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Theory in Practice: Identifying theory-based techniques in health coaches' tailored feedback during a weight loss intervention

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Theory in Practice: Identifying theory-based techniques in health coaches' tailored feedback during a weight loss intervention

Abstract

Objective: A taxonomy of ninety-three functionally different behaviour change techniques (BCTs) has been identified. However, it is not fully clear how these and other theory-based techniques are applied in the day-to-day practice of people delivering health behaviour change interventions. This study examines feedback provided by expert health coaches in a behavioural weight-loss intervention, to describe; a) what theory-based techniques are used in sessions, b) which techniques are used most frequently, c) what occurs in sessions, beyond existing theory-based techniques.

Main Outcome Measures: Theory-based techniques (BCTs/tailoring strategies); relational/content-based techniques

Design: 10 tailored feedback videos from two health coaches were coded using a hybrid thematic analysis approach. Theory-based techniques were coded deductively; content not matching definitions of theory-based techniques but that addressed a determinant of behaviour change were coded inductively and relational codes were connected into themes.

Results: Seventeen BCTs were coded *M*=20.88 times (range:1-109). Eight tailoring techniques were coded *M*=25.25 times (range:1-91). Relational themes included; 'Autonomous interpersonal coaching style,' 'Supportive accountability,' and 'Coach as expert'. Additional behavioural techniques were also identified.

Conclusion: This work highlights what and how theory-based techniques are implemented in a weight-loss intervention, drawing attention to the role of tailoring techniques and health coaches in supporting behaviour change.

Keywords: health behaviour change; tailoring; behaviour change techniques (BCTs); human support; health coaches; implementation; weight loss; behaviour change theory

Introduction

Many population health challenges can be addressed through supporting health behaviour change (e.g. promoting healthy diet, promoting physical activity) among those who are at risk of, or have already developed, chronic or acute illness (Michie, Fixsen,

Grimshaw, & Eccles, 2009). In the interest of public health, it is vital to design and deliver effective behaviour change interventions (Elwell, Powell, Wordsworth, & Cummins, 2014). However, behaviour change interventions are complex and contain many interacting components, and it is often difficult to understand which component of reported interventions lead to observed behavioural change outcomes (Michie et al., 2013). Thus, researchers have identified and described the individual 'active' components of behavioural interventions, establishing a 'behaviour change technique' (BCT) taxonomy (Michie et al., 2013).

The BCT taxonomy (v1) includes detailed definitions of 93 behaviour change techniques, grouped within 16 categories. BCTs are "an observable, replicable, and irreducible component of an intervention designed to alter or redirect causal processes that regulate behaviour" (Michie et al., 2013, p. 23) (see Appendix A), are proposed to be the 'active ingredient' in a behavioural intervention. The BCT taxonomy is currently used *prospectively*, where BCTs can be used as components in the design and development of interventions, as well as *retrospectively*, to explicate the implicit theories that form the basis for intervention (Little, Presseau, & Eccles, 2015). These efforts help link key theoretical components (BCTs) with specific health outcomes. Tate et al., (2016) has contended that deconstructing complex interventions into their component parts is a new frontier in behavioural research. Other researchers have endeavoured to ascertain how and when BCTs are used, for example: eHealth physical activity interventions for people with cardiovascular disease (Duff et al., 2017) and implementation interventions for managing Diabetes (Presseau et al., 2015).

Deconstructing weight loss interventions

In the context of weight loss, Hartmann-Boyce et al., (2014) conducted a systematic review and meta-analysis to assess how behavioural techniques and programme delivery

characteristics influence mean weight loss. They found that calorie counting, contact with a dietitian and use of BCTs that compare participants' behaviour with others were associated with greater weight loss (Hartmann-Boyce et al., 2014). They identified behaviour change techniques using the CALO-RE taxonomy (Michie et al., 2011a), a predecessor to the BCTT-v1, including: goal setting and review of goals, action planning, barrier identification and/or problem solving, graded tasks, self-monitoring of behaviour, feedback on performance, instruction on how to perform behaviour and planning social support and/or social change.

Similarly to weight loss, in a review and content analysis of weight management apps, goal-setting and self-monitoring were most frequently identified techniques (Bardus, van Beurden, Smith, & Abraham, 2016). The authors analysed 23 apps from GooglePlay and iTunes and, using previous taxonomies (Abraham & Michie, 2008; Michie et al., 2011a), identified an average of 10 techniques per app (range: 1–17). In a related study, the quality of 28 of the most popular smartphone apps for weight management was assessed, including for the incorporation of BCTs (Chen, Cade, & Allman-Farinelli, 2015). The authors found fewer BCTs in the apps than Bardus and colleagues, with an average of 6.3 (*SD*= 3.7). Self-monitoring was common to all apps, and feedback on performance was present in the majority of apps (86%). A more recent study downloaded and used 30 free health and lifestyle apps for physical activity, diet, and sleep from GooglePlay and AppStore. App features were coded using the BCTT-v1 finding 9/93 BCTs (range 1-20) were present across the apps, with goal setting and feedback being most common (Antezana et al., 2018).

The need for clear specification of theoretical components

Collectively, this work accrues evidence for determining what techniques are linked to health outcomes, and is imperative in building an understanding of effective approaches to behaviour change (Tate et al., 2016). However, the above reviews were conducted through a

process of identifying BCTs from written descriptions of interventions or inspection of mobile applications, which may not reflect the direct content of an intervention as it is implemented with participants. Analysis of the written descriptions relies on accurate and reliable reporting to establish what BCTs are there, yet the quality of written descriptions varies (Johnston et al., 2018) and reporting of behavioural interventions often lacks sufficient detail to discern exactly which BCTs were included and how they were offered (Moller et al., 2017). Even interventions that aim to produce a specific behavioural outcome (e.g. weight loss) through seemingly comparable programmes (i.e., judging by written intervention descriptions) have varying results in terms of weight loss which can be attributed to disparities in reporting quality (Hartmann-Boyce et al., 2014). This indicates a need for better specification of BCTs and underlying theory-based mechanisms in both traditional and digital behavioural health interventions. Having a clear insight into the techniques being implemented in practice helps to identify the precise elements of an intervention which contribute to its overall effectiveness (Harrington & Noar, 2012; Hartmann-Boyce, Johns, Jebb, Aveyard, & Group, 2014; Michie & Abraham, 2004; Nilsen, 2015). There are other advantages of explicit specification of theoretical techniques, including aiding the subsequent implementation of the intervention and promoting replication efforts in research.

