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Health Psychology and weight loss maintenance: Current issues

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"Insanity: doing the same thing over and over again and expecting different results"
(Albert Einstein)

Can such a simple statement provide insight into the processes of weight loss maintenance? Perhaps yes, perhaps no; but often it is the case that individuals experience weight loss only to regain the weight as a result of reverting back to previous unhealthy habits. To start to lose weight, individuals often introduce lifestyle choices that involve certain behavioural and psychological changes. Although they may succeed in achieving initial weight loss, the weight loss is often not maintained. The discipline of health psychology can provide new insights into the area of weight loss maintenance and knowledge to help support individuals who return to their default option -overeating, not exercising, feeling down about their weight, and 'doing the same thing over and over again' -which, in many cases, results in weight regain.

This Special Issue is timely given some of the challenges in the area of weight loss maintenance. Behavioural and surgical interventions are current options offered to people who want to lose weight. However, such interventions often do not provide sustainable effects. Moreover, the long term effects of these interventions are unclear. The articles in this Special Issue showcase a range of research and practitioner-oriented articles that explore current thinking in the area of weight loss maintenance. In the next section, we identify three key themes or issues that highlight the current collection of papers: (1) suitability of weight loss treatment, (2) intervention timing and components, and (3) recipient's motivation. In a final paper, suggestions for future research and solutions for supporting people to maintain weight loss are provided.

Highlights of the Special Issue

First, a key theme is the issue of suitability of treatment especially in regard to appropriate communication methods for the effectiveness of weight loss interventions; a timely and important topic in this context arising from the contribution of Chater (2016). The theme outlines the importance of language and emotion in weight loss maintenance. Chater provides a personal account from a practitioner-oriented perspective working within a Specialist Obesity Service in the United Kingdom. She describes the disconnectedness among healthcare professionals who surround 'patients' before and after bariatric surgery. Although these professionals are working toward supporting and empowering clients, poor communication skills that focus on the traditional biomedical model of health care, lack of programme cohesiveness, and limited recognition of client emotions are believed to result in less desirable treatment outcomes. Chater advocates for helping clients to develop a level of intrinsic motivation (similar to Santos, Silva & Teixeira, 2016, in this issue), to focus on the language that is used by healthcare professionals when consulting with such clients, and to emphasize the positive emotions that follow successful weight loss. Chater uses the 'GROW' model (i.e., goal, reality, options, will/way

forward), and integrates appropriate Behaviour Change Techniques within the consultation process to support long term weight loss maintenance. She emphasizes the power of positive psychology, highlighting that goals are more achievable when people are experiencing positive affect, and that providing individual choice and understanding individuals' perspective is crucial in optimizing behavioural change.

The second theme reflects the thoughts presented by McDonald, Bergh, and Sniehotta (2016) who present an account of opportunities and challenges regarding when one should intervene and how one should intervene following bariatric surgery. The authors highlight the peak in weight loss during the first couple of years post surgery, which is driven by physiological mechanisms. At this stage, psychological and behavioural factors may be less important. Behavioural interventions promoting healthy lifestyle practices are considered less 'invasive' yet to date are shown to be not as effective as bariatric surgery in terms of immediate weight loss outcomes. The authors suggest that a key challenge to the effectiveness of behavioural interventions in this context is to identify the 'critical window' of when to apply behavioural interventions and what to include in them.

A third theme, which is also emphasized in the articles by Chater (2016) and McDonald, Bergh, and Sniehotta (2016) is the need for developing individualized behavioural approaches most suitable to individual needs. Weight loss maintenance requires motivation, autonomy and choice from the individual who is aiming to the lose weight and maintain the weight loss. Santos, Silva, and Teixeira (2016) describe a self-determination theory perspective on weight loss maintenance. They argue that the difference between motivation for initiation and maintenance of weight loss lies in the level of self-determination experienced by the individual, which is often developed after initiating the new behaviour. The authors suggest that in order to maintain behaviour, the person needs to internalize and integrate new values and skills. They provide an illustration of the critical processes associated with successful internalization, separating processes that increase likelihood of maintaining weigh loss ('I want to' motivation) and processes that reduce likelihood of maintaining weigh loss ('I have to' motivation). They also argue that successful maintenance is underpinned by intrinsic goals and autonomous regulation, whereas unsuccessful maintenance is underpinned by extrinsic goals and controlled regulations.

In a final theme, Kwasnicka and Dombrowski (2016) present potential solutions to the challenges associated with weight loss maintenance and discuss novel approaches and technology used to change weight-related behaviour. In a modern world, the use of technology to intervene to help individuals lose and maintain weigh loss cannot be ignored. Kwasnicka and Dombrowski provide a narrative review of technology-based applications such as web programs, text messaging, mobile phone applications, social media, online devices and sensors used to battle the current obesity crisis and support people to maintain weight loss. Although the evidence for weight loss maintenance achieved through various technologies is still limited, the authors highlight the potential to prevent weight regain applying such technologies as well as the need for individualized approaches.

Conclusion

Taken together, the current collection of papers in this themed issue provide an illustration of important lines of research and insights on the psychology of weight loss maintenance, highlighting the role of treatment suitability, intervention timing and components, individual motivation, and novel technologies. Future research needs to identify the content, duration,

intensity, and most suitable delivery mode for weight loss maintenance interventions taking into account personalization and making use of technology.

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original article

The power of language and emotion in specialist obesity services: A scientist-practitioner perspective

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My interest in this area began early in my career, where I investigated perceptions of binge eating. I was interested in the number of calories that needed to be consumed to be deemed as 'binging' and the speed at which food was eaten. The DSM-IV guidelines at the time (American Psychiatric Association, 1994) on this classification were vague and my research found that perception of binge eating differed significantly depending on gender and whether one was consciously trying to control their weight (for weight loss and weight loss maintenance). This led to the desire to understand the phenomenon of 'yoyo' dieting and weight loss maintenance, inspired by the work of Keys et al. (1950) on semi-starvation associated eating behaviours and the link between dietary restraint and binge eating. It seemed, the more a person 'diets' or cognitively restrains their eating… the more they binge eat. It is argued that there is a chicken and egg relationship here, questioning which comes first; however, Key's work, and that of Herman & Mack (1975) and Polivy and Herman (1985) researching the Restraint Theory, would argue that dietary restriction precedes binge eating behaviour.

In 2005 I attended a public health conference, discussing the role health psychology can play in weight loss and the treatment of obesity. It highlighted the detrimental influence the focus on dieting can have to weight loss maintenance, and its link with binge eating episodes. I was approached by an exercise physiologist from the Specialist Obesity Services at the Luton and Dunstable hospital who wanted to know more about health psychology as they were unfamiliar with the discipline. We arranged to meet, with the practice manager and lead surgeon/ endocrinologist for the service a week later. The service predominantly delivers tier 4 bariatric surgery (gastric bypass, sleeve and band) to those with a BMI of 40 and above (35 with a co-morbidity), as well as medical clinics supporting those with diabetes and sleep apnoea. After our meeting, these practitioners were impressed with what health psychology could offer to the field of weight loss and weight loss maintenance, most notably in the area of evoking intrinsic motivation and behaviour change. They were keen to adapt their multidisciplinary team to include a health psychologist, expanding the role from what was once solely a role for a clinical psychologist (as they so often are in this type of service).

