features of apps relating to ongoing engagement; and change processes initiated by app use. These themes emerged from categorisation of the interview data. The names used in the quotes below have been changed to preserve anonymity but gender has been retained.

What motivates people to use weight-loss apps and how can apps encourage weight-loss motivation?

Most users wanted to lose weight to enhance physical attractiveness, increase self-confidence or to feel better about themselves. For example:

> *'To keep the weight off and to look physically better and it makes me feel good as well. It gives some purpose some structure… it's a break from work and other things and it makes you feel good.' (Tim)*

Sometimes such motivation was prompted by an upcoming social event for which users wanted to look good. Such goal-specific motivation appeared to sustain app use and weight loss activity. For example, one user noted that:

'I normally have like a goal.... my last one was [to lose weight before being a] bridesmaid at my first wedding, so that was kind of my big motivation.' (Beth)

Some users were more concerned about health and fitness than appearance, particularly if they saw themselves as being at increased risk. For example:

'Health comes first of all… I have a family history…. [of] type 2 diabetes, and…. a family history of…. stroke… I don't want either of those things.'(Colin)

Use of apps bolstered, structured and directed motivation for many users. Apps could inspire by identifying role models, provide concrete daily goals such as eating within recommended calorie limits and build confidence by highlighting achievements. For example:

'It had articles on Olympic runners and stuff like that but it was good, because it was inspirational, motivational.' (Kate)

'There are loads of ideas in my head, but I can't channel it so with this website it kind of channels my motivation and my energy into reaching that goal.' (Kate)

I found it helped me… maintain my weight and so … it has made me more aware about what I'm eating so it is useful' (Bob)

'I've achieved something… to have tiny little things [highlighted] *would mean* [a lot] *for people… who haven't lost any weight … might give them that kind of little spark of hope to say actually there is some progression' (Aaron)*

Our participants' responses suggest that apps may sustain interest by including content relevant to aesthetic and health-related motivations, by boosting confidence in change and by facilitating goal-specific targets.

Which app characteristics enhanced users' satisfaction and ongoing engagement?

Initial motivation to use a weight loss app does not guarantee sustained interaction with the software, so apps that do not elicit user satisfaction and engagement are unlikely to be effective. Our analyses identified four key quality-of-experience factors affecting

engagement and satisfaction with use, namely, (1) ease of set up and use, (2) attractiveness of user interface, (3) accessibility and (4) personal tailoring. In addition, five specific app features were highlighted as helpful, namely, (1) an extensive food database, (2) a food scanner, (3) notifications and reminders, (4) provision of dairies and (5) online contact and support.

Ease of set up and use

If an app is not easy to set up and straightforward to use then users may not persist, as one user put it, *'to set it up it takes a little while, so it is off putting.' (Cassie)* and another noted,

> *'It's so time consuming that you just… get discouraged to do it every day for a long time and it makes you so paranoid of everything you eat.' (Ann)*

Attractiveness of user interface

The user interface played an important role in how users interacted with apps and how engaged they became. A well-designed, structured, attractive, easy to use interface increased daily use. This included the attractiveness of the visual interface:

> *'There were lots of colourful pictures of fruit and veg and… exercise equipment.' (Ben)*
>
> *'it gave it to you in like a little pie chart… and said right… this is what you're doing, so… it… showed it to you in a very visual way, which is good for me as numbers bore me… I need visual things.' (Alice)*

However, not all comments were positive. Some participants described their apps and websites as poorly structured noting that, '*it isn't really that intuitive' (Ken)* and that *'it can be a bit intimidating… it could be a bit more organised' (Ben).* Poorly designed interfaces may make it difficult to navigate around apps and menus so discourage use:

'The gym one is really simple. It is all laid out for you. Just click on what you want and it's pretty much there. [Brand name website] is a bit more confusing because you've got to sort of navigate around.' (Penny)

Suggestions offered by our participants to improve interfaces and enhance user experience included visual cues to prompt actions and representations of progress, including graphs and charts to enhance self-monitoring of food intake:

'I think if you had the traffic lights system and you had more options to select from… that would be more useful.' (Ann)

'I think if there were pictures and if it was more… instead of saying… a 100 gram [of a particular food]… if there was [instead] a picture of a handful of blueberries… or a glass of rice is that many calories that would be useful.' (Ann)

'There… was like a weekly graph and you could see over the week whether you had some good days or some bad days… for that week which is quite handy. So it was quite good to see it visually.' (Emma)

'it did like a pie chart… I think it was adding up all the stuff that you've eaten and saying what proportion protein, carbs or fat you have.' (Tim)

Other suggestions included the 'gamification' of the user interface to make use more playful and appealing:

'like a video game so it's more exciting than general exercise and the games… makes it more fun.' (Emma)

Accessibility

Most interviewees mentioned the benefits of access to online personal information through both phone and computers. Constantly updated "*on-the-go*" statistics provided by smart phones appealed to users because they could be read in most locations allowing self-monitoring and goal setting in spare moments. For example:

"if it was on a phone… [it] would be really easy to log things while you were going

round during the day, whereas, I had to log mine at the end of the day so I missed a few days." (John)

'it does motivate them [app users] quite a bit particularly when they get... apps on the phones… it makes it easier for them to like input stuff in there, on the go.' (Bob)

Personal tailoring

We use "tailoring" to mean any combination of information, strategies or tools personalised to a specific individual's needs and characteristics (Kreuter *et al.*, 1999). Tailoring requires a computerised expert system offering personally relevant advice using various behaviour change techniques. This might include, for example, information provision and goal setting tailored to users' circumstances:

'I quite liked it because at the very start it asks you all these details about yourself, your weight, height and weight loss goals and… and then it … [shows] you how you should go about it… it seems like it's… more tailored to you.' (Kate)

'It straight away said you work in an office, start doing butt clenches at your desk, you know, easy things like that.' (Cassie)

In contrast, non-tailored apps were challenging for users to integrate into daily routines and interviewees expressed frustration about the lack of personalisation provided by some apps:

'it all relied on how much you engaged with it rather than it trying to engage you.' (Ben).

'what I miss the most is… going out for dinners and drinking alcohol… the app doesn't do anything to support you with that… I don't know what I can do instead of that… you are limited in that respect.' (Lucy)

In addition to these qualities of user experience, interviewees identified five specific features that facilitated behaviour change and weight loss.

An extensive food database

Most participants thought that the food database their app provided was comprehensive and detailed enough with its range of brands for particular foods. As one participant put it:

> *'This one has got a massive database of the various foods… if I just wanted to put in an apple say… it immediately comes up… and you can go through all the various apples, cider, royal gala, and the various weights and what calories are for that weight and then you just add that into… your meal.' (Matt)*

An easy to navigate food database is crucial to the accuracy of calorie intake monitoring but doubts about the reliability of this counting process undermined users' confidence in monitoring calorie intake:

> *'I think, for example, there are things that… I can't find on the website… so I have to supplement it with other websites to find the calories.' (Ann)*
>
> *'It's just a matter of… clarity so I just had my lunch and I had a sandwich but is a sandwich made from one slice of bread or two…. I found it interesting… when the meals need to be cooked from scratch. It seems to be a lot more difficult to use than when… the meal hadn't been cooked from scratch, but you could describe it simply like spaghetti Bolognese.' (Ben)*
>
> *'I know through friends of mine, they find the idea of calorie counting terrifying so I think if there was another system that was less daunting then it would be much easier… to assimilate.' (Colin)*
>
> *'I think that there needs to be other factors as well… looking at fat, carbohydrates, sugar and all that stuff… it's obviously useful to have it [calorie counting] but I think it's just a basis.' (Ken)*

So a comprehensive food listing that allows easy translation, not only into estimated calorie intake, but also provides other health-related feedback was important to user satisfaction.

However, the process of monitoring calorie intake was perceived to be laborious and unsustainable in the long term by some users.

A food scanner

Some participants commented on the smart phones capacity to use inbuilt cameras as scanners. Scanning food items with barcodes provided an easy way to quickly record nutritional information enhancing app appeal:

'You can scan the barcode on the packet and that… makes it really easy to use.' (Matt)

However such a feature may be difficult to use when cooking with multiple ingredients.

Notifications and reminders

Some apps alerted users with personal messages which helped to prompt action. This included reminders to self-monitor. For example:

'It gives you reminders of when you want to input your food… when you do your exercise you put that in as well.' (Cassie)

'I think if it has something… [that] popped up on your phone, a notification that said you could be doing this right now… you could be doing star jumps that sort of thing.'(Penny)

A diary

A number of participants commented on the utility of diary keeping. Diary facilities vary across apps and more flexible diaries that tap into affect associated with behaviour may be helpful. In the following example, Colin describes how his app allowed him to record feelings as well as diet and explains how this helped him change his evaluation of his eating habits:

'A useful functionality of this app is there is [a] food and exercise note [where you] can put in … how you feel. So you can say I feel really tired today. I don't feel like I've eaten enough. I feel like I've eaten too much. I felt really bloated after lunch,

things like that… So I know it's… after I started to eat more quality food, I had a lot more energy, so I put a note of that on and when I started to feel more tired… made a note to myself… I wasn't eating enough fruit and veg. That's a functionality that's been useful… to make a note of how you are feeling on that day.' (Colin)

Online contact and support

Some apps encouraged users to share their data with others (sometimes through social media sites) and some participants found the awareness of being monitored by others supportive:

'I didn't realise it was uploading it automatically… someone at work was... keeping track of how [I was] doing… I wasn't even aware that she was doing it, and it wasn't... motivational thing until she said [i.e., told me she was monitoring my progress].' (Aaron)

'I guess there's also[a] social media aspect to MyFitnessPal… you can… link friends to your profile. So… my strength and conditioning coach is linked to my profile and he can see everything… I eat… my weight goals and the activity I do… that's quite daunting and quite terrifying and that's obviously quite a motivator for eating well… because if I don't eat at least semi good, I get stick for that.' (Colin)

In addition, online communities allow participants to monitor others' behaviour and for some participants these social comparisons enhanced their self-efficacy to achieve their goals:

'you know how they're working and how they're exercising, and… I can see that works for you [works for me].' (Cassie)

However, not all participants welcomed social networking. Some app users felt forums or discussion boards were untrustworthy so voluntary sharing is critical:

'*You know that it could be advertising their own product, you just don't know*.' *(Cassie)*

'You can share with friends on a forum… I don't broadcast what I'm doing to the world. So I stick with myself, but you can actually join groups and post on twitter… if you wanted to.' (Matt)

What change processes do apps instigate to promote weight loss and maintenance?