Additionally, clearer understanding of the use and number of BCTs can support the dissemination of the evidence-base for best-practice among health professionals supporting behaviour change efforts (Bauer, Damschroder, Hagedorn, Smith, & Kilbourne, 2015). Some research suggests that a greater efficacy of internet based interventions when more BCTs are included (Webb, Joseph, Yardley, & Michie, 2010), yet a meta-regression of behavioural obesity interventions suggested that greater numbers of identified BCTs are not necessarily associated with better outcomes (Dombrowski et al., 2012). The absolute number of techniques found (e.g. in an eHealth system) may not be as relevant as the efficacy of each

technique (Lyons, Lewis, Mayrsohn, & Rowland, 2014) and understanding the quantity, frequency and efficacy of specific BCTs in health behaviour change interventions is critical.

Understanding what health professionals do, in terms of incorporating constituent theoretical techniques in their day to day practice, is of significant interest. Ogden (2016) highlighted that trained practitioners have a variety of skills and tools at their disposal, which they can adaptively select during behaviour change interventions to meet the unique needs of the client. Furthermore, human support has been suggested as being the most important differentiating component in the effectiveness and adherence of behaviour change interventions (Mohr, Cuijpers, & Lehman, 2011; Santarossa, Kane, Senn, & Woodruff, 2018). Yet it has been suggested that BCT taxonomies currently fixate on content of behaviour change interventions and do not capture techniques that relate to the interpersonal style of health professionals (Hagger & Hardcastle, 2014). For example, in a systematic review seeking to identify BCTs in interventions to promote physical activity and healthy eating for overweight and obese adults, authors met with difficulties in attempting to code BCTs in Motivational Interviewing, Self Determination Theory or Acceptance and Commitment Therapy based interventions, finding no appropriate BCT labels matching: "promoting participants own reasons for change" "provision of choice," "unconditional personal regard" and "in an autonomy supportive manner" (Samdal, Eide, Barth, Williams, & Meland, 2017). This illustrates the contention that health psychology itself has not focused sufficiently on implementation processes, the 'how to' rather than 'what to' of interventions (Hilton & Johnston, 2017). Subsequently, there have been calls to distinguish between content-based and relational techniques in health behaviour change interventions (Hardcastle, Fortier, Blake, & Hagger, 2017). Arguably, to do so would allow for a more complete picture of how interventions are implemented in practice.

Human support in health behaviour change- the role of expert health coaches

The relationship between the health care practitioner and the patient is at the heart of successful behaviour change interventions, and highly developed communication skills are required by a successful practitioner (Lacey & Pritchett, 2003). A cultivation of rapport and empathy, as well as regular contact are noted as essential elements of positive consultations (Cant & Aroni, 2008; Hancock, Bonner, Hollingdale, & Madden, 2012; Rollo et al., 2015).

Expert health coaches deliver educational content, provide guidance and accountability, and increase participant engagement and subsequent weight loss success (Mohr et al., 2011). Health coaches can tailor feedback in a manner that delivers timely content to the recipients' specific needs and interests, and remove irrelevant intervention content (Rothert et al., 2006). Evidence to support the efficacy of remote guidance from a health coach is building, including when guidance is delivered by telephone and email (Tao, Rangarajan, Paustian, Wasilevich, & El Reda, 2014). A retrospective analysis of coach-participant interactions and weight loss in a 6-month online weight management intervention found that the participant's attendance of individual coaching sessions, interactive web-based class attendance, and the amount of daily food log feedback from the coach were significant predictors of weight loss at 6 months follow up (Painter et al., 2018). Feedback has previously been identified as an important factor in eHealth interventions to promote weight loss (Khaylis, Yiaslas, Bergstrom, & Gore-Felton, 2010; Tang, Abraham, Greaves, & Yates, 2014). A meta-analysis found that tailored feedback in internet-delivered weight loss interventions allows for greater flexibility, convenience and time-efficiency for both health care professional and the patient compared with in-person approaches (Sherrington et al., 2016). However, the high heterogeneity of the nature of feedback within weight loss interventions make it difficult to draw conclusions regarding what types of tailored feedback effectively support weight loss in interventions. As such, greater attention is needed to

discern the precise tailoring techniques implemented in these interventions.

Tailoring strategies in health behaviour change

Tailoring is a multidimensional communication strategy whereby the provision of information, advice and support is individualised to the user based on their known characteristics, behaviours, or pre-assessment scores on relevant theoretical constructs (Kreuter, Strecher, & Glassman, 1999). In the context of weight loss interventions, a recent systematic review found that tailored interventions were more effective in producing weight loss than generic or wait list controls, but found that tailoring was implemented in a wide variety of ways (Ryan, Dockray, & Linehan, 2019). Indeed, tailoring strategies can range from relatively simple e.g. employing the user's name, to the more complex, e.g. adapting content to personally relevant variables (Morrison, 2015). Following a literature review, Harrington and Noar (2012) published a list of tailoring strategies in order to improve the reporting of tailored interventions in published articles (Harrington & Noar, 2012). This list includes nine labels, corresponding definitions and examples of tailoring strategies, similar to the BCT taxonomy (Harrington & Noar, 2012; Michie et al., 2013) (see Appendix B).

Tying these strands together, we argue that studying the routine practice of health behaviour change experts in context is critical in understanding how to support behaviour change and bring about health outcomes. Examining raw data recorded from health coach-client interactions can help to characterise not only *what*, but also *how*, theory-based techniques are applied in the process of behaviour change.

The current study

In this exploratory study we aimed to describe the content of a commercial weight loss intervention by retrospectively coding tailored feedback videos delivered by health

coaches. We aimed to describe: a) what theory-based techniques (either BCTs and tailoring strategies) are used in sessions, b) which of these techniques are used most frequently, c) what occurs in sessions, beyond that described by existing theory-based techniques. To be clear, our aim was not to evaluate these techniques in terms of subsequent weight loss efficacy, but rather to provide an initial step toward this. We aimed to characterise the techniques and style which make up health coaches' feedback to assess if the theory can adequately describe what occurs in practice.

