



People trying to lose weight dislike calorie counting apps and want motivational support to help them achieve their goals



Linda Solbrig^a, Ray Jones^b, David Kavanagh^c, Jon May^d, Tracey Parkin^e, Jackie Andrade^{d,*}

^a School of Psychology, Plymouth University & NIHR CLAHRC South-West Peninsula, UK

^b School of Psychology, Cognition Institute, Plymouth University, UK

^c School of Health Professions (Dietetics), Plymouth University, UK

^d School of Nursing & Midwifery, Plymouth University, UK

^e Institute for Health & Biomedical Innovation and School of Psychology & Counselling, Queensland University of Technology, Australia

ARTICLE INFO

Article history:

Received 21 July 2016

Received in revised form 21 December 2016

Accepted 22 December 2016

Available online 10 January 2017

Keywords:

Weight loss

Motivation

Apps

Behaviour change

Imagery

Diet

Physical activity

ABSTRACT

Background: Two thirds of UK adults are overweight or obese and at increased risk of chronic conditions such as heart disease, diabetes and certain cancers. Basic public health support for weight loss comprises information about healthy eating and lifestyle, but internet and mobile applications (apps) create possibilities for providing long-term motivational support.

Aims: To explore among people currently trying to lose weight, or maintaining weight loss, (i) problems, experiences and wishes in regards to weight management and weight loss support including e-health support; (ii) reactions to Functional Imagery Training (FIT) as a possible intervention.

Method: Six focus groups ($N = 24$ in total) were recruited from a public pool of people who had expressed an interest in helping with research. The topics considered were barriers to weight loss, desired support for weight loss and acceptability of FIT including the FIT app. The focus group discussions were transcribed and thematically analysed.

Results: All groups spontaneously raised the issue of waning motivation and expressed the desire for motivational app support for losing weight and increasing physical activity. They disliked calorie counting apps and those that required lots of user input. All groups wanted behavioural elements such as setting and reviewing goals to be included, with the ability to personalise the app by adding picture reminders and choosing times for goal reminders. Participants were positive about FIT and FIT support materials.

Conclusion: There is a mismatch between the help provided via public health information campaigns and commercially available weight-loss self-help (lifestyle information, self-monitoring), and the help that individuals actually desire (motivational and autonomous e-support), posing an opportunity to develop more effective electronic, theory-driven, motivational, self-help interventions.

© 2017 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Rising obesity levels put half the UK's adult population at risk of developing serious morbidities, such as Type 2 diabetes, cancers and various heart conditions (Eastwood, 2013). The array of interventions spans educational methods, behavioural interventions, drug treatments and bariatric surgery. Bariatric surgery, drug treatments and very low-calorie diets pose the risk of life threatening side effects and patients typically do not reach their desired weight (Encinosa et al., 2005, 2013; Picot et al., 2009). Clinical and commercial weight loss programs are not optimal

either, producing short-term weight loss, but a typical long-term weight regain of about 40% (Bessesen, 2006). Most people who seek to lose weight, however, receive no professional support; 90% of overweight or obese patients have no weight management interventions recorded. Those who do receive support in the primary care setting generally get lifestyle and diet advice only (Booth et al., 2015; Laws, 2004).

General practitioners are keen to help obese patients lose weight but feel they lack time to offer extensive help (Ruelaz et al., 2007). Patients too feel that doctors would not have sufficient time to help them (Levine et al., 2014; Tan et al., 2005). There is some mismatch between GPs' and patients' perceptions of the problems. In Ruelaz et al.'s (2007) study, GPs thought that patients lack self-control and are helplessly exposed to an obesogenic environment and in a recent systematic-review, Levine et al. (2014) report 'provider-barriers' including limited consultation time, lack of training and poor competency amongst primary

* Corresponding author at: School of Psychology, Cognition Institute, University of Plymouth, Drake Circus, Plymouth PL4 8AA, UK.

E-mail address: Jackie.andrade@plymouth.ac.uk (J. Andrade).

care staff when dealing with obese individuals. Patients on the other hand felt there was a place for GPs pointing them into the right direction, by providing useful information on nutrition and exercise, but that long-term weight management was their own responsibility and they wished to manage it themselves (Ruelaz et al., 2007). These discrepancies offer opportunities for improving weight management services to address patients' needs within the existing constraints on healthcare provision.

Web-based and mobile applications (apps) that provide diet and physical activity support are readily available and many are free of charge (Breton et al., 2011). They are increasingly popular as a tool for weight management (Azar et al., 2013) and are accessible to the 70% of the UK population who are smart-phone users (Deloitte, 2014 figures for all ages and trend rising).

These apps could help GPs save time during consultations, save costs and enable people with obesity and overweight to work autonomously on weight control in their own time. Outside of general practice, effective online support also has the potential to reach a wider audience who might benefit from help with weight-management. Improved support is needed because self-management has provided only modest results so far, compared to commercial weight loss programmes (Heshka et al., 2003).

Publicly available weight management apps typically offer calorie and step counting and limited amounts of self-monitoring and goal-setting (Turner-McGrievy et al., 2013). Using the MARS rating scale, a new tool for trialing, classifying, and rating the quality of mobile health apps (Stoyanov et al., 2015), Bardus et al. (2016) found that the 23 most popular weight loss apps on Google Play and iTunes in 2015 incorporated most commonly self-monitoring and goal-setting, but also semi-automated tracking, app communities, social media sharing and notifications. Apps with the most behaviour change techniques and user-friendliest design were rated highest in quality by two independent coders (Bardus et al., 2016; Tang et al., 2015).

This research suggests scope for adding additional behaviour change elements to apps. Evidence on the importance of sustaining motivation for weight loss suggests that automated motivational support is an important target for development, for example apps could include stress reduction or problem solving tools to support motivation during difficult periods (Pagoto et al., 2013; Webber et al., 2010). Motivation is a good predictor of long-term weight loss (Elfhag et al., 2005; Silva et al., 2011; Teixeira et al., 2004) and weight loss trials show benefits of motivational support delivered face-to-face (Armstrong et al., 2011) or remotely (Fjeldsoe et al., 2009; Patrick et al., 2009). For example, Jackson and colleagues (Jackson et al., 2011) found benefits for weight loss of online motivational interviewing in their Video Doctor trials. In Jackson et al.'s (2011) study, patients accessed the Video Doctor in GP surgeries. The majority of people who are trying to lose weight will not have accessed GP services and will be attempting to manage their weight autonomously. While there is scope for developing mobile motivational support, it will only be accessed if people want help with sustaining motivation.