I was recruited as a Health Psychologist to Specialist Obesity Services a few months later and my role was to assist patients to adhere to their treatment protocol for weight loss and to support their weight loss maintenance. Treatment began routinely with a low calorie liquid diet for the first 4 weeks, which consisted of milk and vitamins and a physical activity plan. This was followed by support to ensure the maintenance of an energy balance through diet and physical activity, and for those who had surgery, adherence to vitamin supplements. Through the multidisciplinary team I would work closely with the specialist nurse, dietician and exercise physiologist, to assist the client to lose 5% of their body weight prior to a collaborative referral to the surgeon and follow-up work post-surgery.

My consultations drew from a tool kit that I had

developed through my health psychology training and additional courses in the areas of motivational interviewing (MI: Miller & Rollnick, 2002), cognitive behavioural therapy, health coaching and mindfulness. I would select relevant Behaviour Change Techniques (BCTs: that can now be found helpfully in a taxonomy developed by Michie et al., 2013) to use based on the client's needs such as goal setting, decisional balance (pros and cons), problem solving, creating cognitive dissonance (incompatible beliefs: discrepancy between current behaviour and goal), emotional regulation (reducing negative emotion, enhancing positive emotion), action planning, self-monitoring, and positive reinforcement (reward). I would always follow a similar format for my clinics, using motivational interviewing skills and techniques such as open-ended questions and reflective listening following the 'typical day' method; and health coaching approaches such as the 'GROW' model (goal, reality, options, will/ way forward; Whitmore, 2002), integrating the BCTs within the consultation. Drawing from health psychology helped me to support my client to action advice given to them from the rest of the multidisciplinary team, while also addressing cognitive barriers and facilitators to behaviour change.

Adapting dietary intake and increasing physical activity, while also reducing sedentary behaviour, were the target behaviours of change. A typical example of what my clients would experience during a multidisciplinary team clinic is as follows:

The client would first be checked in by the clerk and would take a seat in the waiting room (this is where much of the social-support would happen!). They would first see the specialist nurse, who would give feedback to the patient on their blood results, highlighting that their diabetes or cholesterol is not being managed correctly and that they need to change their dietary intake. The nurse would ask about their medication and would often use the 'righting reflex' (where the health practitioner tries to 'right' or fix the client's problems for them) by telling the patient how important it is to take their medication as prescribed and the risks if they do not (this is not MI congruent and can lead to resistance). The patient would then see the dietician who would tell them that they need to eat less calories. Initially, the dietician would calculate how many pints of milk they needed to drink on their 4 week low calorie liquid diet. They would then provide them with a meal planner and tell them what they should and shouldn't eat going forward. The exercise physiologist would then check the patient's fitness levels, and inform them that they need to move more, and sit less, providing them with a pedometer to log their daily steps. Their surgeon would have already told them that if they do not do all of the above, they will be dead within a year. This is an extreme example, but I have witnessed such clinics, and been the final appointment in such multidisciplinary teams on a weekly basis for hundreds if not thousands of patients, with many sitting in front of me saying; "I know all of this… but…" The challenge was how to support their behaviour change best.

Throughout this multidisciplinary team clinic example, first notice that I use the term 'patient'. My clinic did not like me to use to term client as they were under medical care, so immediately they were medicalised. During this example, they are given a number of BCTs to 'support' behaviour change. Using the coding from the BCT taxonomy version 1 (Michie et al., 2013), they were 'provided with information on health consequences', 'provided with bio-feedback', given goals using 'goal setting for both behaviour and outcome', given 'actions plans', asked to 'monitor their behaviour' and so on. However, it was all in a prescribed manner. Although helpful in terms of focusing on behaviour change, the way in which these techniques are communicated may influence their efficacy. Let's take a 15 minute exercise physiologist consultation using goal setting and

action planning to support weight loss maintenance as an example. This could go one of two ways. The amount of exercise (goal setting) and ways in which this could be obtained (action planning) could be prescribed by the practitioner. Or the practitioner could ask the client what their goal is in relation to achieving increased physical activity levels (goal setting) and how they could see themselves achieving this (action planning). In my experience, and research using theories such as Self-Determination Theory (Deci & Ryan, 1985) would support this, the latter approach that encourages a more autonomous way of thinking, is more efficacious. The way in which any type of behaviour change technique is delivered would follow a similar premise, it should be self-generated rather than prescriptive, and for this, practitioners need effective communication skills.

We know that there is an increased link between improved quality of communication and positive health outcomes (Miller & Rollnick, 2002; Rubak et al, 2005), acknowledging the importance of understanding clients' concerns to help reduce distress and support behaviour change, and ensuring that it is 'client-centred'. Therefore, the linguistics of a behaviour change consultation are key to its application and effectiveness (Chater, 2015; Jubraj et al., 2015). So the way in which we communicate to support weight loss and weight loss maintenance is essential to get right.

But I think one missing piece of the puzzle to support weight loss maintenance is affect and the concept of emotional eating. There is a high co-morbidity of negative affect (anxiety, depression, loneliness, boredom) in those with eating difficulties and weight concerns. During my clinics, I would spend time listening to the client's story, their weight-related journey. I would feel saddened by what I heard, the things that had impacted on their eating and exercise patterns. The majority of my clients experienced regular low mood, perhaps not clinical depression, but a battery of 'bad days'. They would often describe eating for comfort. Some told me of traumatic life events; child abuse, domestic violence and bereavement of close loved ones. All understandable events that would need an element of comfort. Others would describe their embarrassment over their inability to cook. One young man had lost his mother in his late teens, she used to cook for him and after her death he felt he had no alternative but to eat take away food and ready meals. Agoraphobia was high in some. A middle aged gentleman described the fear he had of leaving his house, caused by a tirade of abuse about his weight by a local gang of youths. The delivery drivers of his local pizza and Chinese takeaways had become his only friends. One lady told me of her guilt every time she put food in her mouth, developed from a lifetime of dieting. She dreamed of being able to eat a pudding in a restaurant and just enjoy it, stopping when she was full. But her 'all or nothing' thinking prevented her from ever enjoying food, so she would eat past fullness and feel shame thereafter. A young girl told me of her struggle to deal with the anger and frustration she felt over her dad's alcoholism. She would beg him to stop drinking and barter with him; if he stopped drinking alcohol she would stop overeating. But every time in her eyes he 'let her down', she would go and binge eat until she felt physically sick, consuming thousands of calories in one sitting.