Method

Participants

Two health coaches holding Masters degrees in Clinical Nutrition/Exercise and Nutrition Science provided a self-selected sample of their client feedback sessions. One male health coach with ~8 years of experience (A) provided four videos and one female with ~3 years of health coaching experience (B) provided six videos.

Intervention Description:

The intervention was an 8-week behavioural weight loss program. Health coaches met with clients individually at baseline and post-intervention. Based on baseline measurements including body weight, clients were set individualised daily dietary intake (macronutrient) and exercise goals. Clients were trained in the use of a smartphone application and website (MyFitnessPal), account access shared with the coach. Coaches monitored (via app) and provided feedback to clients each week, based on daily body weight, dietary intake and exercise logged to the app. Feedback was delivered via an asynchronous video recording or phone call.

Feedback Videos:

A sample of ten feedback videos which clients received (via email link) when they participated in the program were analysed. The videos were on average 4.7 minutes long and involved the health coach recording their screen on the shared MyFitnessPal account discussing the client's' previous seven days of diet, exercise and weight.

Analysis:

Each feedback video was transcribed by KR. The data were analysed using a hybrid thematic analytical approach of inductive and deductive coding as described by Fereday and Muir-Cochrane (2006). This approach integrates data-driven (inductive) codes with theory-driven (deductive) codes, enabling a rigorous process of qualitative analysis that builds on and supplements existing theoretical frameworks. The approach involves a six stage process:

In stage one a codebook was used to provide an evidence trail of the coding process (Fereday & Muir-Cochrane, 2006). Two frameworks comprised the *a priori* (or deductive) codes. The first was the Behaviour Change Technique Taxonomy (v1) (BCTT-v1) to identify BCTs (Michie et al., 2013). The second framework, used nine contemporary tailoring strategies based on the labels and definitions compiled by Harrington and Noar (2012) p. 336 (Appendices A and B, respectively). To prepare for coding, online training in BCT identification was undertaken by both coders. First, the coders (KR and LM) independently studied the transcripts and the definitions in the two frameworks. An *a priori* (theory-based) code was applied (e.g. 'Feedback on Outcome of Behaviour'; 'Descriptive Feedback') if the content in the transcript matched the definitions in the codebook. Three passes of the data coding were conducted; the first pass coded the BCTs, the second coded tailoring strategies and the third identified any other potential strategies not covered by the theoretical codes. Transcripts sections which did not match the *a priori* codes but were considered to be addressing a determinant of behaviour change (e.g. attempting to increase the client's motivation) were coded inductively.

Stage two involved testing the reliability of the codes to determine the applicability of the code to the raw information (Boyatzis, 1998). Coders met twice to check alignment of coding strategy. Each transcript was reviewed for the presence or absence of codes, as well as other potential techniques. When discrepancies arose, the coder who identified the techniques justified their reasoning to the other, discrepancies were then resolved through discussion which enabled consensus.

Stage three involved summarising the data, via memo-writing throughout the coding process, and included consideration of the main 'message' delivered and manner of delivery from the health coach. These were compared in discussion of the data and were applied in cases where there were discrepancies in early coding efforts (Stage two).

Stage four involved re-applying the coding template (deductive) and additional coding (inductive). On the second occasion, transcripts were coded using NVivo. A 'node' in NVivo was a technique (either deductive *a priori* code or inductive code). This second pass of coding attained 100% agreement between the coders for the number of times each code was applied. This was important as we were interested in coding the frequency of techniques to capture implementation of the techniques in routine practice. Discrepancies were then resolved through discussion and consensus, although stage two ensured that the coding strategy was aligned and so agreement was obtained. The frequency of deductive (theory-based) codes were compiled across all feedback videos, as well as within each individual feedback video. NVivo was used to collate these figures and Excel was used to compute means. The inductive codes were categorised into either content-based (e.g. stand-alone behavioural techniques to bring about weight loss) or relational techniques, (e.g. to do with the manner in which the techniques were delivered by the health coaches), in line with conceptualisations in Hardcastle et al. (2017).

Stage five involved a process of connecting the relational inductive codes and identifying themes or patterns in the data (Braun & Clarke, 2006). Themes were considered to be unified by a central organising concept, linked to the research question (Braun & Clarke, 2006). The semantic meaning of each code was considered and these were developed into themes pertinent to the delivery of behavioural feedback. If the relational codes seemed ultimately to be similar to another code, they were combined. Memos from each coder (KR and LM) were used in this process to understand the manner in which techniques were applied by the coaches.

Stage six involved corroborating or legitimating coded themes using NVivo. The codes and their supportive quotes were re-examined to verify whether they fit within their corresponding theme in order to confirm the findings (Crabtree & Miller, 1999). Each theme was considered in relation to each other theme, to ensure that they were independently describing something unique about how the coaches delivered the feedback. Themes were fused together into sub-themes if after consideration and discussion they appeared to be two strands of the same master theme.

Ethics:

The secondary analysis was conducted in a manner consistent with the Psychological Society of Ireland's Code of Ethics (PSI, 2010), and approved by the School of Applied Psychology Ethics Committee, University College Cork, Ireland in December, 2017.

Results

In this study we aimed to identify the BCTs, tailoring strategies and other interpersonal delivery strategies that are implemented by health coaches in a sample of 10 pieces of tailored feedback in a behavioural weightloss eHealth programme. First we will

describe the behaviour change techniques present, secondly the tailoring strategies and thirdly what occurs in sessions, beyond the theory-based techniques.

a.) What behaviour change techniques were implemented?

Seventeen unique behaviour change techniques were identified in the feedback videos. Table 1 describes how many times BCTs were coded across all feedback videos, *M* = 20.88 (range: 1-109). Nine BCTs were most common (coded in over half of the videos): 'Feedback on behaviour', 'Social Reward', 'Social support (unspecified)', 'Discrepancy between current behaviour and goal', 'Instruction on how to perform the behaviour', 'Credible source', 'Information about health consequences', 'Feedback on outcome(s) of behaviour' and 'Review Behaviour goal(s)'. Less commonly used BCTs (e.g. coded less than half the videos) were coded between 1-5 times, much less frequently across videos.