Often motivational support is provided only at the start of a weight loss attempt, as in the Video Doctor trials (Jackson et al., 2011). Motivation is one of the commonly reported barriers to weight loss among treatment-seeking overweight and obese adults, along with stress, depression, food cravings (Sharifi et al., 2013), lack of knowledge, lack of control, and lack of time (Welsh et al., 2013). Less is known about the need for ongoing support among those who have already begun losing weight and wish to maintain or further reduce their weight. Previous studies have reported lack of 'willpower', or waning motivation, as potential issues in weight regain; these data come from sub-group analyses of participants already enrolled in weight-loss trials (Metzgar et al., 2014; Sabinsky et al., 2007), and a descriptive study of a sample representative of individuals looking for weight loss treatment in research settings (Burke et al., 2008). There is a need to explore what might affect people's motivation over time, focusing on individuals typical of the majority who try to manage weight autonomously, and what support could be helpful.

Developments in cognitive theorizing about motivation and desire suggest scope for improving upon motivational interventions, such as motivational interviewing (Armstrong et al., 2011), in weight-management. Elaborated Intrusion theory (EI theory) (Kavanagh et al., 2005) posits that vivid multi-sensory mental imagery is a core component of desire. This imagery is particularly vivid when craving appetitive substances like alcohol or chocolate (Kavanagh et al., 2004; May et al., 2014) but is also reported in desires for healthy activities such as sport (May et al., 2008). Eliciting and practising imagery for healthy goals and strategies for attaining them should strengthen desire for those goals and increase belief that they are achievable. Because imagery relies on limited-capacity working memory systems (Baddeley and Andrade, 2000), goal-related imagery should also interfere with imagery for conflicting rewards, weakening cravings in the same way that other types of imagery have been shown to (May et al., 2010; Kemps and Tiggemann, 2007, 2015)

Functional Imagery Training (FIT) is a direct translation of EI theory into a new manualised intervention based on motivational interviewing (particularly in the way it is delivered), with two important differences: it aims to strengthen motivation through development of emotionally charged mental imagery during therapy sessions and it aims to maintain motivation by training individuals to practise imagery of goal-related behaviours routinely, and particularly when setting new goals. This imagery practice should help images of goal-achievement in the immediate future come to mind readily and vividly, particularly when faced with temptations, thereby boosting motivation and weakening cravings. Ultimately, this imagery should become a cognitive habit, but until that point, mobile apps can help keep individuals on track. We have developed an app to support FIT by allowing individuals to record new sub-goals, track their imagery practice, and view their progress. Users can upload their own photos and select a photo to focus on while listening to a guided imagery practice session.

The current study explored people's experiences of trying to maintain motivation during weight loss attempts and the motivational support they would like for the future. The population chosen were people who were not enrolled in a commercial program or research trial at the time of the discussions but were either thinking about losing weight, trying to lose weight, or maintaining weight loss on their own. Focus group interviews covered experiences of weight management, barriers to success, and desire for support and particularly mobile support. After exploring these issues in general, the researcher described FIT briefly and showed screenshots from the FIT app to elicit views specifically on FIT as a form of motivational support. The study thus provided a first step in testing whether FIT might be acceptable to participants accessing it remotely through an app or face-to-face.

2. Method

Ethical approval for this study was granted by the faculty research ethics committee of the Faculty of Health and Human Sciences, Plymouth University, March 23rd, 2015.

2.1. Participants

Participants were recruited from a pool of volunteers from the general public who responded to an advert seeking those who wanted to lose weight or maintain previous weight loss. The 24 (6 males and 19 females, mean age = 30, age range = 19–70) who responded received £12 for taking part.

2.2. Procedure

Six focus group discussions (group sizes of three- seven participants) were facilitated and audio recorded by the primary researcher (LS) in a comfortable lab on the Plymouth University campus.

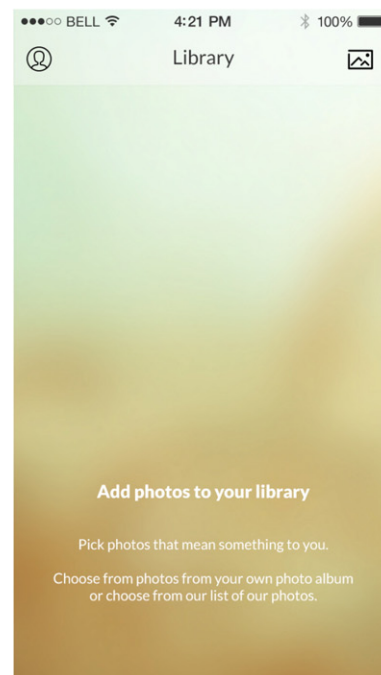
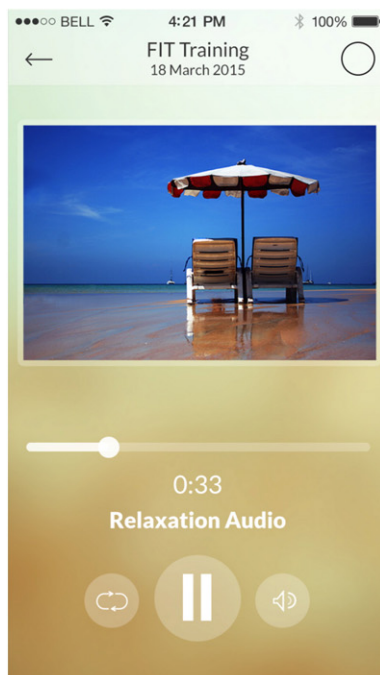
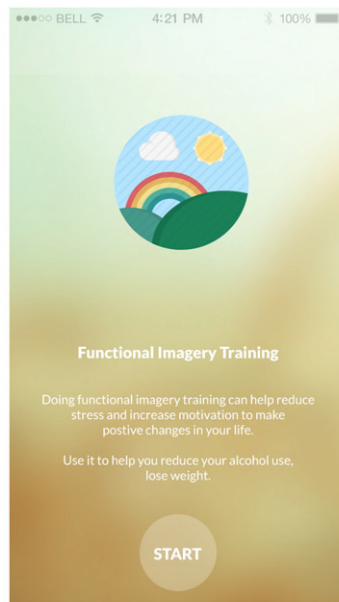
After welcoming participants, obtaining consent, and beginning audio recording, participants were encouraged to discuss any questions and points of interest that might arise from the group discussions amongst themselves rather than addressing the facilitator. The following questions were used to start the discussion: “Have you tried to control your weight before? Or are you trying to diet at the moment?” and 2) “What do/did you find the hardest part?”. If conversations did not spontaneously reach this point, groups were asked what sort of support would help them and, if they mentioned apps, what sort of app they would like.