After I had listened to their stories, I would use cognitive dissonance to let them explore what their lives would be like if, when they walked out of my consultation room, they made no change. I would visually draw this as a path out of the consultation room door, and they would describe all the limitations in their life. One vividly recalled a time when they visited a friend's house for dinner and their toilet seat broke under their weight. They feared they would never socialise again. Another told me of relatives that had moved to Australia, and the likelihood that they would never see them again if they did not lose some weight as they would not be able to fit in the aeroplane seat. In

all of these future scenarios, my clients looked sad.

I then would ask them to describe to me what their life would be like if they did lose weight and maintain their weight loss… what would this pathway look like, and I would draw another, going in the opposite direction. All of a sudden their expression changed, they smiled and told me of all the positive things they could achieve, how amazing it would feel and how improved their life would be. One lady shared her dream to be able to ride a horse across a sunset beach, something she didn't feel she could do at her current weight. Another told me of all the fun he would have with his grandchildren, playing football in the garden and taking them to a theme park… again something he currently couldn't do because of his size. All of my clients, during this phase of our session, showed me signs of happiness.

So I started to research the power of positive psychology. Our research found that feelings of happiness are linked to higher levels of self-efficacy and a lower BMI (Cook & Chater, 2010). Self-efficacy is an important construct for weight loss maintenance (Latner et al., 2013), so this was an exciting finding. Based on my experience in clinical practice, I started to trial some small scale interventions that aimed to enhance levels of positive affect through simple pleasures (such as taking a bubble bath), as a way of supporting weight loss (Cook, Gaitán, & Chater, 2010). We used Implementation Intentions (Gollwitzer, 1993; Hagger et al., 2016) to identify triggers to over-eating (such as being bored) and asked participants to replace their anticipated outcome (eating) with something that makes them happy. We found that this not only increased happiness and self-efficacy, but it also reduced anxiety, depression and most importantly BMI (Chater & Cook, 2010).

In conclusion… what is my view on how health psychology can support weight loss and weight loss maintenance? I would have to say that a lot of it comes down to the language we use when communicating with our clients and their emotions. You can tell someone to eat less and move more until you are blue in the face, but invariably, they will put a wall up, as no one likes to be told what to do, and in reality, they know this already. But if we listen to their story, understand their triggers and barriers to over eating and lack of exercise and illuminate their strengths and deep rooted desires, values and fears, we are engaging in more than just effective communication, we are helping them to hear their own inner voice. Thus developing a level of intrinsic motivation that they may have never known they could achieve. And at the heart of this in my mind is emotion, as things can so often seem easier and more achievable when you are feeling positive.

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original article

Weight loss maintenance after bariatric surgery: Opportunities and challenges

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Bariatric surgery is an effective treatment for individuals with severe obesity who have a BMI of more than 40kg/m² or more than 35kg/m² and the presence of comorbidities which are expected to improve significantly with weight reduction (National Institutes for Health and Care Excellence, 2014). Bariatric surgery leads to substantial and sustained weight loss compared to standard care and non-surgical interventions (Gloy et al., 2013); however, there is also considerable evidence that patients frequently regain weight in the long term after bariatric surgery (Karmali et al., 2013). One study with a follow-up period of five years reported an average weight regain of 8kg (±11kg) in the 2-5 year period following surgery (Aftab et al., 2014). Weight loss must be maintained to ensure that the health and economic benefits associated with bariatric surgery are optimised. It is important to improve our understanding of whether behavioural interventions are effective in reducing weight regain after bariatric surgery and, if so, when and how to intervene. There are a number of ways in which psychological and behavioural science can contribute to the development of effective interventions for weight loss maintenance (Sniehotta, Simpson, & Greaves, 2014).

When should we intervene?

Weight loss is likely to peak at approximately 1-2 years after bariatric surgery. After maximum weight loss is achieved, individuals are at risk of weight regain over time (Courcoulas et al., 2013). Weight loss and weight regain is influenced by a complex interaction of physiological mechanisms and behaviour. Weight loss during the initial 1-2 year post-surgical period is primarily an effect of physiological mechanisms such as changes in gut hormones and appetite control (Chakravartty, Tassinari, Salerno, Giorgakis, & Rubino, 2015), whereas psychological factors are mainly associated with patients' physical activity and dietary behaviour, rather than actual weight loss, at this early stage (Bergh, Lundin Kvalem, Risstad, & Sniehotta, 2015). There appears to be a transitional period when the physiological effects of surgery may be diminishing and the need for lifestyle modification is increasing, and the timing of the onset of this transitional period may differ considerably between individuals (Courcoulas et al., 2013).

Targeting patients during the transitional period may appear to be a feasible approach. However, there is limited evidence about the precise timing and sequence of weight regain to enable the prediction of this window of opportunity in individual patients. Interventions promoting weight loss maintenance may need to be delivered to patients earlier, before the risk of regaining weight. During the early post-surgical period, it has been shown that patients are aware that surgery is 'doing all the work' (Lynch, 2016). Therefore, it is not clear whether patients would be receptive to interventions encouraging the initiation and maintenance of behaviours required to sustain weight loss at this stage in their post-surgical trajectories. Some patients may resume or develop

new unhealthy behavioural habits (e.g., grazing), which could influence the likelihood of future weight regain. Another option is to intervene before patients undergo surgery, addressing illness and treatment beliefs and highlighting the role of behaviour change for the maintenance of surgical weight loss. Teaching patients strategies to maintain weight loss prior to weight loss itself may indeed be an effective approach (Kiernan et al., 2013).

An evidence base about weight loss, weight loss maintenance and weight regain is accumulating within the non-surgical context. Systematic reviews have shown that behavioural interventions targeting changes in physical activity and dietary behaviour are effective in reducing weight with an average weight loss of 1.56kg or more in the first year (Dombrowski, Knittle, Avenell, Araujo-Soares, & Sniehotta, 2014; Middleton, Patidar, & Perri, 2012). Theory about behavioural maintenance may be important to inform interventions for weight loss maintenance in bariatric surgery patients. A recent systematic review of behavioural theories showed that few theories explicitly address behavioural maintenance. However, five areas were identified where theories suggested distinct theoretical explanations for behaviour change initiation and for behaviour change maintenance. These highlight the importance of developing maintenance motives that facilitate gratification without relying on constant change, active self-regulation, psychological and material resources, social and environmental conditions as well as the development of habits and routines as key to successful long term maintenance of initial behaviour change (Kwasnicka, Dombrowski, White, & Sniehotta, 2016).