Table 1. Summary Table demonstrating Frequency of Techniques across all videos

Behaviour Change Technique	**Present in *N* videos**	**Number of times technique coded**
2.2. Feedback on behaviour	10	109
10.4. Social reward	10	78
3.1. Social support (unspecified)	10	10
1.6. Discrepancy between current behaviour and goal	9	35
4.1. Instruction on how to perform the behaviour	9	33
9.1. Credible source	8	31
5.1. Information about health consequences	8	27
2.7. Feedback on outcome(s) of behaviour	6	7
1.5. Review behaviour goal(s)	5	11
8.2. Behaviour substitution	3	5
2.6. Biofeedback	2	2
1.1. Goal setting (behaviour)	1	2
1.4. Action planning	1	1
3.3. Social support (emotional)	1	1
6.2. Social comparison	1	1
5.6. Information about emotional consequences	1	1
12.1. Restructuring the physical environment	1	1
Mean (Range)	5.06 (1-10)	20.88 (1-109)
Tailoring Techniques	**Present in *N* videos**	**Number of times technique coded**
Evaluative feedback	10	91
Identification	10	40
Descriptive feedback	9	26
Personalisation (general)	8	39
Comparative- progress feedback	6	7
Contextualisation	4	7
Comparative- normative feedback	1	1
Raising expectation of customisation	1	1
Mean (Range)	6.13 (1-10)	25.25 (1-91)

To determine the frequency of BCTs in each video, we examined each individual feedback video, see Table 2. We found that videos contained on average 8.4 BCTs (range 3-12), coded 35.5 times each (range: 16-58). We examined the difference in implementation dependent on coach, finding that B implemented on average 7.33 BCTs per video, delivering

each of these on average 32 times (range: 16-44). A delivered a mean of 10 BCTs per video, delivering each of these on average 40.75 times (range: 24-58).

Table 2. Summary table depicting the number of times each technique was present within each feedback video

Video	A1	A2	A3	A4	B1	B2	B3	B4	B5	B6	Means
Behaviour change technique (BCT)											
1.1. Goal setting (behaviour)				2							
1.4. Action planning									1		
1.5. Review behaviour goal(s)	1			4	1			2	3		
1.6. Discrepancy between current behaviour and goal	6	2	1	5	4	7	1	4	5		
2.2. Feedback on behaviour	10	11	9	16	12	12	10	10	12	7	
2.6. Biofeedback	1						1				
2.7. Feedback on outcome(s) of behaviour		2	1	1			1	1	1		
3.1. Social support (unspecified)	1	1	1	1	1	1	1	1	1	1	
3.3. Social support (emotional)		1									
4.1. Instruction on how to perform the behaviour	4	3	1	6	1	4	6	3	5		
5.1. Information about health consequences	6	4	1	7		3	3	1	2		
5.6. Information about emotional consequences	1										
6.2. Social comparison		1									
8.2. Behaviour substitution	1			1		3					
9.1. Credible source	6	4	2	6		6	5	1	1		
10.4. Social reward	7	7	8	9	7	8	10	7	7	8	
12.1. Restructuring the physical environment	1										
Frequency of BCTs coded per video	45	36	24	58	26	44	38	30	38	16	35.5
Number of BCTs implemented per video	12	10	8	10	6	8	9	9	9	3	8.4
Tailoring Techniques											
Comparative- normative feedback		1									
Comparative- progress feedback	1	2	1	1	1				1		
Descriptive feedback	5	2		4	2	1	2	3	5	2	
Evaluative feedback	9	9	8	16	10	10	10	8	7	4	
Personalisation (general)	6	4		12	4	1	8	1	3		
Contextualisation			1				2	2	2		
Identification	1	2	2	2	5	6	5	6	5	6	
Raising expectation of customisation	1										
Frequency of tailoring techniques coded per video	23	20	12	35	22	18	27	20	23	12	21.2
Number of techniques implemented per video	6	6	4	5	5	4	5	5	6	3	4.9

b.) What tailoring techniques were implemented?

Eight tailoring strategies were identified out of nine in Harrington and Noar's (2012) list, see Table 2. They were coded across all videos 25.25 times (range: 1-91). 'Evaluative feedback', 'Identification', 'Descriptive Feedback', 'Personalisation-general' and 'Comparative-Progress Feedback' were most commonly implemented, occurring in >5 feedback samples. Each feedback video contained *M*= 4.9 tailoring techniques (range: 3-6), coded an average of 21.2 times per video (range: 12-35), see Table 2. As with the BCTs, differences occurred in the use of tailoring techniques among coaches; A delivered *M*= 5.25 tailoring techniques across all videos, on average 22.5 times, while B delivered *M*= 4.66 tailoring strategies, 20.33 times per video. While many of these techniques were used by both health coaches, some were used more by one coach than the other, for example, B used

'Identification' more times than A, who tended to use 'Comparative-Progress Feedback' more than did B.

c.) What occurs beyond existing theory-based techniques?

There was a substantial number of observed strategies that were beyond the scope of BCTs or tailoring techniques. They were coded as 'content-based' or 'relational' in line with Hardcastle et al. (2017). Each of the codes was identified as a potentially positive influence on the desired target behaviours (physical activity and dietary change) or engagement with the weight loss intervention, for example, through increasing capability, opportunity or motivation of the COM-B model of behaviour change (Michie et al., 2011b). The list of inductive codes, categorised into either 'relational' or 'content,' are illustrated with supporting quotes in Table 3.