Towards the end of all group discussions, the facilitator briefly explained the concept of FIT as being an intervention where individuals are trained to generate and practice mental imagery of how and why

they will achieve their goals, and introduced three screen shot example slides of the FIT app under development (see below):

2.3. Transcript analysis

Audio recordings were transcribed by the primary researcher as the first step to becoming immersed in the data (Bird, 2005). Transcripts were then checked against the audio files. The transcript analysis was guided by a 6-step theoretical thematic analysis outlined by Braun and Clarke (Braun and Clarke, 2006). Data interpretation was theory-driven, in the sense that the researcher was specifically attuned to participants' views on experiences of weight loss, obstacles, and support needs, as well as views on the new approach, FIT (Braun and Clarke, 2006). This



process consisted of the following steps: 1) transcribing data, reading repeatedly and noting down initial ideas; 2) coding as many themes as possible, systematically, across the entire data set; 3) searching for and ordering codes into potential themes; 4) checking and reviewing themes against their coded extracts and the complete data set; 5) developing clear definitions and names for each theme, while refining and defining subthemes and the overall narrative the data analysis provides; 6) final review of data analysis and data write-up.

To ease the coding and sorting of emerging themes and subthemes the primary researcher used several colour codes, stickers and shapes on a printed version of the original transcript, for the entire set of responses from all 6 the focus groups. A second researcher (JA) peer-reviewed the initial set of themes and subthemes. After agreeing the final set of themes, she then sampled the transcript and checked allocation of excerpts to subthemes. Discrepancies were resolved through discussion until agreement was reached.

3. Results

Eight main themes emerged from the transcripts, comprising 31 subthemes (see Table 1). The themes clustered into four categories: motivation, previous experiences with weight loss programmes and self-help, desired changes for support, and comments on FIT (Table 1). The following section illustrates these results using participant quotations, accompanied by a participant identification number. The duration of focus group interviews ranged from 60 to 90 min, with an average of 65 min.

Table 1
Major categories, themes and sub-themes reported by participants.

Categories	Themes	Sub-themes
Motivation	Initial motivation	Health and looks
	Staying motivated	Social Support
Previous experiences with weight loss programmes and self-help	Barriers	Good weather Attention on physique Using pictures Goal setting
		Inability to stay motivated Time and tiredness Slow results Limited knowledge and conflicting knowledge of nutrition No control over cravings Unwanted social influences
Desired changes for support	Advantages	Peer Support Apps provide 24/7 mobile access
	Limitations	Dislike of calorie counting Apps are too complex No personalisation and not relevant to user No long term support
Comments on FIT	App support	App features wish list Setting/reviewing goals
	Motivational features	Routine Not too many alarms Personalisation Having control Rewards Progress reports Competition Sharing
Comments on FIT	Acceptability	FIT's potential Gender difference I would imagine...

3.1. Motivation

3.1.1. Initial motivation

When asked if they were trying to manage their weight at present, participants across all groups predominantly mentioned they were motivated to lose weight, or to exercise, to become healthy and more attractive.

5A: *'Well I suppose... I am trying to lose weight for various reasons really...there is probably a bit of vanity involved. Cos I want to look better, who doesn't...it's become increasingly more about health, not just the way I look.'*

3.1.2. Staying motivated

Many participants described methods that helped them stay motivated.

Some found **Social Support** helpful:

1C: *'When I am back at home... my mother, she has turned into this kind of health fitness freak... She is my motivator. And I find when I am back in St. Albans I do more, I do a lot more exercise because she is there.'*

Mentions of social support consistently sparked discussion about following friends' fitness activities'. About half the participants said they found this inspired them:

3C: *'I look at like Instagram and Facebook and my friends are busy posting their activities and sometimes it's actually almost like: If they can run a half marathon maybe I can go to the gym?...I don't know if I want to share my own progress all the time, but I look to others for inspiration.'*

Four participants reported that **good weather** had a positive effect on their motivation. One participant said:

1C: *'Yeah. Nice weather. The weather is a massive key factor.'*

Another participant suggested that hotter climates might focus **attention on physique**:

4B: *'...Last time when I was in Australia the body image... seems so much more important over there...here it's very easy to cover up isn't it? And I think that perpetuates the fact that: I will just cover those wobbly bits and no one will see them...'*

Across all groups several participants found motivation by looking at **pictures** of themselves and others:

2C: *'It's so funny, in our flat we are all girls and we have currently printed of pictures of bikinis and we put our heads on it, so this is what we could look like and we put it on the fridge to remind us of eating well and going to spinning or whatever, so we look and feel good.'*

Participants frequently talked about using **goal setting** as a strategy for motivation. One participant mentioned:

3C: *'...like when you have a goal you do push harder to get there like. If I am like at 1000 steps I think: I want to do more and I even start walking around the house more in the day and break up periods of like sitting.'*

3.1.3. Barriers

Without exception groups spontaneously raised the issue of **motivation** when it came to weight management and admitted this was the biggest barrier to sustaining changes in diet and physical activity. Some described the issue as follows:

4C: *'... I am really bad with sticking at things. That's why I can't diet. I can't actually stick to a diet.'*

6F: *'...It's quite easy to lose the first bit of weight, but when you get passed that it becomes difficult...'*

2C: *'It's motivation isn't it? I find it easy to change my diet a bit and try new things from the internet, but to fall into an exercise routine and then follow it through for a long time, em, it is very hard to stay motivated.'*

Another subtheme relating to motivation was **time and tiredness** interfering, especially with the motivation to cook healthily and to exercise regularly:

4C: *'...eating properly is the hard thing to do on a shift... You don't have time really to stop and to have an actual meal...and when you get home you are so tired you don't want to then go and cook a meal.'*

Four participants said that **slow results** caused them to lose motivation:

3A: *'...I do start to go to the gym and this lasts for a few days and then I can't see any difference in myself and I just get impatient and the drive just goes.'*

Three participants described their **limited knowledge** of healthy nutrition and physical activity, which they found to be a barrier to getting started with adequate weight management. Even when participants felt they had some knowledge and interest in nutrition, they found the lack of scientific consensus in online nutrition and exercise advice confusing:

5A: *'It is very very very confusing because the sciences often contradict each-other for a start, so that's one area that needs to be looked at, to actually clarify facts and actually come to some sort of agreement, or more agreement.'*

Many participants stated they had **no control over food cravings** and felt helpless:

4A: *'I have no control. I can't eat [just] a bit of chocolate, if I see chocolate...'*

Although social support could be motivating, there were also instances of **unhelpful social influences**:

1B: *'I have no one to motivate me. My husband, if he could, would sit there all day in his chair, in front of the TV and that's it. So no, it's demotivating.'*

4A: *'No, they [my GP] just said: Well, you're the same weight you were ten years ago and they were kind of saying I wasn't overweight and I feel, yeah, they must be crazy...Cos I thought they were quite keen on getting people to lose weight and I clearly am overweight and they were just acting sort of like there wasn't anything wrong with me.'*

Although over half of participants highlighted the benefits of social media, other participants across groups described possible down sides to social media in regards to diet and exercise. Here is one example:

4A: *'I find it quite demotivating when you are not doing well...and everybody knows about it... But if you are doing well you feel great and might think: Hang on, I can share this and motivate others and I'd be happy to post it. But when it's kind of negative things, I found it was really frustrating.'*

3.2. Previous experiences with weight-loss programs

3.2.1. Advantages

Most participants had previous experience with weight management and had either enrolled in a comprehensive weight loss programme, such as 'Slimming World', or had used Web-based and app support to lose weight and become more active.