Evidence from non-surgical contexts may contribute to understand weight loss maintenance after bariatric surgery. However, there are some key differences in the characteristics of weight change in surgical and non-surgical populations which may limit the applicability. Firstly, bariatric surgery leads to considerably more weight loss than behavioural interventions (i.e. an average of 26kg more weight loss than behavioural interventions; Gloy et al., 2013). In addition, individuals receiving behavioural interventions tend to experience weight regain around 6 months after the intervention (Dombrowski et al., 2014) whereas weight loss is often maintained for a longer time after bariatric surgery (Courcoulas et al., 2013). Weight regain may be more variable between individuals after surgery compared to after behavioural interventions. Patients undergoing bariatric surgery and individuals who lose weight after participating in behavioural interventions may also differ in their attributions of weight loss. Bariatric surgery patients acknowledge that the surgical procedure is driving post-surgical weight loss and as a result these patients may attribute their weight loss to external factors (Lynch, 2016). Making internal attributions about weight loss may be crucial to promote self-efficacy and maintained weight loss (Bandura, 1997). Due to the number of potential differences, it is not known to what degree insights from weight loss maintenance after non-surgical weight loss can be applied within the bariatric context.

Much of what we know about bariatric surgery is limited to the initial 1-2 year post-surgical period. Future research should adopt methods which can illuminate the temporal processes involved in weight change trajectories over time. Longitudinal methods that employ qualitative enquiry and ecological momentary assessments of behaviour would promote the understanding of determinants of weight regain and weight loss maintenance and how they interact. Intensive measurement methods such as N-of-1 methods could be well suited to reveal the temporal nature and predictors of weight regain (McDonald, Araujo-Soares, & Sniehotta, 2016; McDonald & Davidson, 2016). More recent studies employing objective and ecological momentary assessment methods have revealed that patients are inactive and highly sedentary before

bariatric surgery and make only modest changes in physical activity and eating behaviours after surgery (Bond & Thomas, 2015). Most systematic reviews have focused on identifying predictors of weight loss, but there is limited knowledge about predictors of weight regain (Livhits et al., 2012). Studies of predictors of weight regain have mostly used a short follow-up period (i.e. first year post-surgery; Odom et al., 2010) when weight changes are not necessarily driven by factors under patients' control. Identifying which patients are most able to maintain weight and who are more vulnerable to weight regain could improve pre-surgical procedures such as patient selection and pre-surgical weight management. Future research should consider how predictors of weight regain may change over time, should focus on the measurement of behaviour and behavioural outcomes (i.e. weight), and should work towards establishing an agreed definition of clinically relevant weight regain (Karmali et al., 2013). Research in these areas would facilitate the development of interventions, which can promote weight loss maintenance after bariatric surgery.

How do we intervene?

Behavioural interventions targeting weight regain in bariatric surgery are usually evaluated 1-2 years post-surgery so it may not be surprising that they are often ineffective (Stewart & Avenell, 2016). Studies with longer follow-up (>3 years) show more promising effects (Stewart & Avenell, 2016). There are opportunities to test whether effective behavioural interventions developed in the non-surgical context apply to this area. Interventions that include techniques that encourage individuals to make internal attributions for their weight loss may be effective in preventing weight regain (Evans et al., 2015). Interventions based on theoretical explanations of maintenance may also be applicable to guide the selection of target variables (Kwasnicka et al., 2016). The delivery of interventions is likely to benefit from the increased use of mobile and online platforms and the development of technology which can measure behaviour and weight loss outcomes in real time including mobile phones, ecological momentary assessment and wireless scales (Evans et al., 2015; Kalarchian & Marcus, 2015). Interventions personalised to the individual are likely to be important due to the great variability in weight change trajectories between individuals. The use of adaptive interventions, which involve the delivery of appropriate intervention to individuals in real time when problem behaviours are detected, is also likely to be a promising avenue for future intervention development (Kalarchain & Marcus, 2015). Finally, it is important that interventions are acceptable to patients and this requires enquiry into what patients want and need at different stages during the surgical journey. The use of technology makes it possible to personalise interventions to the needs and preferences of the individual (McDonald et al., 2016).

Conclusions

Behavioural interventions for individuals undergoing bariatric surgery have great potential in improving long-term outcomes. A key challenge is identifying the 'critical window' when interventions are most needed to prevent weight regain and the selection of potentially effective intervention components. The identification of patient support needs would also benefit from individualised research approaches. To advance our understanding in this clinically important area future research needs to address a number of unanswered questions about the content, intensity, duration, timing and delivery mode of effective and acceptable interventions which may promote weight loss maintenance after bariatric surgery.

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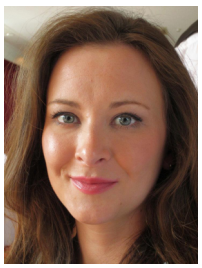

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original article

A self-determination theory perspective on weight loss maintenance

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Weight loss maintenance is a major challenge for obesity care. The success rate of previously overweight/obese individuals when trying to maintain weight loss is low and regaining weight is the most common result (Wing & Phelan, 2005). At the heart of this problem lies an interaction between human biology and the current environment, which, for many individuals, translates into physical activity and eating patterns that favor weight gain and regain (MacLean et al., 2015). This said, individual reasons for weight management attempts vary considerably and there is both theoretical and empirical support for investigating whether motivational processes underlying behavioural regulation help explain part of the success and failure in obesity management (Teixeira, Silva, Mata, Palmeira, & Markland, 2012).

A recent systematic review on theoretical explanations for behaviour change maintenance identified five interconnected themes reflecting theoretical explanations about how individuals maintain initial behaviour changes over time (Kwasnicka, Dombrowski, White, & Sniehotta, 2016). One of these themes focused on maintenance motives, which are hypothesized to facilitate behaviour change maintenance by enabling specific satisfaction-related outcomes derived from engaging in the new behaviour. Among other features, one difference between initiation and maintenance motives could lie on the level of self-determination experienced by individuals, something that often develops after initiating the new behaviour. From the perspective of self-determination theory (SDT; Deci & Ryan, 2008), this article explores motivation-related processes viewed as necessary for the persistence of weight management-related behaviours over time.

Self-determination, commonly referred to as autonomy, is related to the perceived origin of one's behaviour or its (internal) locus of causality – that is, the extent to which a behaviour is adopted with a sense of choice and self-endorsement. According to SDT (Deci & Ryan, 2008; Ryan & Deci, 2000), having the psychological need for autonomy satisfied, together with the need for competence (i.e., an individuals' need to feel a sense of mastery and capacity to accomplish the behaviour) and relatedness with others (i.e., an individuals' need to feel meaningfully connected to others, valued and understood) energizes autonomous motivation, promoting behavioural persistence and well-being (Deci & Ryan, 2000). In turn, when these three needs are thwarted, people will tend to develop controlled motivations, regulating their behaviour based on external contingencies and internalized self-judgments (Vansteenkiste & Ryan, 2013). Evidence from several domains supports the theoretical premise that different motivational regulatory processes underlying goal pursuit are differentially associated with behavioural outcomes and wellbeing. Importantly, it suggests that maintaining certain behaviours over time (which is crucial for weight management) requires that the individual internalizes and integrates values and skills for change, and experience self-determination (Ng et al., 2012; Teixeira, Carraca, Markland, Silva, & Ryan, 2012).