Table 3. Inductive codes and examples

Inductive codes	**Examples (supporting quote)**	**Relational/ Content**
Awareness of disengagement	so ahm, if you've any questions give me a buzz I did try ringing you last week, and I think the week before, definitely last week anyway, so I'll just see what time I have booked in there for ya for your next call, it was the 14th at half nine I rang you, so I'll book in a call for two weeks after that which will be the 27th, ahm at half nine again and I'll touch base with you then. – A1	Relational
Caring manner	I want you to make sure that your meals are as nutritious as possible –A3	Relational
Collaborative speech	so honestly well done, keep up the good work, for ahm one last good week before Christmas and we'll get another couple of pounds off ahm as well – B4	Relational
Comparative feedback (dose-response)	if you're let say taking in 150-186 grams in the day your body is running on that dietary fat for the entire day and it would never need to use your stores of fat so therefore there won't be any weight loss, whereas the days that your fats are 93, 106 (points to specific days) if they're lower again let's say, down on 80s or 70s, your body will have to use your body fat as an energy source on those days -B2	Content

Conveying experience (with other clients)	So a good tactic for that is, what I often say to people is - A4	Relational
Correcting incorrect beliefs (reattribution)	little bit more added fat there would help with the energy levels, and it's not gonna make you fat like people would have you believe- AS1	Relational
Demonstrating that P is being monitored	I know you're not logging the exercise separately this week- oh there is, sorry there's exercise in there since yesterday-A2	Relational
Enthusiastic tone	So looking forward to touching base with you eh next Tuesday and seeing how the bloods have responded, –A3	Relational
Flexible approach	again if you do want me to give you some feedback just pop in the foods -A1	Relational
If-then motivational cue	carbohydrate intake is nice and consistent, so this level of consistency, ahm once you keep it up for y'know whatever amount of time it is that you want to to achieve your ahm, weight that you're happy with or or target, ahm this level of consistency is is all your need. So 80 grams of carbohydrates is bang on its perfect. Ahm when it comes to HbA1c… or your blood glucose, ideally pushing it down towards 50 or 60 would be the ideal level but you can still 100% reverse Diabetes with the level of carbs that you're on at the moment -A3	Content
Information about bodily processes	your body is made up of mostly water so if you take in slightly too much sodium it retains a little bit of water to protect it, ahh sodium looks pretty okay, so its probably not that, but you can get, I mean there are so many reasons for it, hormonal fluctuations, slightly more carbohydrates than usual, plenty of reasons where your body can retain a little bit of fluid, -A2	Content
Intermittent fasting	have your lunch at half twelve or one o' clock, your dinner at half six, seven, half seven, and leave it at that. Now you can eat just as much food as you would normally eat in terms of the volume of food, but you're just splitting it down into two mealtimes, so you're reducing the amount of insulin production that comes from food because its only happening twice during the day- A2	Content
Investment in clients results	I know normally you do log on a Friday so I presume that you have log- you have weighed this morning as well, so hopefully it has come down, -B5	Relational
Normalising what client is going through	it went up a little bit then you'd a big drop from 238 down to 234 and quite common- ahh quite commonly, that your body responds by holding a little bit of water as a protective mechanism, this is perfectly normal I can't stress that enough, ahm I see this on a weekly basis with people, a couple of times a week they go up a pound or a pound and a half, and of course the first reaction –A2	Relational

Persuasive talk	try your best Geraldine, I know we're a week and a co- a week and a couple of day out from Christmas so it can be hectic, but just trying to get another wa- ehh extra couple of walks, or even a longer walk, trying to go for that forty minutes –B4	Relational
Questioning logging	but the doughnut giving you 20 grams of carbohydrates, which in my view is very low, ahhh- your average doughnut should be giving probably about 50-60-70 grams depending on really the amount of sugar they add in, but 20 would have been definitely too low for it ahm so I would have expected the carbohydrates to been a lot higher there on Monday, okay? –B4	Relational
Rapport building	So, if you want to have like bacon and eggs or something like that in the morning that will be just as good, but I know you're in a routine with the (laughs) with the chicken as well, - A1	Relational
Reassurance	Okay so, the bottom line is you've absolutely nothing to worry about, in fact I was just looking through there, its exceptionally unusual that your weight has dropped down so much without actually bumping up much, - A2	Relational
Recapping feedback and goals	very good week, the only small thing was just those higher fat nuts, so going for a lower fat option, won't spike up the fats too high much more in the day, so you'll still be able to eat a good amount of the hazelnuts and the walnuts, or sorry- the hazelnuts and the almonds and they won't have the same effect on your fat intake as the likes of the Brazil the pecan and the walnut, -B2	Relational
Understanding attitude	I know it can be hard, of course ahm with work and things like that, -B5	Relational

Relational themes:

The relational codes in Table 3 were connected by a process of identifying semantic commonalities and patterns in the data (themes) (Braun and Clarke, 2006). Codes in respective themes were linked by a central organising concept. Two initial themes were subsequently deemed to be sub-themes: 'Nature of Delivery' and 'Interpersonal style', capturing two strands of one core theme: 'Autonomous Interpersonal Coaching style'. Finally, three overall themes were identified: *Supportive accountability*; *Autonomous interpersonal coaching style* and *Coach as expert*. Table 4 demonstrates which relational codes correspond to each theme.

Table 4. Overarching relational themes and corresponding codes

Supportive accountability	**Autonomous interpersonal coaching style**		**Coach as expert**
	Nature of delivery	**Interpersonal style**	
Awareness of disengagement	Flexible approach / Understanding attitude*	Rapport building	Conveying experience (from other clients)
Demonstration of external monitoring	Enthusiastic tone	Collaborative speech	Correcting incorrect beliefs
Drawing attention to phase of programme	Persuasive tone	Investment in clients results	Normalising what client is going through / Reassurance*
Questioning logging	Caring manner		

*Combined codes are separated with a '/'

The following three themes were developed from the relational inductive codes.

1. *Supportive accountability*

Supportive accountability, provided by the health coach, was identified as an overarching relational theme present in the transcripts. The health coach was an external other, and provided health information and caring motivational feedback. This was delivered through the following processes, which could be considered to be important contextual information in how the behaviour change techniques were implemented. Coaches provided clients with 'Demonstration of external monitoring'. This is separate to other BCTs in the Feedback and Monitoring category, as the health coaches are clearly monitoring the behaviours of the clients and they are explicitly telling clients of this process in their feedback. For example, if the client did not log their behaviours for a number of days, the health coaches their awareness of this disengagement to clients who received feedback with a non-chastising comment to this effect. Coaches also delivered detailed tailored 'Comparative-progress feedback,' for example, explicitly mentioning their expected weight loss projection. This denotes to the client that they are being externally monitored and their progress is noted

which adds to the sense of accountability being created by the health coach. "*You tend to be dropping somewhere in the region of 1.5kgs a week*"- A3. This is also addressed through 'Drawing attention to the phase of the programme' that the client is at, contextually situating them in terms of their expected weight loss outcomes.