The benefits of **peer support** were highlighted by a number of participants:

4B: *'...I believe Weight Watchers come out quite well in this, there is an association with peer support... but also embarrassment when you are not succeeding.'*

Apps overall were viewed as helpful in terms of being portable, informative and giving users 24/7 access and support:

5A: *'...Apps are easy to use at anytime and anywhere and that's another way to do it.'*

Apps could also provide useful information:

4A: *'I did MyFitnessPal ... I've used it last year and found it very good. It basically scans things. So say if you are going to eat like yoghurt, you scan the barcode and it'll come up with what it is.'*

One participant mentioned that apps provide useful 'aftercare':

6D: *'...I mean I know that the Slimming World app for example doesn't stop you being part of the community once you have reached your goal, but you can continue to use it for the nutritional, like health information and ask questions and answer questions...'*

3.2.2. Limitations

The majority of participants in this study expressed a **dislike of calorie counting**, especially when required for weight loss app support:

2D: *'...it calculates it, like em, how many calories you have got left to use up in the day... It tells you how on track you are. But I really didn't like it cos I don't like counting.'*

Further, participants predominately said they disliked MyFitnessPal because of the focus on calorie counting:

Other participants described how they started obsessing about food/cal when using standard diet apps:

6F: *'I got a bit obsessive with calorie counting and I got to the point where I said: 'Oh no, I'd better not have milk in my tea; that's another 18 calories.' And it became far too, in my brain, almost a bit obsessive...and there was no enjoyment in anything that I ate because I was thinking about it per mouthful, per calorie.'*

There was consensus across groups that modern diet and exercise apps are **too complex**, sometimes malfunction and annoy users:

4A: *'... I used it only for four days now and I can't be dealing with it. It is too much input, too annoying and automatically goes to share on the social media and I want a choice and simple things, not over kill. They remind you constantly if you have not filled everything in for that day ...'*

2A: *'...With My Fitness Pal I deleted it because it was so complicated and had, em this narrow calorie counting focus.'*

A number of participants also raised the issue of **apps not being personal**.

2D: *'Yeah, in MyFitnessPal it asks you like, em what is your calorie goal, or like activity goal for this week and then it calculates it all for you based on, em all the input... it feels basically really not very personal or like it doesn't grab you...'*

Some participants expressed concern about the typical weight-re-gain people experience after having slimmed down with the help of a weight-loss program. In the following example one participant talks about their friends' struggle with the **lack of long-term support**:

6F: *'I've got friends that go to Slimming World and Weight Watchers and all they seem to do now is get weighed each week and...once they get near to where they want to be the weight goes back on.'*

3.3. Desired changes for support

3.3.1. App support

When participants talked about what type of support they would like to help them make changes to their diet or exercise behaviours, they frequently proposed **app support and suggested potentially helpful app features**:

4A: *'I would use alarms on my phone probably. Or even if there could be a very simple, easy to run app?'*

Participant 6C, who had previous experience with FIT, suspected that app support would have helped her stay on track with FIT:

6C: *'...I want to pick it up again... if I had had something to remind me, like the app, I would have continued because it just went out of my mind...'*

Those participants who had poorer knowledge of nutrition and exercise wished for a link to nutrition and exercise info to be added to weight loss and exercise apps:

3A: *'It's like everywhere you look, tells you different information. So, if you had it all in one place and you'd stick to that...So a link for meal planning and how to be more active would be very important to people like I.'*

3.3.2. Motivational features

The majority of participants suggested motivational features they wished to have included on a weight loss support app, such as a space to input and **review ones' goals**:

2D: *'So if I could review and set goals like on that app here or even the imagery app. It would like encourage me I think.'*

A number of participants expressed the desire for getting into a **routine** with making changes to their lifestyle:

1C: *'... I think what I would like to do actually is get into some sort of routine. Like, I know it will be hard the first two or three weeks, but then it em will get easier...'*

Even though participants would appreciate a routine with set times to exercise or pay special attention to their diet, they unanimously warned us they would not appreciate **too many reminders from apps**:

1C: *'...too many alarms are definitely not good, maybe a snooze function would work, kind of that I can press when I happen to be busy...that would really work for me. I would really kind of start now.'*

Participants wished to choose their own alarm/reminder times, relating to their diet and activity goals:

2C: *'It would be best to set reminders on the phone or apps ourselves. It would have to be my own schedule...'*

Many participants that were using pictures in one way or another to motivate themselves suggested further **personalisation** via photo attachments on apps:

2D: *'...And then maybe I would use a picture of my running shoes to remind me of those goals...'*

The advantages of personal photos often emerged from participants discussing how they routinely ignored generic reminders, set by them or generated by weight loss or exercise apps:

1B: *'I just always switched the reminder alarms of, maybe because I had no picture attached that meant anything to me.'*

A number of participants said they would like to be able to upload music to apps, songs that motivate them and that are connected to their physical activity ideas:

6A: *'uploading motivational music I think it is something that could help me...'*

Over all it appeared that participants wished to **have control** over how they would utilise lifestyle apps:

4C: *'I think it's nice when you are controlling like all of it...'*

In regards to **rewards on apps**, participants generally felt such a feature should be included. Some suggested motivational messages or little badges:

6A: *'I think even something simple like a gold star with a little message like: You have come so far, don't give up now. Or something you know like that. It doesn't have to be anything major.'*

Others requested something along the lines of an 'I did it button' and doubted that impersonal badges could be useful:

5B: *'...it is more for myself in my case, my motivation and I think that something like that would be good to have. I don't think just a badge on a screen is going to motivate a lot of people...'*

Several participants suggested the inclusion of a **progress report** pages to help them visualise their efforts more effectively:

4C: *'...maybe you can add a progress page also...'*

A few participants raised the issue of purely virtual rewards not being enough to motivate people and suggested 'real world' rewards instead.

5C: *'I think it'd be great to earn coins over time that eventually could make up vouchers.'*

A small number of participants said they would like to **compete against others** within an app community to keep them interested:

1A: *'Oh, I would love to win everything, for me it would be very motivating...'*

There were mixed views on the benefits of competition within an app community:

5A: *'If you are one of these people who become discouraged easily it doesn't help. It works for me.'*

Although the majority of participants in this study had announced they used social media for inspiration on weight management, some of them felt it was best to **share progress** and follow others only within a closed app community:

6F: *'I don't think I would share on the social media, but within the app community I think it is important to like inspire and be motivated by others.'*

A few participants spoke out strongly against an option to share from weight loss support apps to social media:

6E: *'...Social media is taking over your life. And do we need another app that does that? Really?'*

However, others agreed there should be an option of being able to share within a closed community and social media if they felt like it:

6D: *'I think it should be a choice added to your app, a box you can tick or something.'*

3.4. Comments on FIT

3.4.1. Acceptability

After a brief introduction to FIT, participants had a chance to express their understanding of FIT. Participants frequently mentioned **FIT's potential** to change peoples' thinking.