Recent developments in the theory show that

not only regulatory processes can be different (as a result of need satisfaction vs. frustration), but also that "not all goals are created equal" (Vansteenkiste, Niemiec, & Soenens, 2010). In brief, the outcomes that individuals are pursuing through the new behaviour – i.e., the content of individuals' goals or aspirations – can have intrinsic or extrinsic qualities, which can also influence behaviour maintenance. Relative to "extrinsic goals" (e.g., wealth, social recognition, physical attractiveness), "intrinsic" goals (e.g., health, personal growth, social connectedness) tend to be regulated by more self-determined forms of behavioural regulation and are thought to result in improved self-regulation and longer-term outcomes (Ingledew & Markland, 2009; Kasser & Ryan, 1996).

In respect to weight loss maintenance, individuals can start a weight loss attempt, or join a weight loss program, with different prevailing goals in mind. For instance, wanting to improve some aspect of their health (a more intrinsic goal) or improving appearance (a more extrinsic goal). Subsequently, the motivation associated with the course of action, such as the adoption of a specific behaviour that contributes to weight loss (e.g., physical activity), can shift during the process and vary in the level of choicefulness and personal endorsement. For example, from an externally-driven (controlled) form of regulation (e.g. "because my doctor scared me by noting the severe health consequences if I don't do it"); to a partially internalized regulation (e.g., "I feel that I should do it because I am afraid that others think of me as a lazy person"); to more autonomous forms of regulation (e.g., "I want to be able to experience myself with energy"); all the way to intrinsic motivation (e.g., "I challenge myself and I really enjoy the process"). The notion of 'prevailing goal' is important to note here, since people commonly have multiple goals associated with a single behaviour.

According to SDT, the satisfying experience of autonomy, competence, and relatedness while engaging in that specific behaviour will foster the internalization process by reducing the psychological effort required for long-term behavioural regulation, resulting in psychological wellbeing and long-term weight loss maintenance. In the Figure, we describe critical processes thought to be associated with successful internalization. These include an individual's exploration of personal and meaningful values; the incorporation of the change in behaviour as part of identity change ("I am a vital and healthy person, and my physical activity and eating patterns reflect that"); the experience of behaviour-related enjoyment, confidence, and ability ("while exercising I feel tension-free, happy, energetic and capable. I feel powerful!"); the adoption of positive and flexible behavioural patterns ("I know that sometimes I cannot go to the gym so during these periods I try to walk more"); and the experience of connection and trust with important others, among others.

In contrast, when the individual experience of autonomy, competence, and relatedness (in relation to weight control behaviours) is actively frustrated by controlling (i.e., pressuring and manipulative) environments, and change remains a function of external or internal pressure, the psychological energy required to self-regulate the behaviours is thought to be higher. Consequently, resource depletion and fatigue, behavioural non-adherence (e.g., quitting the weight loss attempt), and negative psychological consequences are more likely to ensue. In this case, other conditions may apply such as the experience of pressure and obligation; a sense of incongruity (because behaviour change does not reflect the individual's values); feelings of guilt, inferiority, and self-criticism; the adoption of negative and rigid behavioural patterns; and the experience of social isolation and not being accepted, among others.

A growing body of studies has investigated the relation between SDT-related motivation variables and weight loss maintenance or energy balance-

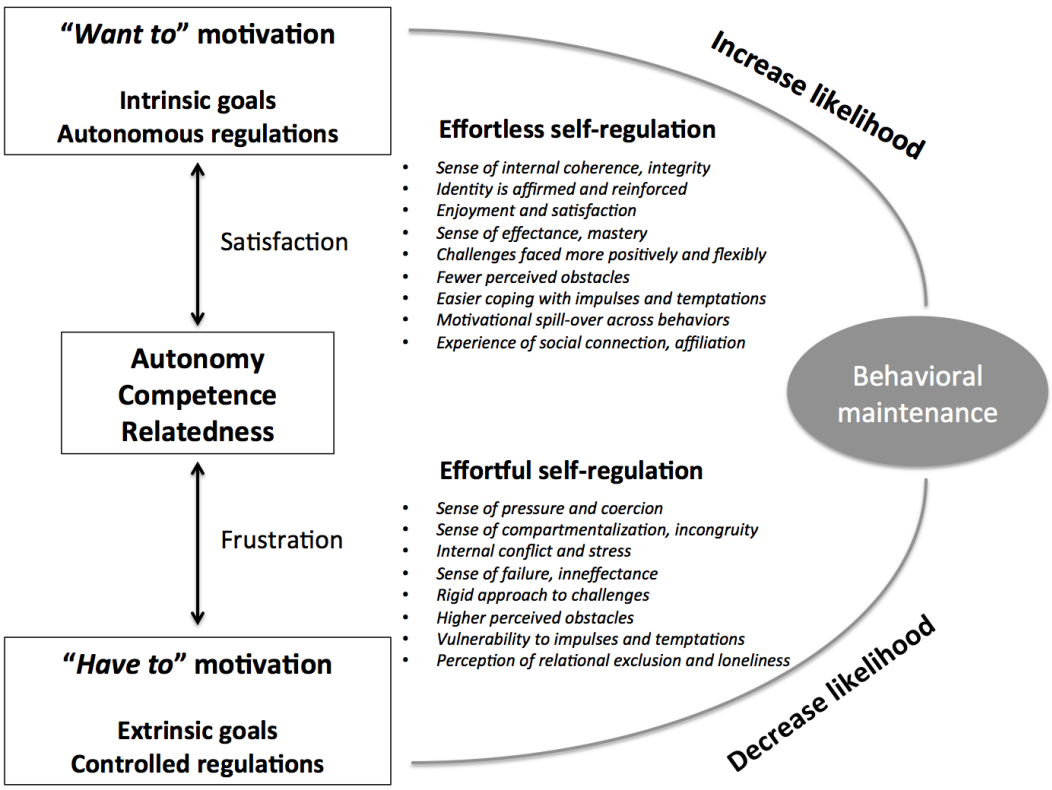

Figure 1. Critical processes and conditions involved in behavioural maintenance

related behaviours (Patrick, Gorin, & Williams, 2010; Teixeira, Silva, Mata, Palmeira, & Markland, 2012). For instance, Gorin et al. showed that autonomy support from one's partner predicted better weight loss outcomes at 6 and 18 months among overweight and obese individuals participating in a behaviourally based lifestyle intervention, while more directive forms of support hampered progress (Gorin, Powers, Koestner, Wing, & Raynor, 2014). More recently, in the context of a 1-year SDT-based randomized controlled trial with a 2-year follow-up period, a large set of behavioural and psychological variables at the end of intervention as predictors of 3-year weight loss maintenance in overweight and obese women was examined (Santos, Mata, Silva, Sardinha, & Teixeira, 2015). Seeking for a hierarchy of predictors, this study showed that, from the 28 potential predictors included (within general and exercise motivation, psychological wellbeing and quality of life, eating behaviours and eating habits, and physical activity), exercise autonomous motivation emerged as the best predictor of at least 10% weight loss maintenance at 3 years. Moreover, women with high exercise-related autonomous motivation also showed greater psychological wellbeing, quality of life, and a more adaptive motivational profile (e.g., higher perceived choice and self-efficacy), suggesting a synergy between these features. An earlier longitudinal study from the same trial highlighted the importance of increasing autonomous motivation during treatment (1 year) for long-term physical activity participation (2 years), which mediated long-term (3 years) weight change (Silva et al., 2011). In a different cohort, an epidemiological study recently explored the association of different aspects of physical activity motivation – including intrinsic motivation and goals, namely health, fitness, appearance, weight, relaxation, and stress relief

goals – with short and long-term behaviour among Australian women. It showed that intrinsic motivation was the most predictive variable for sustaining physical activity participation over time among women trying to control their weight (Santos, Ball, Crawford, & Teixeira, 2016).