The features identified by users as helpful suggest that apps are activating a range of psychological change processes using recognised behaviour change techniques (Abraham, 2012; Abraham & Michie, 2008). For example, easy to use, attractive and accessible interfaces may be perceptually rewarding and so engage users' attention. While difficult to navigate apps are frustrating and provide negative reinforcement and so are likely to be abandoned. Food databases, scanners and diaries all allow self-monitoring of calorie intake and physical activity as well as of feelings and situation-specific responses. Notifications and reminders can serve to reorder goal priorities and renew commitment to weight control in context. Online contact can result in helpful upward and downward social comparisons as well as social facilitation and social support for users who feel comfortable with that form of interaction. A number of change processes and corresponding behaviour change techniques were highlighted by participants. Below we discuss seven identified by at least two participants, namely, (i) goal setting, (ii) self-monitoring in relation to set standards, (iii) feedback following self-monitoring, (iv) awareness of affective consequences and anticipated regret, (v) tangible self-rewards, (vi) identification of achievements and symbolic rewards and (vii) social support.

Goal setting

A number of participants referred to goal setting in relation to calorie intake, physical activity and weight, for example:

'you put in your age and your height and… it's calculating the number of calories that you should be eating depending on your age and height and current weight, so… kind of personalised to your calories and then you can set up a goal.' (Ann)

'It doesn't necessarily give you goals… but it definitely makes me more aware then of [why] I'm using it. I'm more aware of my own goals if that makes sense.' (Colin)

Some participants also found that app use allowed them to set context-specific goals, including if-then plans, or implementation intentions:

'Especially when there's cakes in the office... makes me think right I'm going to eat an apple instead of cake that everyone else is eating… because an apple is only 80 calories and cake is… 120 calories.' (Beth)

Self-monitoring in relation to set standards

All apps considered here included self-monitoring tools and this was the change process most often discussed by interviewees. Some set standards against which self-monitored behaviour could be assessed:

'I mean it's pretty clear when you put it in how much fat and how much sugar is… in the food and… it kind of tallies it up, and you can compare that to your recommended amounts so you know how far off you are from exceeding what… you're supposed to be eating.' (Bob)

'it can also count your steps and you can see how far you walk every day. It… not just counts them but traces where you go, it can map out… where you go.' (Penny)

For some users regular self-monitoring of their behaviour increased awareness of, and attention to, small lifestyle choices that influenced their daily energy balance. This in turn encouraged re-evaluation of such choices and the desire to break old habits. Resultant behaviour change intentions were also bolstered by anticipating regret in relation to "*looking bad*" on the self-monitoring record:

'What I actually find… benefiting… is the… food analysis because I can physically

see. It's so easy to sort of do the old, I'll just have a biscuit here and biscuit there. When you actually key in and realize that one biscuit was 170 calories' (Cassie)

'it's given me a much bigger idea… that if I go in and have a big teaspoon of peanut butter, it's quite a heavy bit of calories, fats and stuff like that… I love peanut butter… now I've learnt to actually ration myself to it.'(Matt)

'I guess I became more consciously aware of what I was eating so before I'd just have a biscuit, but now I'm like, should I have this biscuit, I would have to put it in the app and then that would look bad so I guess that's something…. to be more aware.' (Emma)

Feedback following self-monitoring

Self-monitoring followed by app feedback could enable internalisation of positive feedback allowing the user to support change independently, thereby enhancing self-efficacy and self-control. Developing such self-regulatory capacity is important because self-monitoring, for its own sake can become boring. For example:

'Because I can see I'm getting better, I use the app now, but I can see myself in the future not having to use it. Kind of like a stepping stone I guess.' (Beth)

'now I feel I've got to a stage where I don't… need that good feedback any more from the tool. I've got that feedback from myself without needing to use the tool, but I think it's a good stepping stone to where I am right now.' (Kim)

'When I first got the App… it was new and I quite liked monitoring everything. Recently I got a little bit bored of it' (Lucy)

Feedback could also be negative and advise a change in behaviour:

'I've tried to average around the 1200 calories. If you go below that it comes up with the message… you are eating too few calories and you will go into starvation mode.' (Matt)

Awareness of affective consequences and anticipated regret

When self-monitoring of affect was prompted, some participants reported that this made the negative consequences of eating certain foods more salient. This in turn led to change in eating evaluations and intentions. Feedback provided by apps could change evaluations of eating certain foods and, thereby, induce guilt and anticipated regret:

> *'so my weight problems in the past was down to feeling low and I guess comfort eating and…. it's helped me to be a bit more aware of that, 'ate too much pasta today, had a miserable day'… [being] in touch… [with] your eating habits from an emotional level… makes you regulate it a bit more… so that's quite good.' (Colin)*
>
> *'I had a chocolate bar today and It would say, this chocolate bar contained this much saturated fat and… I just feel really guilty now.' (Kim)*

Energy balance awareness and self-reward

Some apps focused on energy balance rather than on calorie cutting and weight loss. This facilitated flexible decision making among users and allowed them to give themselves rewards for physical activity increases, as well as for changes in diet:

> *'It kind of helped me make healthy choices… because it's not just about losing the weight, it's about being healthier… because you can add exercise… if I do go to the gym tomorrow, instead of just going home and sitting on the sofa… I can add a glass of wine as a reward probably.' (Beth)*
>
> *'You can have your goals and… know your certain amount of calories for that day and if I had pizza that's using up a whole chunk of it, then I know I can't have… a biscuit or whatever, because I ate that pizza earlier.' (Emma)*

Identification of achievements and symbolic rewards

Some apps were able to recognise dietary or physical activity achievement and provide symbolic rewards. Some users found such rewards motivating and wished to have such incentives if they were not provided by their app:

'It then started putting all your times and then when you did, even just a tiny achievement… like… you did a climb up a road… they give you a gold star.' (Aaron)

'some sort of more incentive kind of stuff rather than just saying what the facts are, because they might not necessarily make as much difference.' (Kim)

However, not all users were impressed with this feature. In particular, in Ben's case, who did not '*consider [a] virtual badge to be at all very exciting*.'

Social support

As noted above some users appreciated their app's capacity to put them in contact with others and found such contact motivating. Others were less sure:

'It's always helpful I think to have someone to do stuff together so… in terms of physical activity if you had someone who you go running with… that always motivates you and you motivate the other person.' (Ann)

'I'm not very fit and I don't really want people to know that so I just use it by myself… but I suppose it could be helpful to some people, like motivating, joining up with their friends. Trying to lose weight together.' (Emma)

Discussion

To our knowledge, this is the first study to explore young adults' perspectives on e-health apps designed specifically for weight control. Users reported a number of components and features they found to be supportive or unhelpful in facilitating weight control. Our findings suggest a series of recommendations for designers of weight loss apps for younger adults.

First, such apps should embrace both physical appearance and health-related motivations for app use and should seek to translate such motivation into specific goals. The design of many freely-available, weight-loss applications has been shaped by marketability rather than usability. Such applications often involve a high degree of dexterity and good visual acuity and can take considerable time to master (Patrick, Griswold, Raab, & Intille,

2008). Unsurprisingly apps that are easy to set up and use, have attractive user interfaces, allow dual access on both smartphones and computers and provide personal tailoring that are more satisfying and engaging to use and, therefore, more likely to be used for longer (e.g. Oenema, Brug, Dijkstra, De Weerdt, & De Vries, 2008). Our participants found non-user friendly and non-tailored apps to be difficult to integrate into their everyday daily lives and found information provided to be less meaningful. This emphasises Norman's (1998) assertion that product functionality should take priority above all else. Norman warns that we should be wary of sophisticated designs that are self-indulgent and impractical for users.

Interaction speed and real time tracking were important aspects of satisfaction with the user interface. Use of small immediately-reinforcing rewards highlighting achievement and links to everyday cues was seen to be important. This also mirrors findings suggesting that individuals with eating problems find it difficult to 'delay gratification' (Epstein, Salvy, Carr, Dearing, & Bickel, 2010).

Designers should consider helpful app features desirable to users such as an extensive food database, a food scanner and provision of dairies, which can support self-monitoring of eating, calorie intake and affective responses to eating. Notifications and reminders can also be helpful and these may serve to reorder goal priorities. Online forums and chat rooms can facilitate social facilitation and social support and were found to be helpful by some, but not all, users. Hence, such features should be available, but optional. Designers should also consider the importance of user interface design as it determines the functionality, and consequently, usability of an e-health weight loss app.

Interviewees identified a number of behaviour change techniques used in their apps which have been found in a range of health-behaviour change interventions (Abraham & Michie, 2008). However, this also leaves a variety of other evidence-based behaviour change techniques which were not identified by our participants (Pagoto *et al*., 2013). Techniques identified included goal setting (e.g. "*increase daily intake of fruit and vegetables*"), context-

specific if-then planning (e.g., "*if there is cake in the office I will only eat an apple*"), self-monitoring in relation to set standards (e.g. "*to be aware of healthy and unhealthy foods and number of calories*"), provision of feedback following goal setting and self-monitoring (e.g. "*message users to keep to weight loss goals*"), highlighting affective consequences and so prompting anticipated regret (e.g. "*feeling tired after consumption of certain unhealthy foods*"), providing information (e.g. "*calorie deficit of 500 calories for a pound weight loss per week*") and having achievements acknowledged through symbolic rewards (e.g. "*a gold star for the achievement of a physical activity goal*").