4A: *'Yeah, I mean what you are doing is more of a lifestyle thing isn't it? .This FIT training is more like changing your mind-set and teaching you to think differently about food and exercise.'*

All, but one participant expressed confidence that FIT could help them improve weight management:

1B: *'I think it looks great and it might just be the kick up the bum from this FIT app that we need.'*

In one group two participants discussed potential **gender differences** in terms of FIT acceptability and concluded:

6E: *'I think all guys use some level of imagery to be honest. Maybe we won't admit it cos we also might get motivated in other ways...So with the FIT app, it looks great for both genders, so why not?!'*

Participants were always asked what **they would imagine** if they were to use FIT. Here is one example:

2B: *'Yes, so what I would do is imagine myself as a very good dancer, nice and fit and light on my feet...'*

Another two participants addressed the issue of feeling confident in one's own body and how they would use functional imagery to potentially help them achieve this goal:

2A: *'I used to be really self-conscious when I was younger and I had a weight problem...even now I don't really like wearing swim suits amongst other things and I am still a bit self-conscious. So if I could use imagery to help that it would really be a good step for me: To imagine myself confident in my bikini on the beach.'*

One participant thought positive imagery would not work for him, suspecting a negative version of FIT might be more useful to him:

1A: *'No, I think the only motivational imagery that would work for me, might be a negative... blocked arteries...and people dying of a heart attack and so on with a pasty in their hand...with the imagery in an app, even if it was simple, I would still not find that motivating enough if it was only positive imagery related to my activities...'*

3.4.2. FIT APP support

One participant had received FIT as part of a previous study and suggested an app would be a useful component:

6C: *'I stopped... it's a bit more chaotic at home and I fell out of the habit...I have not put as much weight on as I lost... I lost quite a bit of weight actually during the study...I was really surprised because it was over a short period as well, only three weeks...I want to pick it up again... if I had had something to remind me, like the app, I would have continued because it just went out of my mind...'*

Participants welcomed the neutral design and simplicity of the FIT app example slides:

4A: *'It has very neutral colour, a very em neutral screen. Like I said please keep it simple otherwise you will lose people and the slides look really easy to handle.'*

Many participants welcomed the inclusion of a mini FIT audio session on the app, to guide them as needed.

1B: *'Oh yes that is good because imagery is still difficult I find at times and this way I suppose I can go over how to do it again if I need to.'*

4. Discussion

Focus group participants who were currently trying to self-manage their weight found that staying motivated was the hardest part. Some

reasons given were similar to those identified in previous research, for example lack of time and energy and controlling cravings (Sharifi et al., 2013; Welsh et al., 2013), but there was a sense that these issues, and also slow results and boredom, made it harder to stay motivated during a weight loss attempt than to get motivated to start one. There was an underlying assumption that participants were tackling this on their own – there was rarely any mention of health care professionals' involvement once weight loss had begun – and would like more support when motivation was waning.

Participants spontaneously mentioned that apps could potentially provide this support by helping them set goals and gain encouragement from other people, features that are known to be effective (NICE, 2006; Pagoto et al., 2013) and that are included in some currently available apps (Bardus et al., 2016). They had tried a variety of diet and physical activity apps and voiced frustration with their focus on calorie counting and exercise monitoring. Self-monitoring can be useful at the start of a behaviour change attempt (Steinberg et al., 2013) but our participants found that continual self-monitoring sapped rather than strengthened their motivation. In concordance with their desire for trustworthy information, Breton (Breton et al., 2011) analysed publicly available apps and found that they largely provided advice and monitoring, but could have done much more to build on evidence-based recommendations for exercise and dietary change (e.g., supporting portion control, regular weighing, drinking water instead of sweetened drinks). As an intervention, provision of lifestyle advice on its own is ineffective when delivered through primary care services, so it is unlikely that simply providing it via apps will be very effective (Booth et al., 2015; Laws, 2004).

The reported difficulty with maintaining motivation in our study is consistent with qualitative studies with overweight individuals in other populations wishing to lose weight (Sabinsky et al., 2007; Young et al., 2010) and with the success of motivational interviewing for weight loss and encouraging physical activity (Armstrong et al., 2011; Franz et al., 2007; Jackson et al., 2011; Mulgrew et al., 2016). Although recent studies using online delivery of motivational interviewing in primary care settings have demonstrated encouraging results (Jackson et al., 2011), our participants made it clear that they wanted ongoing support rather than a one-off intervention. They criticised commercial weight-loss programmes such as 'Slimming World' or 'Weight Watchers' for providing continued access to online information on healthy eating or exercise regimes but not continued motivational support, leading to weight regain after completing the programme. Their experiences mirror the report by Fothergill et al. (2016) that all but one of the contestants on a major televised weight loss competition that led to massive amounts of body fat loss had regained weight six years later.

Most participants spontaneously used some strategies to motivate themselves to make healthier eating or physical activity choices, and had ideas for how apps could better support these strategies, for example by facilitating social support, as also recommended by Breton et al. (2011). The option for a share function to be added to motivational mobile support was voiced numerous times, and specifically the option of sharing within a closed community of individuals in similar positions to themselves. Fear of negative attention was also expressed by participants in previous studies of physical activity apps, who preferred to share to a closed group/app community or not at all (Newman et al., 2011; Price, 2013). (Munson and Consolvo, 2012b) found that participants given the option to share their physical activity progress with other app users, via step counts and messages, were more likely to achieve their daily physical activity goals than those who could not share.

Slow results made it hard to stay motivated and participants noted the potential of apps to sustain motivation by providing rewards and encouraging messages. Opinions varied on the benefits of different types of rewards. Icons and badges (widely used in mobile applications) were felt by some participants to be positive and reinforcing but others

felt they had no place when the goal was to become healthier, not to collect badges. Likewise, (Munson and Consolvo, 2012a) found the majority of their participants liked being presented with virtual trophies when they achieved certain activity goals; other participants reported it had no influence on their initial motivation. Some participants in the current study desired more tangible rewards, such as money or vouchers. However, a systematic review by (Paul-Ebhohimhen and Avenell, 2008), found no effect of financial incentives on weight loss or maintenance at 12 and 18 months of financial incentive weight-loss interventions. Rewards can be counterproductive, undermining intrinsic motivation to engage in behaviours because they are personally rewarding/enjoyable, or lead to personally valued goals (for a systematic review see: (Ryan and Deci, 2000)).