Additionally, the health coaches clearly convey to the client that they are casting a critical eye on the what they enter to the app, through the code 'questioning logging': *"the calories burned, that's definitely incorrect"* -A3. By questioning what the clients have specifically logged, the health coach demonstrates that they are paying close attention not only to their logged behaviours (e.g. their reported dietary intake and exercise), but also to the quality and quantity of logging to their shared app account. This provides the sense that the health coach was closer at hand than if they were left without this continuous input throughout the intervention.

2. *Autonomous interpersonal coaching style:*

This overarching theme was a result of combining two sub-themes, 'nature of delivery', which described the way in which health coaches delivered the feedback, relating moreso to the health coaches own manner, and 'interpersonal style' which related to how the health coach related to the client, or were intended to build the relationship with the client. Both of these sub-themes worked together to simultaneously build the coach-client relationship and to empower the client to reach their goals.

2.1 Nature of Delivery

The first sub-theme referred to the nature of the health coach's delivery of feedback. Both coaches used a 'flexible approach' with an accompanying 'understanding attitude' in their feedback to support the clients to change their behaviours. For instance, for those clients who were receiving feedback indicating they were non-adherent to their goals, a coaxing approach was often implemented, with a light, friendly 'enthusiastic tone' and the option of

re-engaging with the coaches at their earliest convenience. This served to emphasise the client's autonomy in deciding to continue to engage with the intervention. However, the caring manner with which they delivered the feedback indicated their investment in the client's wellbeing and appeared to be an impetus for the client to remain focused on their goals. Coaches applied this warm, supportive and flexible manner in delivering the BCTs and tailoring strategies alongside a 'persuasive tone' to motivate the client. For example, the BCTs 'instruction on how to perform a behaviour' 'review behaviour goals' and tailoring strategies 'identification' and 'contextualisation' were implemented here: *"try your best Geraldine (not real name), I know we're a week and a co-a week and a couple of day out from Christmas so it can be hectic, but just trying to get another wa- ehh extra couple of walks, or even a longer walk, trying to go for that forty minutes" – B4.*

2.2 Interpersonal style

This sub-theme referred to how the health coaches applied strategies to enhance the coach-client relationship. Their choice of language demonstrated their emotional and personal 'investment in client results'. *"So looking forward to touching base with you eh next Tuesday and seeing how the bloods have responded"* –A3. This demonstrated an in-depth knowledge of the client's unique lifestyle situation/ goals (e.g. presence of a comorbid disease) and choices (e.g. demonstrating an awareness of their client's dietary preferences) alongside their intentions to lose weight was a method of 'rapport building'. This was emphasised further when health coaches used 'collaborative speech' and the use of the word "we" often to position themselves as being on the same team as the clients. The client's behaviour change was construed in the feedback as a team effort, uniting the health coach and the client on the same side. *"So I know energy was an important thing for you so ahm, what <u>we</u> need to do to get your energy up is fuel your body primarily on fats, cause they're amazing for energy and <u>we</u> want to get your carbohydrates down"* - A1

3. *Coach as expert*

Despite clearly being supportive and cultivating client autonomy, the health coaches very clearly demonstrated their expertise in an authoritative, but not dictatorial way. The positioning of the health coaches as expert seemed to function as a way to build trust in the credibility of their advice through their past successes. Health coaches 'conveyed their experience' with previous clients and used laughter, joking and a light relaxed tone with clients. They also 'corrected incorrectly held client beliefs' regarding target behaviours and normalised some of the patient's experiences: *"little bit more added fat there would help with the energy levels, and it's not gonna make you fat like people would have you believe"* – A1. In addition, the firm but kind 'reassurance' provided to clients normalised the client's struggles during their process of weight loss. It also gave a sense of credibility to the health coaches in their ability to guide them through the weight loss journey demonstrating that their experiences are similar to those who have attained results in the past. *"Okay so, the bottom line is you've absolutely nothing to worry about, in fact I was just looking through there, its exceptionally unusual that your weight has dropped down so much without actually bumping up much"* - A2.

Content-based techniques:

There were four additional codes relating to the content of a weight loss intervention that did not directly fit with the definitions of the *a priori* theory-based codes, but rather provided supplementary detail on tools perhaps specifically relating to bringing about weight loss behaviourally. For instance, *information about physical or physiological processes* was differentiated from the BCT '*information about health consequences*' which refers to 'the provision of information (e.g. written, verbal, visual) about health consequences of performing the behaviour'. We coded this technique when the health coach was describing the physiological processes which were presently occurring during the process of weight loss,

for example, in describing the bodily response when the client was on a reduced carbohydrate diet. The focus of the health coaches' message was not focused on the overall future health consequences of performing the behaviour, but rather the current processes that were occurring for the person, bringing the health processes of weight loss to a more present-day and tangible point for the client.

Similar techniques were the *comparative-dose response,* which is linked to the above technique in that detailed physiological processes are described and involved the health coach giving feedback how the body would precisely react (in terms of the target behaviour- weight loss) given certain precise quantities of macronutrients consumed. Days where the physiological response would have occurred based on the macronutrient consumption were compared with days where it would not have occurred. This also fed into the technique *if-then motivational cue,* where in a strong effort to reinforce the positive behaviour, the health coach specifically would draw attention to and describe a day when the client was very consistent with their daily intake of carbohydrates. They then told the client that were they to replicate that dietary intake on a more consistent basis, they would certainly reach their target weight (and additional goals). This was deemed to be a motivational cue to continue that behaviour. Both these techniques seemed to serve to make the target behaviour more tangible and the target goal more achievable for the client. The coach highlighted that the client had successfully carried out the target behaviour it in the past, and re-emphasised the goal to replicate it in order to attain their weight loss goals.

Lastly, many of the samples of feedback included a section at the end which recapped the main points made over the course of the feedback video. This highlighted key interim behavioural goals to focus on in the shorter term, in the context of their baseline goals. It gave the client something to focus on for the coming week, repeating what had been said before, *"So just to sum up for the week ahead S, ahm a bit more consistency with the*

carbohydrate intake, your fats are good, your protein could do with coming down a little bit, which will bring your fats up slightly higher so thats okay, ahm and just keep up the exercise everything else is great"- A4.