We found that goal setting and feedback on calorie intake/energy balance were the most widely used behaviour change techniques, confirming the findings reported by Pogoto *et al*. (2013). Specific planning of attainable goals (including if-then plans) is more likely to prompt action and lead to good dietary and exercise habits for long term behaviour change and is therefore a valuable asset (Gollwitzer, 1999) and we were surprised that users did not report more widespread use of this behaviour change technique.

Information on calorie balance was included to some extent in all the apps used by our participants and most users acquired the ability to estimate confidently the amount of calories for a range of foods after using a calorie counting tool. This resulted in dietary changes in snacking behaviour and in the amount of junk food consumed including soft drinks, chocolate, sweets, cheese, biscuits, bread, and high fat foods, such as sausages. Apps also had an influence on how participants felt towards certain types of foods. Assigning emotional value through emphasising future affective consequences also helped some participants to regulate food intake.

Carver & Schier's (1982) control theory proposes five self-regulatory techniques central to behavioural self-control. These are prompting intention formation, self-monitoring of behaviour, goal setting, receiving prompt feedback on performance and review of behavioural goals. Diet and physical activity interventions including self-monitoring in

combination with one or more of the other 4 techniques based on control theory have been shown to be more effective compared to interventions that do not include these techniques (Michie, Abraham, Whittington, McAteer, & Gupta, 2009). In line with these theoretically specified behaviour change techniques and partial support from the meta-analysis, most of our users supported the use of these techniques delivered by e-health to self-regulate weight related activity. In particular, the most reported behaviour change techniques reported by users were self-monitoring, feedback and goal setting.

One technique not mentioned by our interviewees, which evidence suggest may be important to weight control was prompting problem solving (Avery, Flynn, van Wersch, Sniehotta, & Trenell, 2012; Greaves *et al*., 2011). Promoting self-regulation should enhance learning from experience and while goal-setting, monitoring and feedback facilitate this process, problem-solving is also required to enable sensible re-setting of behavioural goals (Greaves, 2012). Hence, features to support barrier identification and problem-solving could potentially add value to apps that are based on facilitating self-regulation.

Participants' comments corresponded to some of the key design principles that Norman (1998) highlighted in relation to usability. These included the consistency, visibility and the level of feedback provided by applications. However, three other important design features: affordance (e.g. button shaped features can be pressed), mapping (e.g. expectation of a certain effect if an action is performed) and constraints (e.g. components that don't apply are greyed out) were largely unexplored in our interviews. Nonetheless, designers would be well advised to take account of Norman's recommendations.

Several limitations of this study should be borne in mind. First, participants were selected using convenience sampling from a small demographic area in South West England, including both urban and rural dwelling participants. The applicability of our findings to other populations is unclear. Although our sample size was sufficient for this exploratory study, a more diverse sample including participants with lower socioeconomic status and

more ethnic variation would be informative. A larger sample could also ensure inclusion of a more representative range of apps operating on a wider range of platforms. Second, all our users from this study were comfortable in their ability to use a computer and/or smart phone. It is unknown how much benefit inexperienced e-health/computer users, including older people, would derive from weight loss apps. Third, our data and methods did not allow us to characterise apps in relation to intensity of behaviour change technique use, but it would be interesting to relate not just inclusion of behaviour change techniques but the intensity of their use to user satisfaction and effectiveness. Finally, the interview method, relying on recall, could have be supplemented by a think-aloud study which would track participants' responses to apps in real time. A laboratory-based think-aloud study could provide more detailed data on specific use problems and challenges. It would be difficult, however, to use this method to gain insights into naturalistic patterns of use and evaluation, over time.

Despite these limitations, our study presents recommendations for designers of e-health weight loss apps that could support engagement, long term use and effectiveness. Effort should be made to investigate whether additional behaviour change techniques or strategies identified in evidence-based guidelines on supporting lifestyle behaviour change can also be included in such apps (National Institute for Health and Clinical Excellence, 2011; National Institute for Health and Clinical Excellence, 2013). Moreover, further experimental work is needed to assess the impact of inclusion of particular behaviour change techniques and particular features on long term weight control.

In conclusion, the weight loss e-health apps investigated incorporated a number of established behaviour change techniques, primarily aimed at encouraging engagement with the programme and behavioural self-regulation. The data suggest that weight loss app designers should ensure that apps embrace both physical appearance and health-related motivations, are easy to set up and use, have attractive user interfaces, enable personal tailoring and allow smartphone and computer access. The data support the use of techniques

to promote goal setting, if-then planning, self-monitoring, feedback, awareness of emotional consequences, use symbolic rewards and facilitate social contact/support. However, exploration of other techniques associated with effectiveness in interventions to increase physical activity and change eating behaviour is warranted.