Participants wanted apps to be very simple and customizable to their own goals and timescales. They wanted apps that could help them set and review goals – an important component of successful behaviour change interventions (Michie et al., 2009; NICE, 2006) – and which could help them get into healthy routines through reminders and alarms. It was important that these reminders were under the user's control. Participants viewed generic goal reminders, generated by apps at times that were not set by users, as pushy and annoying. Prestwich et al. (2009) directly compared personalised text message reminders to exercise with general or no reminders; only the personalised messages increased exercise levels. Some participants wanted to personalise apps with their own music. Hallett et al. (2016) found comparable effectiveness of a self-chosen pre-exercise piece of music and implementation intentions, in meeting exercise targets.

Other participants wanted to upload personal photos, consistent with their spontaneous use of pictures to boost motivation. According to Elaborated Intrusion theory (Kavanagh et al., 2005), mental imagery supports motivation by emulating the rewarding feeling of achieving one's goals. Physical pictures or photos can help trigger motivating mental imagery, but this imagery can also demotivate if the goal is mentally detached from a clear path for achieving it (Oettingen et al., 2010). Functional Imagery Training (Andrade et al., 2016) uses short interview sessions to set and build desire for specific, achievable sub-goals by training participants to imagine positive changes that might happen very soon (for example, how their skin will glow after exercising today, or how well they will sleep tonight), to imagine the specific actions they will take to achieve sub-goals, and to identify and imagine using techniques that have worked for them in the past when they have needed to use 'willpower' (Andrade et al., 2016). After a short introduction to FIT, all but one participant felt confident that proximal goal-directed imagery would be a valuable skill they could use to help them sustain motivation. One summarised it as a way of "changing your mind-set". They welcomed the simplicity of the FIT app and the guided imagery audio that would support their practice.

A limitation of this study is that we did not ask participants systematically about their past experiences. This was a deliberate strategy as we wanted to explore the sum of people's experiences and the issues that bore most strongly on their current experience of weight management. In terms of evaluating the FIT app, an important limitation is that we did not give participants a chance to try out the app because it was still under development, so their responses were based on screenshots rather than actual use. We also did not want to prejudice their discussion of app support in general. The FIT app is now being included in trials of FIT but evaluation of its usability and engagement using the MARS scale (Bardus et al., 2016; Stoyanov et al., 2015) is a topic for future research.

In conclusion, participants who were trying to self-manage their weight found that staying motivated was the hardest part. They wanted apps that gave them control and encouragement. Future apps could support motivation more effectively by using photos and reminders tailored to individuals' personal goals, giving progress reports and help with setting new goals when earlier ones have been achieved, and providing access to social support from other app users. These

developments are already technologically possible, are supported by evidence on behaviour change interventions (Andrade et al., 2016; Michie et al., 2009, 2011; NICE, 2006), and would satisfy people's desire to self-manage their weight with motivational support available whenever they need it.

Conflict of interests

The authors declare that there is no conflict of interest.

Acknowledgement

This research was funded as part of NIHR CLAHRC Southwest Peninsula (PenCLAHRC) studentship.