Discussion

The aim of this exploratory study was to apply a theoretical lens to the practice of health coaches, to understand what theory-based techniques are prevalent in the practice of health coaches, and to identify other interpersonal delivery strategies applied. We coded the behaviour change techniques (BCTs), tailoring strategies along with other interpersonal delivery strategies that were implemented by two health coaches who provided ten samples of tailored feedback, and we note the aim of this study was not to provide an all-encompassing record of what health coaches do to support behavioural weight loss. Current applications of theoretical approaches rely on adequate description, labelling and interpretation (Johnston et al., 2018). Through this approach, we conducted a secondary analysis of samples of health coach practice thereby removing the layer of description and the self-serving bias implicit in the process of reporting. Gaining an insight into the quantity and frequency of BCTs (and other techniques) that are delivered in feedback sessions helps us to move towards specifying the optimal "dose" of delivery of these techniques in promoting health behaviour change.

Seventeen unique BCTs were identified across all the video feedback transcripts representing 18% of the BCTT-v1 taxonomy. Each individual feedback video contained on average, 8.4 BCTs (range 3-12). This suggests that while a diverse range of techniques were being implemented by health coaches generally, in terms of each individual video, a more limited number were used. This could be taken as evidence of tailoring BCTs - the process of deciding which techniques are appropriate for individual clients. In assessing the number of times the BCTs were coded, we gained an insight into which BCTs may be more generally

applicable. The nine BCTs that were most often implemented included: 'Feedback on behaviour', 'Social Reward', 'Social support (unspecified)', 'Discrepancy between current behaviour and goal', 'Instruction on how to perform the behaviour', 'Credible source', 'Information about health consequences', 'Feedback on outcome(s) of behaviour' and 'Review behaviour goal(s)'. We also coded more rarely used BCTs in our sample, which we interpret as pertinence of certain BCTs, tailored to individual client needs at a given timepoint. For example, both 'Restructuring the physical environment' and 'Information about emotional consequences' were applied in only one video respectively to address a certain issue for that particular client, the former in advising the client to set an alarm to log their food, as they were forgetting to record their dietary intake and exercise. The latter was implemented in informing the client about how they will feel once they continue eating according to their meal plan. Decision-making around 'BCT tailoring' may be a fruitful line of inquiry, e.g. to investigate how health coaches or other professionals make decisions regarding which clients should get which BCT at a given time.

The delivery of 8.4 BCTs per video was comparable to the number found by Bardus et al (2016) in their review of commercial apps for weight management. Goal setting and self-monitoring techniques were most frequently identified by the authors, similar to the findings of Antezana et al. (2018) in their analysis of 30 free health and lifestyle applications. These authors found that 9 BCTs (range 1-20) were present across apps for healthy eating, physical activity and sleep, reporting 'Goal setting' and 'Feedback on behaviour' as the most commonly used. In Chen et al.'s (2015) review of 28 apps for weight loss, 'Self-monitoring' was present in all 28 apps, as was 'Feedback on behaviour'. In contrast to the findings of the above-listed reviews, neither 'Goal-setting' nor either of the BCTs relating to self-monitoring were coded in our study, although these BCTs were implicit in the intervention. Goals were set at baseline and the feedback videos were based on the clients' logged diet and exercise

('Self-monitoring of behaviours') and weight ('Self-monitoring of outcomes of behaviours'). However, in our interpretation of the BCTT-v1, and in the interest of specificity to the content of the videos, we only coded BCTs when we saw clear evidence within the transcript.

Eight tailoring strategies were identified out of the nine included in Harrington and Noar's (2012) strategies. 'Evaluative feedback', 'Identification', 'Descriptive Feedback', 'Personalisation-general' and 'Comparative Progress feedback' were most commonly used in the feedback videos. There was overlap between some BCTs and tailoring techniques. Of the tailoring strategies, we found the definitions in relation to the nature of tailored feedback (e.g. comparative-progress, descriptive or evaluative feedback) particularly, could be used as a supplement to the BCT Taxonomy, for example, by adding detail to the BCT 'Feedback on Behaviour.' We suggest that specifically outlining the type of 'Feedback on behaviour' using these four tailoring techniques relating to feedback, may enable assessment as to whether these techniques have differential effects.

These tailoring techniques in the provision of 'Feedback on Behaviour' is evident in existing research. For example, in a review, Hartmann-Boyce et al. (2014) found that use of behaviour change techniques that compare participants' behaviour with others was effective in producing weight loss of 1.5 kilograms. This approach aligns with the tailoring technique, 'Comparative-normative feedback' (Harrington & Noar, 2012). On the other hand, Chen et al. (2015) identified technology-enhanced features pertinent to weight loss, including energy progress bars/charts. This is a form of 'Descriptive feedback', with content being delivered to the individual based on inputted data (Harrington & Noar, 2012).

To our knowledge, this is the first article to code raw intervention content for tailoring techniques. This advances previous methods as it enables an insight into not only *what*, but *how* intervention content is disseminated to the recipient, which has been highlighted as being important (Hagger & Hardcastle, 2014). Systematic reviews have demonstrated

evidence in support of tailoring approaches for health behaviour change, including physical activity, diet and smoking (Lustria et al., 2013) and outcomes, e.g. weight loss (Ryan et al., 2019). However, both of these reviews concluded that greater specificity is required in describing tailored interventions for health behaviour change using the internet. Building on these findings, we believe tailoring approaches could be used to a much wider degree to effect positive health behaviour change, and applying and building on the tailoring strategies by Harrington and Noar (2012) is a promising step forward in future efforts.

That said, in applying the definitions of the tailoring strategies, some were more straightforward to code with certainty than others, e.g. 'Identification' as a strategy, involved using the client's name, while 'Content Matching' was considerably more difficult, considering the definition itself was rather broad, e.g. "*matching appropriate intervention content (based on key theoretical determinants) to the individual*". This is a difficulty that is not unique to this list of strategies, but represents a larger difficulty in coding techniques using taxonomies. In addition, while many of the tailoring techniques were used by both health coaches, e.g. 'Evaluative Feedback', some were used more by one coach than the other, for example, B used 'Contextualisation' while A did not. These discrepancies could be a reflection of which techniques were appropriate to each client at that point in time but they could also be a reflection of individual differences among health coaches' e.g. a product of their level of experience or unique style of relating to clients, and these lines of inquiry warrant future investigation.