For its role in energizing the direction and persistence of human behaviour, motivation is clearly among the best candidates for predicting weight loss maintenance. As these and other studies show (see (Ng, et al., 2012) for a meta-analysis of SDT empirical studies and (Teixeira et al., 2015) for a systematic review of intervention studies), not all types of motivation predict long-term and positive behavioural outcomes. Therefore, targeting the motivational quality underlying weight-related behaviours, rather than imposing and prescribing behavioural changes, seems to be more promising for helping individuals achieve weight loss maintenance. This can be promoted by creating more enjoyable contexts, helping individuals set their own valued and aspired goals (instead of imposing or promoting standard and socially-valued goals), exploring how goals can be accomplished in their daily living (i.e., focusing on their own behavioural targets), and identifying factors that encourage more autonomous reasons for changing the behaviours while supporting autonomous action (for example, by giving structured choice). Taking the example mentioned above – engaging in physical activity as a weight control behaviour –, health professionals can emphasize the experience of the behaviour itself, and more intrinsic and positive psychological benefits of regular practice. For example, by reducing the "instrumental" focus (i.e., as a means to achieve weight loss and maintenance) and encouraging individuals to explore a way to exercise that is fun and enjoyable, challenging yet personally valuable, and, and that fits in their lifestyle, therefore increasing the potential for long-term integration. For instance, if an individual likes to dance, the suggestion can rely on trying various dance classes, instead of suggesting one of the activities on the top of the fitness trends (e.g., high-intensity interval training); these are promoted and valued by many people worldwide but may not be suitable for that particular person. The challenge is thus supporting a shift from "should/must/have to" motivation (i.e., simply comply with demands) to "want to" motivation (i.e., accept the regulation for change as one's one) for adopting the weight control and other behaviours requiring self-regulation (Milyavskaya, Inzlicht, Hope, & Koestner, 2015). Meanwhile, while research is uncovering the neuro-affective mechanisms by which autonomous motivation influences self-regulation (Legault & Inzlicht, 2013), more SDT-based intervention research is needed to further support (or reject) the benefits of such an approach and, perhaps more importantly, its parameters of effectiveness.

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original article

Novel technologies and weight loss maintenance

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Novel technologies can help us to understand and change human behaviour. Alongside traditional behaviour change intervention delivery such as face-to-face interventions, recent technological advances can be used to support people in their change efforts. The advantages of novel technologies include wide reach, scalability to large population segments, and potential cost-effectiveness. Examples of novel technologies are web-based information and support platforms; phone or text messaging systems; mobile phone applications (i.e. apps); monitoring devices including weight tracking scales; activity monitors and sensors; and social media, such as Twitter and Facebook. Many novel technologies have been explored and systematically reviewed in the context of weight management; however the research on the use of technology to maintain weight loss is still limited.

Novel technologies to change weight related behaviour

Behavioural weight management interventions have used a range of novel technologies and typically show positive but small effects. Web-based interventions can lead to significant small weight loss and engagement with website features is usually associated with greater weight loss (Neve, Morgan, Jones, & Collins, 2010). A systematic review of web-based interventions promoting health behaviours (including physical activity and dietary behaviour) found that interventions that employ a greater number of behaviour change techniques (BCTs) and use additional methods of contact, especially text messages, tended to have larger effects (Webb, Joseph, Yardley, & Michie, 2010). Text messaging interventions for weight management are typically a well received and commonly accepted medium of communication within interventions, although their evidence for effectiveness is varied (Shaw & Bosworth, 2012). A meta-analysis examining behaviour change following text message interventions found small, positive, and significant effects (0.29) which were greater when multiple messages per day were sent (0.39) (Orr & King, 2015). The effectiveness of text messaging for weight loss maintenance is currently unknown.

Mobile phone apps to support weight management have shown promising effects (Årsand et al., 2012; Okorodudu, Bosworth, & Corsino, 2014). However, weight management apps often include only a limited number of behavioural strategies, delivering insufficient evidence-informed content (Breton, Fuemmeler, & Abroms, 2011; Pagoto, Schneider, Jojic, DeBiasse, & Mann, 2013). One review of 204 apps coded presence of 13 evidence-informed practices for weight control and only a small number of apps (15%) had five or more of the 13 practices (Breton et al., 2011). Another review of the top 20 paid and 20 unpaid physical activity and/or dietary behaviour apps found that these included 8 BCTs on average which was higher for paid versus unpaid apps (10 vs. 7 BCTs) (Direito et al., 2014). The most frequently included BCTs were providing instructions (16/20), setting a graded task (14/20), and prompting self-

monitoring (12/20). Several behavioural strategies that improve motivation, problem solving and help to reduce stress, were omitted from apps despite promising favourable evidence suggesting inclusion (Pagoto, Schneider, Jojic, et al., 2013).

Devices that can be used to support weight management include weight tracking scales, activity monitors and sensors. A wide variety of methods have been used to perform self-monitoring, mainly focusing on diet, exercise, and self-weighing (Burke, Wang, & Sevick, 2011). Weight tracking can be performed using digital scales that detect weight automatically and provide output to platforms such as websites or apps (Gilmore, Duhé, Frost, & Redman, 2014). Users can monitor their performance on a personal online platform which can be accessed via app. Devices usually synchronises with the platform via Bluetooth. The same principle works for activity trackers. Weight and activity trackers can be synchronised together and can also link to a food diary, which can be self-reported (e.g. taken from a food database) or imputed with QR code-scanning technology (Yusof & Iahad, 2012). Recent studies have shown that individuals want to use and control their personal sensor data, although only some of the commercially available devices provide this facility; and personal preferences varied across different devices (Barua, Kay, & Paris, 2013). Users of novel devices and sensors have joined a new era of weight management, often relying on technology to support weight loss and weight loss maintenance.