References

- Andrade, J., Khalil, M., Dickson, J., May, J., Kavanagh, D.J., 2016. Functional imagery training to reduce snacking: testing a novel motivational intervention based on elaborated intrusion theory. *Appetite* 100:256–262. <http://dx.doi.org/10.1016/j.appet.2016.02.015>.
- Armstrong, M.J., Mottershead, T.a., Ronksley, P.E., Sigal, R.J., Campbell, T.S., Hemmelgarn, B.R., 2011. Motivational interviewing to improve weight loss in overweight and/or obese patients: a systematic review and meta-analysis of randomized controlled trials. *Obes. Rev.* 12 (4):709–723. <http://dx.doi.org/10.1111/j.1467-789X.2011.00892.x>.
- Azar, K.M.J., Lesser, L.I., Laing, B.Y., Stephens, J., Aurora, M.S., Burke, L.E., Palaniappan, L.P., 2013. Mobile applications for weight management. *Am. J. Prev. Med.* 45 (5):583–589. <http://dx.doi.org/10.1016/j.amepre.2013.07.005>.
- Baddeley, A.D., Andrade, J., 2000. Working memory and the vividness of imagery. *J. Exp. Psychol. Gen.* 129 (1):126–145. <http://dx.doi.org/10.1037/0096-3445.129.1.126>.
- Bardus, M., van Beurden, S.B., Smith, J.R., Abraham, C., 2016. A review and content analysis of engagement, functionality, aesthetics, information quality, and change techniques in the most popular commercial apps for weight management. *Int. J. Behav. Nutr. Phys. Act.* 13 (1):35. <http://dx.doi.org/10.1186/s12966-016-0359-9>.
- Bessesen, D.H., 2006. Systematic review: an evaluation of major commercial weight loss programs in the United States. *Yearbook of Endocrinology*, 2006:pp. 153–157 [http://dx.doi.org/10.1016/S0084-3741\(08\)70338-X](http://dx.doi.org/10.1016/S0084-3741(08)70338-X).
- Bird, C.M., 2005. How i stopped dreading and learned to love transcription. *Qual. Inq.* 11 (2):226–248. <http://dx.doi.org/10.1177/1077800404273413>.
- Booth, H.P., Prevost, A.T., Gulliford, M.C., 2015. Access to weight reduction interventions for overweight and obese patients in UK primary care: population-based cohort study. *BMJ Open* 5 (1), e006642. <http://dx.doi.org/10.1136/bmjopen-2014-006642>.
- Braun, V., Clarke, V., 2006. Using thematic analysis in psychology. *Qual. Res. Psychol.* 3 (May 2015):77–101. <http://dx.doi.org/10.1191/1478088706qp0630a>.
- Breton, E.R., Fuemmeler, B.F., Abrams, L.C., 2011. Weight loss—there is an app for that! But does it adhere to evidence-informed practices? *Transl. Behav. Med.* 1:523–529. <http://dx.doi.org/10.1007/s13142-011-0076-5>.
- Burke, L.E., Steenkiste, A., Music, E., Styn, M.A., 2008. A descriptive study of past experiences with weight-loss treatment. *J. Am. Diet. Assoc.* 108 (4):640–647. <http://dx.doi.org/10.1016/j.jada.2008.01.012>.
- Centre for Public Health Excellence at NICE (UK and National Collaborating Centre for Primary Care (UK). (2006). *Obesity: the prevention, identification, assessment and management of overweight and obesity in adults and children*.
- Deloitte, 2014. *Global human capital trends 2014. Engaging the 21st century workforce* (Retrieved from <http://www2.deloitte.com/sa/en/pages/human-capital/articles/human-capital-trends-2014.html>).
- Eastwood, P., 2013. *Statistics on Obesity, Physical Activity and Diet. Health and Social Care Information Centre. Lifestyles Statistics 2*, pp. 15–35 (<http://doi.org/978-1-84636-274-3>).
- Elfhag, K., Rössner, S., Rossner, S., Wu, T., Gao, X., Chen, M., ... Rössner, S., 2005. Who succeeds in maintaining weight loss? A conceptual review of factors associated with weight loss maintenance and weight regain. *Obes. Rev.* 6 (1):67–85. <http://dx.doi.org/10.1111/j.1467-789X.2005.00170.x>.
- Encinosa, W.E., Bernard, D.M., Steiner, C.A., Chen, C.-C., 2005. Use and costs of bariatric surgery and prescription weight-loss medications. *Health Aff.* 24 (4):1039–1046. <http://dx.doi.org/10.1377/hlthaff.24.4.1039>.
- Encinosa, W.E., Bernard, D.M., Steiner, C.A., Chen, C.C., Treadwell, J.R., Sun, F., ... Fallis, A., 2013. Systematic review and meta-analysis of bariatric surgery for pediatric obesity. *J. Chem. Inf. Model.* 35 (4):259–269. <http://dx.doi.org/10.1017/CB09781107415324.004>.
- Fjeldsoe, B.S., Marshall, A.L., Miller, Y.D., 2009. Behavior change interventions delivered by mobile telephone short-message service. *Am. J. Prev. Med.* 36 (2):165–173. <http://dx.doi.org/10.1016/j.amepre.2008.09.040>.
- Fothergill, E., Guo, J., Howard, L., Kerns, J.C., Knuth, N.D., Brychta, R., ... Hall, K.D., 2016. Persistent metabolic adaptation 6 years after “The Biggest Loser” competition. *Obesity* <http://dx.doi.org/10.1002/oby.21538> (0(0)), n/a–n/a).
- Franz, M.J., VanWormer, J.J., Crain, A.L., Boucher, J.L., Histon, T., Caplan, W., ... Pronk, N.P., 2007. Weight-loss outcomes: a systematic review and meta-analysis of weight-loss clinical trials with a minimum 1-year follow-up. *J. Am. Diet. Assoc.* 107 (10):1755–1767. <http://dx.doi.org/10.1016/j.jada.2007.07.017>.
- Hallett, R., Wing, R.G., Health, F., 2016. Evaluation of a Motivational Pre-exercise Music Intervention, 1–25. <http://dx.doi.org/10.1177/1359105316674267>.
- Heshka, S., Anderson, J.W., Atkinson, R.L., Greenway, F.L., Hill, J.O., Phinney, S.D., Miller-kovach, K., 2003. *Weight loss with self-help compared.* 289 (14).
- Jackson, R.a., Stotland, N.E., Caughey, Aarbrug, J., Oenema, A., Ferreira, I.B., Gerbert, B., 2011. Improving diet and exercise in pregnancy with video doctor counseling: a randomized trial. *Patient Educ. Couns.* 83 (2):203–209. <http://dx.doi.org/10.1016/j.pec.2010.05.019>.
- Kavanagh, D.J., Andrade, J., May, J., 2004. Beating the urge: implications of research into substance-related desires. *Addict. Behav.* 29:1359–1372. <http://dx.doi.org/10.1016/j.addbeh.2004.06.009>.
- Kavanagh, D.J., Andrade, J., May, J., 2005. *Troilus & Cressida*. pp. 446–467.
- Kemps, E., Tiggemann, M., 2007. Modality-specific imagery reduces cravings for food: an application of the elaborated intrusion theory of desire to food craving. *J. Exp. Psychol. Appl.* 13 (2):95–104. <http://dx.doi.org/10.1037/1076-898X.13.2.95>.
- Kemps, E., Tiggemann, M., 2015. A role for mental imagery in the experience and reduction of food cravings. *Front. Psych.* 6 (JAN):1–4. <http://dx.doi.org/10.3389/fpsy.2014.00193>.
- Laws, R., 2004. Current approaches to obesity management in UK primary care: the counterweight programme. *J. Hum. Nutr. Diet.* 17 (3):183–190. <http://dx.doi.org/10.1111/j.1365-277X.2004.00528.x>.
- Levine, D.M., Savarimuthu, S., Squires, A., Nicholson, J., Jay, M., 2014. Technology-assisted weight loss interventions in primary care: a systematic review. *J. Gen. Intern. Med.* 32–34 <http://dx.doi.org/10.1007/s11606-014-2987-6>.
- May, J., Andrade, J., Kavanagh, D., Penfound, L., 2008. Imagery and strength of craving for eating, drinking, and playing sport. *Cognit. Emot.* 22 (4):633–650. <http://dx.doi.org/10.1080/02699930701446296>.
- May, J., Andrade, J., Panabokke, N., Kavanagh, D., 2010. *Visuospatial tasks suppress craving for cigarettes.* *Behav. Res. Ther.* 48, 476–485.
- May, J., Kavanagh, D.J., Andrade, J., 2014. Addictive behaviors the elaborated intrusion theory of desire: a 10-year retrospective and implications for addiction treatments. *Addict. Behav.* 44 (2014):29–34. <http://dx.doi.org/10.1016/j.addbeh.2014.09.016>.
- Metzgar, C.J., Preston, A.G., Miller, D.L., Nickols-Richardson, S.M., Ziebland, S., Thorogood, M., ... Harrison, C., 2014. Facilitators and barriers to weight loss and weight loss maintenance: a qualitative exploration. *PLoS One* 46 (4). <http://dx.doi.org/10.1111/jhn.12273> (n/a–n/a).
- Michie, S., Abraham, C., Whittington, C., McAteer, J., Gupta, S., 2009. Effective techniques in healthy eating and physical activity interventions: a meta-regression. *Health Psychol.* 28 (6):690–701. <http://dx.doi.org/10.1037/a0016136>.
- Michie, S., Abraham, C., Eccles, M.P., Francis, J.J., Hardeman, W., Johnston, M., 2011. Strengthening evaluation and implementation by specifying components of behaviour change interventions: a study protocol. *Implement. Sci.* 6 (1):10. <http://dx.doi.org/10.1186/1748-5908-6-10>.
- Mulgrew, K.E., Kannis-Dymland, L., Hughes, E., Carter, J.D., Kaye, S., 2016. Psychological factors associated with the use of weight management behaviours in young adults. *J. Health Psychol.* <http://dx.doi.org/10.1177/1359105316675210>.
- Munson, S.A., Consolvo, S., 2012a. *and Sharing to Motivate Physical Activity. 6th International Conference on Pervasive Computing Technologies for Healthcare (PervasiveHealth)*, pp. 25–32 (<http://doi.org/978-1-4673-1483-1>).
- Munson, S., Consolvo, S., 2012b. Exploring goal-setting, rewards, self-monitoring, and sharing to motivate physical activity. *International Conference on Pervasive Computing Technologies for Healthcare:pp.* 25–32 <http://dx.doi.org/10.4108/icst.pervasivehealth.2012.248691>.
- Newman, M.W., Lauterbach, D., Munson, S.A., Resnick, P., Morris, M.E., 2011. It's not that i don't have problems, i'm just not putting them on facebook. *Proceedings of the ACM 2011 Conference on Computer Supported Cooperative Work - CSCW '11*: p. 341 <http://dx.doi.org/10.1145/1958824.1958876>.
- Oettingen, G., Mayer, D., Thorpe, J., 2010. Self-regulation of commitment to reduce cigarette consumption: Mental contrasting of future with reality. *Psychol. Health* 25 (8):961–977. <http://dx.doi.org/10.1080/08870440903079448>.
- Pagoto, S., Schneider, K., Jojic, M., Debiase, M., Mann, D., 2013. Evidence-based strategies in weight-loss mobile apps. *Am. J. Prev. Med.* 45 (5):576–582. <http://dx.doi.org/10.1016/j.amepre.2013.04.025>.
- Patrick, K., Raab, F., Adams, M.A., Dillon, L., Zabinski, M., Rock, C.L., ... Norman, G.J., 2009. A text message-based intervention for weight loss: randomized controlled trial. *J. Med. Internet Res.* 11 (1), e1. <http://dx.doi.org/10.2196/jmir.1100>.
- Paul-Ebhohimhen, V., Avenell, A., 2008. *Systematic review of the use of financial incentives in treatments for obesity and overweight.* *Obes. Rev.* 9 (4), 355–367.
- Picot, J., Jones, J., Colquitt, J., Gospodarevskaya, E., Loveman, E., Baxter, L., Clegg, A., 2009. The clinical effectiveness and cost-effectiveness of bariatric (weight loss) surgery for obesity: a systematic review and economic evaluation. *Health Technol. Assess.* 13 (41). <http://dx.doi.org/10.3310/hta13410>.
- Prestwich, A., Perugini, M., Hurling, R., 2009. Can the effects of implementation intentions on exercise be enhanced using text messages? *Psychol. Health* 24 (6):677–687. <http://dx.doi.org/10.1080/08870440802040715>.
- Price, C., 2013. Outcomes in a program that offers financial rewards for weight loss. *John. J. Chem. Inf. Model.* 53 (9):1689–1699. <http://dx.doi.org/10.1017/CB09781107415324.004>.
- Ruelaz, A.R., Diefenbach, P., Simon, B., Lanto, A., Arterburn, D., Shekelle, P.G., 2007. Perceived barriers to weight management in primary care—perspectives of patients and providers. *J. Gen. Intern. Med.* 22 (4):518–522. <http://dx.doi.org/10.1007/s11606-007-0125-4>.
- Ryan, R., Deci, E., 2000. Intrinsic and extrinsic motivations: classic definitions and new directions. *Contemp. Educ. Psychol.* 25 (1):54–67. <http://dx.doi.org/10.1006/ceps.1999.1020>.
- Sabinsky, M.S., Toft, U., Raben, A., Holm, L., 2007. Overweight men's motivations and perceived barriers towards weight loss. *Eur. J. Clin. Nutr.* 61 (4):526–531. <http://dx.doi.org/10.1038/sj.ejcn.1602537>.