References

Abraham, C., & Gardner, B. (2009). What psychological and behaviour changes are initiated by "expert patient" training and what training techniques are most helpful? *Psychology & Health*, *24*, 1153–1165. doi:10.1080/08870440802521110

Abraham, C., & Michie, S. (2008). A taxonomy of behavior change techniques used in interventions. *Health Psychology*, *27*, 379–387. doi:10.1037/0278- 6133.27.3.379

Allender, S., Peto, V., Scarborough, P., Boxer, A., & Rayner M. (2006). *Coronary Heart Disease Statistics*: British Heart Foundation: London.

Avery, L., Flynn, D., van Wersch, A., Sniehotta, F. F., Trenell, M. I. (2012). Changing physical activity behavior in type 2 diabetes: A systematic review and meta-analysis of behavioral interventions. *Diabetes Care, 35*, 2681-89. doi: 10.2337/dc11-2452

Bartholomew, L. K., Parcel, G. S., Kok, G., Gottlieb, N. H., & Fernández, M. E. (2011). *Planning health promotion programs; an Intervention Mapping approach*, 3rd Ed. San Francisco, CA: Jossey-Bass.

Bennett, G. G., Herring, S. J., Puleo, E., Stein, E. K., Emmons, K. M., & Gillman, M. W. (2010). Web-based Weight Loss in Primary Care: A Randomized Controlled Trial. *Obesity, 18*, 308–313. doi:10.1038/oby.2009.242

Butland, B., Jebb, S., Kopelman, P., McPherson, K., Thomas, S., Mardell, J., Parry, V. (2007). *Foresight: Tackling obesities: Future choices – Project report*. 2nd edition. London: Government Office for Science.

Bryman, J. (2001). *Social Research Methods*. Oxford: Oxford University Press.

Carver, C. S., & Scheier, M. F. (1982). Control theory: A useful conceptual framework for personality–social, clinical, and health psychology. *Psychological Bulletin, 92*, 111–135. doi:10.1037/0033-2909.92.1.111

Chaudhari, D., Crisostomo, C., Ganote, C., & Youngberg, G. (2013). Acute oxalate nephropathy associated with orlistat: A case report with a review of the literature. *Case Reports in Nephrology, 2013,* 1–3. doi:10.1155/2013/124604

Christensen, R., Kristensen, P. K., Bartels, E. M., Bliddal, H., & Astrup, A. (2007). Efficacy and safety of the weight-loss drug rimonabant: A meta-analysis of randomised trials. *The Lancet, 370,* 1706–1713. doi:10.1016/S0140-6736(07)61721-8

Dansinger, M., Tatsioni, A., Wong, J., Chung, M., Balk, E. (2007). Meta-analysis: The effect of dietary counselling for weight loss. *Annals of Internal Medicine, 147*, 41-50. doi:10.7326/0003-4819-147-1-200707030-00007

DPP Research Group. (2002). The Diabetes Prevention Program (DPP): Description of lifestyle intervention. *Diabetes Care, 25*, 2165–71. doi:10.2337/diacare.25.12.2165

Epstein, L. H., Salvy, S. J., Carr, K. A., Dearing, K. K., & Bickel, W. K. (2010). Food reinforcement, delay discounting and obesity. *Physiology & Behavior, 100*, 438–445. doi:10.1016/j.physbeh.2010.04.029

Flegal, K. M., Carroll, M. D., Ogden, C. L., & Curtin, L. R. (2010). Prevalence and trends in obesity among US adults, 1999-2008. *JAMA: The Journal of the American Medical Association, 303*, 235–241. doi:10.1001/jama.2009.2014

Gabriele, J. M., Carpenter, B. D., Tate, D. F., & Fisher, E. B. (2011). Directive and nondirective e-coach support for weight loss in overweight adults. *Annals of Behavioral Medicine, 41,* 252–263. doi:10.1007/s12160-010-9240-2

Gollwitzer, P. M. (1999). Implementation intentions: Strong effects of simple plans. *American Psychologist, 54,* 493–503. doi:10.1037/0003-066X.54.7.493

Greaves, C. J. (2012). Supporting behaviour change in general practice. In: Barnard K, Lloyd CE, eds. *Practical Psychology in Diabetes Care*. London: Springer-Verlag,

Greaves, C., J., Sheppard, K., Abraham, C., Hardeman, W., Roden, M., Evans, P., H., Schwarz, P., & The IMAGE Study Group. (2011). Delivering lifestyle change: A systematic review of reviews of interventions for supporting change in dietary and physical activity behaviour for adults at risk of type 2 diabetes. *BMC Public Health, 11*, 119. doi:10.1186/1471-2458-11-119.

Hill, J. O., & Peters, J. C. (1998). Environmental contributions to the obesity epidemic. *Science, 280*, 1371–1374. doi:10.1126/science.280.5368.1371

Jeffery, R. W., Wing, R. R., Sherwood, N. E., & Tate, D. F. (2003). Physical activity and weight loss: Does prescribing higher physical activity goals improve outcome? *The American Journal of Clinical Nutrition, 78*, 684–689.