Social media is becoming increasingly popular and could play a role in aiding weight loss, shaping public opinions and promoting healthy behaviours, but evidence on the full potential still needs to be established. A recent study showed that the brief exercise #PlankADay can spread via social networks and can be tracked and reinforced online (Pagoto, Schneider, Oleski, Smith, & Bauman, 2013). However, social media can also have a negative impact, mainly due to the anonymity of users (Christopherson, 2007). A study conducted to describe social media interactions regarding excess weight, collecting two months data and gathering 2.2 million posts, showed that Twitter represented the most common channel to talk about excess weight (Chou, Prestin, & Kunath, 2014). Both Twitter and Facebook were dominated by negative messages stigmatising people in relation to their body weight; blogs and forums contained more restrained comments (Chou et al., 2014). Social media are yet to be explored through research on weight loss maintenance.

The possibilities of novel technologies to change behaviour

The use of novel technology in weight management programmes can lead to improved long-term results, and in most cases improved cost-effectiveness (Gilmore et al., 2014). In a review of technology-based weight management interventions, the following key components were identified: self-monitoring; feedback and contact with an expert; social support; and structured, individually tailored programmes (Khaylis, Yiaslas, Bergstrom, & Gore-Felton, 2010). Short-term results from weight-loss interventions using these components and employing technology have been promising. However, long-term results are more mixed and still need further investigation (Khaylis et al., 2010). Although increasingly popular, weight maintenance technologies may lack comprehensive evidence-informed recommendations and rigorous evaluations for healthy weight management (Breton et al., 2011). Currently there are no industry standards for technology developers who provide support for health behaviour change and maintenance. An evidence-based framework for technology developers and programme providers combining up-to-date evidence from health psychology, public health and digital science could

substantially improve weight outcomes at the population level. Evidence clearly suggests that modern technology can be used to change weight-related behaviour so rather than blaming technology for recent population weight increases, technology and recent innovations can be used as part of the solution to combat the obesity epidemic.

Practical examples

Novel technologies provide researchers with new possibilities to understand and change behaviour. Health psychologists are now able to gain access to data that can be gathered unobtrusively and frequently, e.g. through ecological momentary assessment. Pen-and-paper questionnaires are often being replaced by information gathered through devices and sensors and by assessment delivered directly to the mobile phone, computer or tablet. Instant delivery of BCTs such as prompting and feeding back in relevant contexts is now possible due to novel technologies.

An example of using novel technology to understand weight loss maintenance is a recent N-of-1 study which followed participants for half a year, asking daily questions about cognitions such as motivation, confidence, habits, and providing participants with wireless activity monitors and scales gathering daily data on objectively measured outcomes. Each participant was provided with a personal report on the most important predictors of weight loss maintenance, which formed the basis of a discussion about people's views on their weight management efforts (Kwasnicka, Dombrowski, White, & Sniehotta, 2015). Another example of using technology to change and support people to maintain weight loss is the NULevel trial which provided participants with wireless scales and then used pre-defined algorithms to recognise when participants regain their weight and to support them at the times when the support is most needed (Evans et al., 2015).

Future research possibilities and challenges

The use of novel technologies to understand and change behaviour in research is just starting and early evidence is promising. The potential of these innovations to support and shape healthy lifestyle is tremendous with new innovations being developed at a rapid pace. However, with this change come practical and ethical challenges that need to be addressed. Health psychologists will need to collaborate within interdisciplinary teams as the technical skills required are beyond our discipline. Moreover, the design and testing of evidence- and theory-based interventions is typically slow and rigorous process, often taking years. In the context of a rapidly changing field such as novel technologies these approaches might lead to interventions which are outdated before they have been fully developed and tested. Further, the collection of vast amounts of data requires skills to analyse and summarise findings in line with research, which in itself can be a time consuming and complex process. Finally, much of the data we can now collect is sensitive and personal in nature so researchers need to do their upmost to protect participants and their privacy at all times.

In summary, novel technologies have already revolutionised the way we conduct behaviour change research and will continue to do so in the future. Health Psychology should be at the forefront of ensuring that these possibilities are used in a way to help us test and develop our theories and apply our science to impact long-term behaviour change to combat the large public health challenges such as weight management.

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original article

Baseline comparisons and covariate fishing: Bad statistical habits we should have broken yesterday

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Introduction

Checks on baseline differences in randomized controlled trials (RCTs) are often done using null-hypothesis significance tests (NHSTs). In a quick scan of recent publications in the journal Psychology and Health, from 2015 to most recent (accessed 4-2-2016), I noticed that it is common for RCTs to include results of NHSTs on baseline variables, and this tendency seems pervasive throughout the literature. In itself, the enterprise of establishing baseline similarity across conditions is a worthwhile venture, since empirical conclusions based on non-comparable samples would hamper progress in the field. The ability of RCTs to provide unbiased estimates of causal relationships between variables is crucial for scientific progress. Poor tests of theory, misguided follow-up research, misapplication of theory in practice, and waste of research funds: all hang in the balance.That being said, the use of NHSTs to establish the degree of baseline similarity is inappropriate, potentially misleading (Altman & Doré, 1990; De Boer, Waterlander, Kuijper, Steenhuis, & Twisk, 2015; Roberts & Torgerson, 1999; Senn, 1994), and, simply, logically incoherent.

NHSTs on baseline variables are often done under the guise of 'establishing whether randomization was successful', or 'identifying potential confounds and covariates to control for in further analyses'. Despite a large number of authors (e.g. Altman & Doré, 1990; Austin, Manca, Zwarenstein, Juurlink, & Stanbrook, 2010; De Boer et al., 2015; Roberts & Torgerson, 1999; Senn, 1994) who have argued against the use NHSTs to compare baseline differences in RCTs, or as basis for covariate selection, the habit appears hard to eradicate. De Boer et al. (2015) speculate that a we-do-as-others-do tendency, perhaps a form of Bandurian learning, might underlie the persistence of researchers, reviewers, and editors to report and request such tests.

In what follows, I discuss several issues related to this practice, including 1) whether the use of NHSTs as a method of checking randomization procedures is appropriate, and 2) whether selection of covariates is feasible on this basis. The arguments described here are not new or complex, but worth repeating given the persistent habit to involve NHSTs in baseline comparisons. Alternatives and suggestions for improvement on both of the above points will be briefly discussed.

Testing for baseline differences

The CONSORT statement (Moher et al., 2010), to which many medical and epidemiological journals adhere, explicitly states that NHSTs should not be used to test for baseline differences. Instead, descriptive information about baseline data across conditions, combined with proper description of randomization procedures should be given. This statement does not simply follow arbitrary convention, but is rooted in the logic that NHSTs can only result in type I – errors (falsely rejecting a true null hypothesis). To illustrate this, consider first that in a random assignment procedure the samples are by definition drawn from the same population, since all variables have the same

expected means and distributions across samples. For a given variable, both sample means are thus estimators of the same population parameter. Of course, in a single randomization, sample estimates can show large fluctuations on specific baseline variables; depending on the population standard deviation (σ), and size (n) of the samples.