- Sharifi, N., Mahdavi, R., Ebrahimi-Mameghani, M., 2013. Perceived barriers to weight loss programs for overweight or obese women. *Health Promot. Perspect.* 3 (1):11–22. <http://dx.doi.org/10.5681/hpp.2013.002>.
- Silva, M.N., Markland, D., Carraça, E.V., Vieira, P.N., Coutinho, S.R., Minderico, C.S., ... Teixeira, P.J., 2011. Exercise autonomous motivation predicts 3-yr weight loss in women. *Med. Sci. Sports Exerc.* 43 (4):728–737. <http://dx.doi.org/10.1249/MSS.0b013e3181f3818f>.
- Steinberg, D.M., Tate, D.F., Bennett, G.G., Ennett, S., Samuel-Hodge, C., Ward, D.S., 2013. The efficacy of a daily self-weighing weight loss intervention using smart scales and e-mail. *Obesity* 21 (9):1789–1797. <http://dx.doi.org/10.1002/oby.20396>.
- Stoyanov, S.R., Hides, L., Kavanagh, D.J., Zelenko, O., Tjondronegoro, D., Mani, M., 2015. Mobile app rating scale: a new tool for assessing the quality of health mobile apps. *JMIR Mhealth Uhealth* 3 (1), e27. <http://dx.doi.org/10.2196/mhealth.3422>.
- Tan, D., Zwar, N.A., Dennis, S.M., Vagholkar, S., 2005. *Weight management in general practice: what do patients want?* *General Practice - Clinical Practice*, pp. 73–75.
- Tang, J., Abraham, C., Stamp, E., Greaves, C., 2015. How can weight-loss app designers' best engage and support users? A qualitative investigation. *Br. J. Health Psychol.* 20 (1):151–171. <http://dx.doi.org/10.1111/bjhp.12114>.
- Teixeira, P.J., Going, S.B., Houtkooper, L.B., Cussler, E.C., Metcalfe, L.L., Blew, R.M., ... Lohman, T.G., 2004. Pretreatment predictors of attrition and successful weight management in women. *Int. J. Obes. Relat. Metab. Disord.* 28 (9):1124–1133. <http://dx.doi.org/10.1038/sj.ijo.0802727>.
- Turner-McGrievy, G.M., Beets, M.W., Moore, J.B., Kaczynski, A.T., Barr-Anderson, D.J., Tate, D.F., 2013. Comparison of traditional versus mobile app self-monitoring of physical activity and dietary intake among overweight adults participating in an mHealth weight loss program. *J. Am. Med. Inform. Assoc.* 20 (3):513–518. <http://dx.doi.org/10.1136/amiajnl-2012-001510>.
- Webber, K.H., Tate, D.F., Ward, D.S., Bowling, J.M., 2010. Motivation and its relationship to adherence to self-monitoring and weight loss in a 16-week internet behavioral weight loss intervention. *J. Nutr. Educ. Behav.* 42 (3):161–167. <http://dx.doi.org/10.1016/j.jneb.2009.03.001>.
- Welsh, E.M., Jeffery, R.W., Levy, R.L., Langer, S.L., Flood, A.P., Jaeb, M.A., Laqua, P.S., 2013. NIH Public Access 44(6):pp. 507–512. <http://dx.doi.org/10.1016/j.jneb.2010.06.005>. *Measuring*.
- Young, D.R., Gittelsohn, J., Charleston, J., Felix-Aaron, K., Appel, L.J., 2010. Motivations for exercise and weight loss among African-American women: focus group results and their contribution towards program development. *Ethn. Health* 6 (February 2010): 227–245. <http://dx.doi.org/10.1080/13557850120078143>.