Katan, M. B. (2009). Weight-Loss Diets for the Prevention and Treatment of Obesity. *New England Journal of Medicine, 360*, 923–925. doi:10.1056/NEJMe0810291

Kessler, D. A. (2009). *The End of Overeating: Taking Control of the Insatiable American Appetite*. New York: Rodale.

Kreuter, M. W., Farrell, D. W., Olevitch, L. R., & Brennan, L. K. (2013). *Tailoring health messages: Customizing communication with computer technology*. Routledge.

Lench, H. C., Flores, S. A., & Bench, S. W. (2011). Discrete emotions predict changes in cognition, judgment, experience, behavior, and physiology: A meta-analysis of experimental emotion elicitations. *Psychological Bulletin, 137*, 834–855. doi:10.1037/a0024244

Michie, S., Abraham, C., Whittington, C., McAteer, J., & Gupta, S. (2009). Effective techniques in healthy eating and physical activity interventions: A meta-regression. *Health Psychology, 28*, 690–701. doi:10.1037/a0016136

Muñoz, R. F., & Mendelson, T. (2005). Toward evidence-based interventions for diverse populations: The San Francisco general hospital prevention and treatment manuals. *Journal of Consulting and Clinical Psychology, 73*, 790–799. doi:10.1037/0022-006X.73.5.790

Muñoz, R. F., Lenert, L. L., Delucchi, K., Stoddard, J., Perez, J. E., Penilla, C., & Perez-Stable, E. J. (2006). Toward evidence-based internet interventions: A Spanish/English web site for international smoking cessation trials. *Nicotine and Tobacco Research, 8,* 77-87. doi: 10.1080/14622200500431940

National Institute for Health and Clinical Excellence. (2011). *Preventing type 2 diabetes: Population and community-level interventions in high-risk groups and the general population*. National Institute for Health and Clinical Excellence, London.

National Institute for Health and Care Excellence. (2013). *Behaviour change: Individual approaches*. National Institute for Health and Care Excellence, London.

Norman, D. (1998). *The Design of Everyday Things* (Reprint edition.). London: MIT Press.

Oenema, A., Brug, J., Dijkstra, A., de Weerdt, I., & de Vries, H. (2008). Efficacy and use of an internet-delivered computer-tailored lifestyle intervention, targeting saturated fat intake, physical activity and smoking cessation: A randomized controlled trial. *Annals of Behavioral Medicine, 35*, 125–135. doi:10.1007/s12160-008-9023-1

Pagoto, S., Schneider, K., Jojic, M., DeBiasse, M., & Mann, D. (2013). Evidence-Based Strategies in Weight-Loss Mobile Apps. *American Journal of Preventive Medicine, 45*, 576–582. doi:10.1016/j.amepre.2013.04.025

Patrick, K., Griswold, W. G., Raab, F., & Intille, S. S. (2008). Health and the Mobile Phone. *American Journal of Preventive Medicine*, *35*, 177–181. doi:10.1016/j.amepre.2008.05.001

Rabin, C., & Bock, B. (2011). Desired features of smartphone applications promoting physical activity. *Telemedicine and e-Health, 17,* 801–803. doi:10.1089/tmj.2011.0055

Rothert, K., Strecher, V. J., Doyle, L. A., Caplan, W. M., Joyce, J. S., Jimison, H. B., … Roth, M. A. (2006). Web-based weight management programs in an integrated health care setting: A randomized, controlled trial. *Obesity, 14,* 266–272. doi:10.1038/oby.2006.34

Strauss, A. L., & Corbin, J. M. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Thousand Oaks: Sage Publications.

Tang, J. C. H., Abraham, C., Greaves, C. J., & Yates, T. (2014). Self-directed interventions to promote weight loss: A systematic review of reviews. *Journal of Medical Internet Research, 16 (2),* e58. doi:10.2196/jmir.2857

Wieland, L. S., Falzon, L., Sciamanna, C. N., Trudeau, K. J., Brodney, S., Schwartz, J. E., & Davidson, K. W. (2012). Interactive computer-based interventions for weight loss or weight maintenance in overweight or obese people. *Cochrane Database of Systematic Reviews*, 8. doi: 10.1002/14651858.CD007675.pub2

Whitlock, G., Lewington, S., Sherliker, P., Clarke, R., Emberson, J., Halsey, J., … Peto, R. (2009). Body-mass-index and cause-specific mortality in 900000 adults: Collaborative analyses of 57 prospective studies. *The Lancet, 373,* 1083-1096. doi:10.1016/S0140-6736(09)60318-4

Appendix A

Click here to download Supporting information: Appendix A Advertisement.docx

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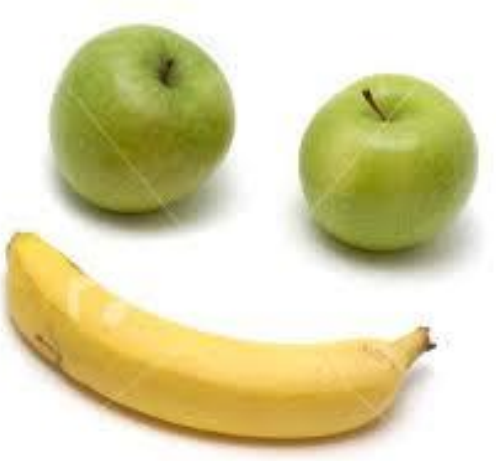
INTERESTED IN USING YOUR COMPUTER OR SMART PHONE TO LOSE OR MAINTAIN WEIGHT?