Three relational themes were identified from analysing the inductive codes related to interpersonal strategies implemented by the health coaches. Health coaches demonstrated interest and investment in both the client and their progress, showing empathy and understanding, which was captured in our theme of 'Autonomous interpersonal coaching style'. 'Supportive Accountability' through external monitoring of behaviours relevant to

weight loss and demonstrating expertise and experience, 'Coach as expert'. Mohr et al. (2011) proposed a model of 'supportive accountability' where they outlined that human factors provided in an eHealth intervention by a coach, including accountability, bond, and legitimacy, can potentially influence participant adherence. They suggest that the effect of human factors is moderated by individual participants' motivational factors, as well as the mode of delivery/communication media used. Tate et al. (2016) also agree that delivery mode and additionally, the degree of tailoring within an intervention, should be accounted for in examining the impact of BCTs on outcomes, as they have potential to mediate behaviour change. 'Summarise the plan' (recapping) and 'Normalising' were both strategies detected in the sample of feedback we analysed which overlapped with Motivational Interviewing strategies, in Hardcastle et al.'s (2017) article. These authors differentiated between 'content' (e.g. BCTs) and 'relational' strategies, as we have done here. These findings draw attention to the important role played by health coaches in providing human support in behaviour change interventions, and points to the need to continue to explore the role of different technologies to facilitate such support.

We also found several standalone techniques to be prevalent in several of the transcripts that we believe supplement what is listed in the BCT taxonomy. We note that Michie et al. (2013) anticipate a further revision and development of the taxonomy, which is also denoted in their description of the BCT taxonomy as 'version 1'. The most noteworthy technique we believe we have identified is 'Information about bodily processes'. This technique extended beyond the 'Information about health consequences' BCT definition. We suggest this technique emphasises the tangible bodily/physiological impact of conducting the desired change on one's health. This may be noteworthy as part of the process of cultivating self-regulation of the target behaviour, as instead of focusing on the consequences in the future in terms of a health condition, it brings the consequences to the more immediate

tangible, physical and physiological body processes. It may fit in with other similar BCTs in the taxonomy category 'Natural Consequences', which includes 'Information on emotional consequences', and 'Information about social and environmental consequences'.

We also note that in spite of the creation of the BCTT-v1 which aimed to harmonise technique terminology and replace previous behaviour change taxonomies, previous versions are still being used frequently in recent academic research, for example the CALO-RE taxonomy articles (Michie et al., 2011a), which precedes the BCTT-v1. We speculate that this may be due to this taxonomies relevance to a particular set of target behaviours. We can verify that within this exploratory study, that we have identified some techniques specific to the outcome of weight loss which are used by health coaches. This raises the question of whether more general, but broader taxonomies like the BCTT-v1 should be used for specific purposes or whether there are certain circumstances where it is more appropriate to use more specific taxonomies. In either situation, there is a case to consider adding more techniques to the BCTT-v1, and consider creating more formal taxonomies around strategies which can enhance the impact of BCTs e.g. tailoring strategies, or refining groups of BCTs specifically for particular health outcomes to make them more easily implementable for those endeavouring to create a theory-based behaviour change intervention.

Future Research

This piece of research was descriptive and exploratory, and aimed to capture the strategies that were implemented as part of feedback delivered by health coaches during a weight loss intervention. We have demonstrated the wide variety of strategies implemented in these small sample of feedback videos, beyond what is currently captured in the BCT taxonomy. The work gives an insight into how theory-based techniques are delivered 'in the wild' as used in the daily practice of health coaches. We believe it takes a step toward bridging the gap between intervention reporting and implementation in practice. Future

research should be clear in reporting intervention details, e.g. BCTs and other process variables (e.g. tailoring strategies) in use (Hill, Richardson, & Skouteris, 2015). In the current study, we have not captured the weight loss outcomes of the clients receiving this behavioural feedback, so we cannot draw conclusions as to the efficacy of the precise strategies that were implemented in this study. This is essential in future research to determine efficacious approaches, particularly in the context of tailoring and eHealth. This work also highlights the quality vs quantity argument in bringing about behaviour change - with more BCTs assumed to equate to more effective interventions. Measuring quantity and frequency of BCTs along with behaviour change outcomes can help us to ascertain the optimal 'dose' of a BCT, i.e. whether delivering a BCT once is adequate to effect behaviour change or indeed, if there is an optimal amount of times a single BCT should be delivered in order to have an effect. It is likely this might vary depending on the individual receiving the BCT and opens an interesting avenue of research.

Limitations:

Ten pieces of feedback from two health coaches were included in this study, which could be seen as a study limitation, however, these videos were analysed in great detail, iteratively, over a course of a year. While it would be desirable to have had access to more coaches and feedback, we note that only two coaches delivered this specific intervention and both adhered to similar feedback structure, i.e. addressing diet, exercise and weight. We examined only one intervention component - feedback videos, which limited the scope of techniques implemented by coaches.

Conclusion:

This work presents a granular description of tailored feedback in a pre-existing behavioural weight loss intervention, in terms of theory-based techniques (BCTs and tailoring techniques) and interpersonal strategies. Were these videos described in an article

and retrospectively coded as part of a BCT labelling exercise, they may have simply been coded as *Feedback on behaviour*, *Feedback on outcome of behaviour*, as anything else would be at best, an estimation of what actually occurs within these videos. We found that theory-based techniques capture the nature of health coaches' feedback to a certain extent, with some crossover among tailoring strategies and BCTs. However, there are a number of other techniques being implemented that extant theory has yet to include, but which may be a factor in changing behaviour. In addition, tailoring and relational techniques should be factored into future research in the area of health behaviour change, as ensuring intervention content is suitable and relevant to the individual and delivered in a supportive way is vital to ensure theory-based content won't fall on deaf ears. These findings draw attention to the important role played by health coaches in providing human support in behaviour change interventions, which points to the need to continue to explore the role of different technologies to facilitate such support. This research also has implications for theory, with new techniques suggested which could be included in future versions of the BCT taxonomy.

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