Accordingly, researchers often proceed testing these observed baseline difference for significance, and this is where practice runs into a logical caveat. There is nothing against calculating descriptive statistics to check baseline similarity across groups, including an appropriate test–statistic and a corresponding probability (p). The p-value then tells us something about how likely a given baseline difference is, given that we are randomizing individuals from the same population into samples of size n[1]. However, to involve this p-value in a null-hypothesis test against a rejection criterion (a significance level of .05, say) - a move towards inferential statistics - is logically incoherent.

Consider a two-group t-test comparison on a scale level baseline variable. To easily spot the error, the tested null-hypothesis on baseline similarity (i.e. h0: $\mu 1=\mu 2$), can also be phrased as: "Both samples come from the same population", which – as described above- we already know is the case given random assignment. Thus, when researchers decide to reject the null-hypothesis of baseline similarity in a RCT (given $p < .05$), they are in effect implying that samples drawn from the same population are not from the same population[2]. Because this is a logical contradiction, the only conclusion that follows from a significance conclusion on baseline dissimilarity is that a Type-I error has been made. Indeed, it seems quite bizarre to examine the evidence against a null-hypothesis that a priori we know to be true in RCTs.

The above argument, of course, hinges on the notion that randomization used in a particular study was in fact truly random (i.e. the study is in fact a RCT). To determine this, researchers should consider whether the procedure used to randomize resulted in a given person drawn from the population to have equal probability of being assigned to each group. For example, a simple randomization procedure in which a set of random numbers is generated using computer software can impossibly be biased – i.e. given a proper algorithm underlying the number generator. To inform reviewers and readers about whether 'randomization was successful', researchers should thus refer to the method of randomization instead of supplying NHSTs.

There are instances where a randomization procedure does not guarantee that the samples in a study reflect the same baseline population originally randomized into an RCT. In this sense randomization is a necessary, but not sufficient reason to assume an unbiased estimate of an experimental effect. For example, individuals with specific characteristics might be more prone to drop out in one of the conditions (due to the condition). Such missing data resulting from non-random drop out complicates matters further, and might require additional steps in order to ensure an unbiased estimate of an experimental effect (Groenwold, Donders, Roes, Harrell, & Moons, 2012).

There are other (randomization-related) circumstances where researchers would need to control for baseline differences. In the case of non-randomized pre-test / post-test designs, though, the question is whether this should be done using analysis of covariance (ANCOVA) or analysis of variance (ANOVA) using change scores (see for discussions, Van Breukelen, 2006, 2013). In RCTs, the crucial point is that randomization issues – and potential bias - can be anticipated by scrutinizing the RCT methodologically (the potential for

1 I leave aside, though, whether probability information of finding specific sample differences in a single randomization is actually informative.
2 This violates a fundamental doctrine of logic: something either is, or is not, and if something is, it cannot be that it is not.

selection bias, missing not at random, and the chosen randomization method) and not statistically using NHSTs.

Covariate selection in randomized controlled trials

Although NHSTs on baseline variables are meaningless in RCTs, this does not imply that chance differences on baseline variables cannot influence the estimate of an experimental effect. In randomized studies, baseline variables (such as demographics, trait measures, and pre-measures of outcome variables) are very often included using ANCOVA models, which applies a linear adjustment to the experimental effect, correcting for between-groups differences on the covariate. As discussed, the decision to include a covariate should not be made based on NHSTs. Moreover, this decision should also not be based on probability values of group differences on a potential covariate. Small p-values for baseline differences do not imply that a particular covariate is worth including a model. Instead, the size of the association between covariate and outcome (in terms of coefficient r, or other standardized indices of effect size) are more clear indicators of a covariate's potential contribution.

It is worth noting that the inclusion of covariates in RCTs (due to randomization) rarely alters conclusions about the size of an experimental effect in the population, i.e. adjusts for confounding. However, adjustment for covariates might affect conclusions about the significance of an experimental effect, due to the resulting increase of statistical power by reduction of error variance. The value of ANCOVA models in RCTs, then, lies in the potential of covariates to decrease the error variance in the outcome variable, not so much in decreasing bias of the estimate of an experimental effect (Van Breukelen & Van Dijk, 2007). This notion is of importance in deciding to include covariates in the analyses, since an imbalance of a covariate across conditions, i.e. the association of a condition variable (X) and covariate (C), is less relevant for the power to detect an experimental effect than the strength of the relationship between the covariate (C) and the outcome variable (Y). The correlation between a covariate and outcome is, thus, a more relevant criterion for inclusion in a model than the existence of baseline differences on the covariate.

When covariates are selected on the basis of substantial influence (as opposed to significance) on an outcome variable, it is unlikely that researchers run into these in an exploratory fashion. Instead, such variables are included in the study protocol in the first place because of the literature suggesting their relevance. In this sense, covariate selection should always be confirmatory, and be included in the study protocol and analysis regardless of any baseline differences (Senn, 1994). Inclusion of covariates on the basis of sample information, indicating baseline dissimilarity across conditions, or an unexpected effect on outcome (Y) is at best statistically suspect, and is an unwarranted form of covariate fishing. This habit might lead meaningful covariates (with an hypothesized, perhaps replicated effect on the outcome variable) to decrease in their potential contributions to the model. In addition, the inclusion of such 'fished' covariates leads to a loss of parsimony, and meaningless corrections to the estimated experimental effect. In sum, two suggestions for improvement of RCT analysis arise from the above discussion:

1) There is no scientific justification for using NHSTs as a tool to establish baseline comparability; researchers should stop doing it, and reviewers and editors should stop asking for it.

2)Covariate selection should be made solely a priori and based on importance of association – implying that covariates should be specified in advance in the study protocol and listed in papers' methods sections.

These recommendations endorse those by previous authors (e.g. Austin, Manca, Zwarenstein, Juurlink, & Stanbrook, 2010; De Boer et al., 2015; Roberts & Torgerson, 1999; Senn, 1994). In following these recommendations, researchers can increase the statistical power to detect an experimental effect in RCTs, and in a non-optimal world of NHSTs this could potentially change a dichotomous significance conclusion. But, the size of experimental effects can (and should) be interpreted independently from any covariates in RCTs, using effect size indices, foremost those that are insensitive to error variance magnitude (e.g. eta-squared, though not a partial eta-squared[3]). For properly powered RCTs, interpretation of such effect size indices is not affected by the inclusion of a priori selected covariates (i.e. not beyond inconsequential changes in the point estimate and corresponding confidence intervals). Therefore, when discussion of results shifts the focus to such indices instead of significance, this arguably renders the use of ANCOVA models in RCTs of little value altogether.

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3 I'm not making the argument that a non-partial eta-squared is statistically superior to the partial variant. Instead, given that partial eta-squared is more sensitive to the inclusion of covariates (because it is based on the condition versus error sum of squares ratio; an error term that decreases with every covariate added), this measure might be more rewarding to the practice of covariate fishing than the regular eta-squared.

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