If so, researchers at ---------- ---------- ------ would like to talk to you.

The researchers are trying to find out who uses these applications and what is useful - or not so useful - about them.

The research is led by ---------- -----, a ---------- registered by the ---- ----------.

IF YOU WOULD LIKE TO TAKE PART

PLEASE CONTACT

---------- FOR FURTHER INFORMATION:

TEL: ----------

EMAIL: ----------

Appendix B

Click here to download Supporting information: Appendix B Brochure.docx

You may be suitable for this project if you:

- are between the ages of 18 to 40 years of age;
- have experience of using weight loss or weight maintenance applications;
- have no experience with weight loss or weight maintenance applications, but interested in using one of our suggested freely available internet-based programmes.

IF YOU WOULD LIKE TO TAKE PART

PLEASE CONTACT

---------- FOR FURTHER INFORMATION:

TEL: ----------

EMAIL: ----------

This project has been reviewed and approved by the ----------

----------Research Ethics Committee

Interested in using your computer or smart phone to lose or maintain weight?

If so, researchers at ---------- ---------- would like to talk to you.

The researchers are trying to find out who uses these applications and what is useful – or not so useful – about them.

The research is led by ----------, a ---------- registered by the ----------.

What is the project about?

You are invited to participate in a study of how people use internet-based applications to lose or maintain weight.

These applications may be on a website or may be a programme downloaded to a computer or phone.

We would like to learn about your experiences and ideas about using such applications.

The data we gather in this research will help us evaluate current applications and could potentially help with development of better applications.

What will participants be asked to do?

No experience of using weight loss or weight maintenance applications

If you have no experience of using such an application, but would like to try one, we can suggest freely available applications.

The amount of time you devote to using the application or programme is up to you.

After 3 weeks, we will contact you to schedule a time for an interview with one of our researchers.

This will involve a researcher asking you a series of questions regarding your experience of using an application.

Have experience of using weight loss or weight maintenance application

If you take part, you will be invited to participate in one face-to-face interview.

This will involve a researcher asking you a series of questions regarding your experience of using one or more applications.

Interviews will last no longer than one hour and may be shorter.

This will take place in a university office or at a location convenient to you.

Your contribution will help us to understand how people can use internet-based applications to maintain a healthy weight.

Appendix C

Click here to download Supporting information: Appendix C Interview Schedule.docx

How can weight-loss app designers' best engage and support users? A qualitative investigation - Interview Schedule

Version: Two Date: 06/08/2012

The interview will be semi-structured and interviewees will be free to talk about their experiences in an order chosen by them. However, where topics are not covered then key prompts will be used. Below we clarify the introduction, questions and key prompts that will be used to structure the interview.

Introduction

Thank you for agreeing to talk to me about your use of internet-based weight control applications.

Are you happy that I record this interview? If so, the recording will be transcribed (written out) but your name will be replaced by another name so the data remains confidential. We will not keep any records which name you or contact you again.

Interview

1. Which programmes, websites or e-health applications are you using or have used?

Prompt. If more than one clarify one or two main applications.

Prompt. Thank you. Let's focus on APPLICATION NAME

2. What's your motivation for using this application?

Prompt. If not answered, clarify if interviewee is - trying to lose weight or maintain current weight?

3. How long have you been using this application?

4. Why did you choose this application?

5. Can you tell me how this application works? What are its most useful features?

6. How often do you use it?

Prompt. If necessary, – for example, a few times a day or a few times a week?

7. How long did it take for you to learn how to use this application?

Prompt. If necessary, – what kind of work and skills are needed to use the application well?

8. What benefits do you get from using the application?

9. Does it have any drawbacks– or aspects you found difficult?

10. Are there features you would like to see added?

11. What changes in your behaviour did you have to make while using the application?

Prompt. If necessary, how has use of this application influenced your eating habits.

Prompt. If necessary, how has use of this application influenced how much physical activity or exercise you do.

12. How easy was it to adopt these changes?

Prompt. What other support did you draw on as well as the application?

13. How convenient do you find calorie counting? Is this a good way of monitoring food intake?

14. How well does this application distinguish between healthy foods and unhealthy foods? (low GI, food density etc).

Prompt. Where necessary explain low GI, food density.

15. What do you think (and feel) about foods that you had to give up? Do you think that this application has changed how you think and feel about certain types of foods?

16. How well does this application take physical activity into consideration when monitoring weight loss, does it distinguish between different types of activities?

17. Has your enjoyment of physical activity changed in any way since you started using this programme? If so, in what way?

18. Do you have a friend who you talk to about weight management?

19. Are you using any support group/network/forum to discuss feelings about eating or towards certain foods?

20. What other support or tools would help you with weight management?