Application of Elaborated Intrusion Theory to the Measurement and Enhancement of Motivation in Type 2 Diabetes

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Abstract

Background

Serious health-related complications from type 2 diabetes may be prevented or minimised from lifestyle adjustments to diet, physical activity and routines such as glucose monitoring. Adherence to treatment regimens is poor, therefore an improved understanding of the mechanisms involved in adherence is needed to enhance patient care and improve clinical outcomes. Additionally, accessible and cost-effective methods of healthcare delivery, such as web-based support, are needed to meet the growing demand for services.

Since substantial effort is required for behaviour change, motivation is likely a critical factor in establishing health-promoting routines. However, a unified definition is lacking in the literature, leading to suboptimal assessment and intervention for motivation. Additionally, there are limited holistic web-based interventions that support self-management and psychological wellbeing.

Elaborated Intrusion (EI) theory posits that motivation begins with intrusive cognitions about a goal. Elaboration through subsequent mental imagery increases desire for its acquisition. The four components of this theory—(i) strength of desire (intensity), (ii) imagery of working towards and reaching the goal (imagery self-efficacy) (iii) imagery of outcomes from achieving the goal (imagery incentives), together with (iv) the extent that these cognitions are accessible (availability)—have informed the development of a measurement instrument (Motivation Thought Frequency scale, MTF) and intervention for motivation enhancement (Functional Imagery Training, FIT). The 13-item MTF measures the frequency of cognitions about desire intensity, imagery self-efficacy, imagery incentives and availability. FIT teaches participants to elaborate on imagery self-efficacy and incentives to increase motivation for a behavioural goal, and interrupt intrusive desires that compete with this goal. These central tenets of imagery intrusion and elaboration have demonstrated utility

in identifying and modifying motivation for a healthy diet and activity in the general population. The theory therefore has relevance to lifestyle adjustments required for diabetes management, and targeting these cognitive processes may improve regimen adherence. EI theory has not previously been applied to motivation for self-management behaviours in diabetes.

Aims

The aim of this thesis was to improve the assessment of a patient's desire for adherence, and increase rates of regimen adherence in diabetes, by generating a measure of motivation and an intervention to enhance motivation. This was achieved through the application of EI theory to a type 2 diabetes management context. Specifically, the objective of Study 1 was to tailor the MTF scale to the adherence goals of diabetes patients and assess its ability to predict related self-care behaviours. The objective of study 2 was to test whether the addition of FIT to a web program for diabetes enhanced adherence motivation and self-care. Secondary aims were to examine the perceived utility and acceptability of this intervention through qualitative feedback, and evaluate the efficacy of the web-based self-management support program in modifying behaviour and improving physical and mental health.

Method and Results

A confirmatory factor analysis was conducted on the MTF scales for glucose monitoring, physical activity and healthy eating, in a sample of 340 patients with type 2 diabetes. A 4-factor internal structure that was consistent with EI theory and previous research (factors: Intensity, Self-Efficacy Imagery, Incentives Imagery and Availability) was found for all three behavioural goals. Subscales correlated positively with the concurrent relevant self-management behaviour.

A randomised controlled trial with 237 type 2 diabetes participants tested a web-based program, OnTrack Diabetes, and the EI theory-grounded motivation intervention, FFIT. FIT

focused on a participant-selected behavioural goal related to diet or activity modification. No benefits from the addition of FIT to the web intervention were observed, but greater use of the OnTrack program reduced weight and lowered 3-monthly glucose readings.

Qualitative feedback on FIT indicated that participants appreciated features of the intervention that were consistent with motivational interviewing, but wanted additional strategies to deal with cravings, a written rationale and instructions on FIT, and greater variety with imagery cognitions.

Conclusion

EI theory provides a partially accurate account of motivation for behaviour change in diabetes. The MTF scales may have clinical utility in assessing desire for health behaviours and adherence to these regimens. However, their longitudinal predictive utility and sensitivity to change in diabetes requires further supportive evidence. FIT is perceived as engaging and helpful but may not sustain behaviour change in diabetes. EI theory possibly accounts for initiation of behaviours and later resistance to situational challenges better than behaviour maintenance, which is perhaps a greater need in diabetes than motivation. OnTrack Diabetes may be a useful supplementary tool for promotion of metabolic change.

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Accepted Manuscripts

Parham, S. C., Kavanagh, D. J., Gericke, C. A., King, N., May, J., & Andrade, J. (2016). Assessment of Motivational Cognitions in Diabetes Self-Care: The Motivation Thought Frequency Scales for Glucose Testing, Physical Activity and Healthy Eating. *International Journal of Behavioral Medicine.* 1-10. doi:10.1007/s12529-016-9607-2

Submitted Manuscripts

Parham, S. C., Kavanagh, D. J., King, N. Andrade, J., May, J., Gericke, C. (under review). Effects of a Diabetes Web-Based Program and Functional Imagery Training: A Randomised Controlled Trial. *Diabetes Care*

Parham, S. C., Kavanagh, D. J., Shimada, M., May, J., Andrade, J. (under review). Qualitative analysis of feedback on Functional Imagery Training: A novel motivational intervention for type 2 diabetes. *Psychology & Health*

Ancillary Publications

Cassimatis, M., Kavanagh, D.J., Hills, A.P., Smith, A.C., & Scuffham, P.A., Gericke, A., & **Parham, S. C**. (2015). Study protocol of the OnTrack Diabetes project: Randomised trial of an automated, interactive, web-based type 2 diabetes self-management and dysphoria intervention. *JMIR Research Protocols*, 4, e27

List of Abbreviations

AIHW	Australian Institute of Health and Welfare
EI theory	Elaborated Intrusion Theory
FIT	Functional Imagery Training
HbA1c	Glycosylated haemoglobin-A1c
MI	Motivational Interviewing
MTF	Motivation Thought Frequency scale
RCT	Randomised Controlled Trial

Statement of Original Authorship

The work contained in this thesis has not been previously submitted to meet requirements for an award at this or any other higher education institution. To the best of my knowledge, the thesis contains no material previously published or written by another person except where due reference is made.

QUT Verified Signature

Signature

Date: 05.05.2017

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CHAPTER 1

Introduction and Overview of Thesis

1.1 Research Problem

Lifestyle plays a critical role in health, and is becoming an acute issue in disease prevention and management. Physical inactivity, prolonged sedentary behaviour and high consumption of nutrient poor food are contributing to the rapid development of diabetes (Global Burden of Disease Study, 2013). There has been a 40% increase in prevalence of all diabetes types since 1980 (World Health Organisation, 2016), and this incline reflects higher rates of overweight adults and obesity across all nations. With an aging population, and current lifestyle trends, it is predicted that the prevalence of type 2 diabetes will continue to rise (Allen, Frier, & Strachan, 2004).

Type 2 diabetes is a chronic condition with deleterious physical, emotional and financial consequences. However, the impact of the disease and intensity of negative outcomes is to some extent dependent on the patient. Worse outcomes are associated with higher weight, poor diet and insufficient physical activity, and adherence to appropriate behavioural health goals reduces chances of premature mortality and diabetes related complications (Shaw & Chisholm, 2003). This in turn alleviates the financial burden of requiring regular medical assistance and the societal demand for physician support (Ritzwoller, Toobert, & Sukhanova, 2006). Further, there is evidence for adequate management improving psychological wellbeing (Penckofer, Doyle, Byrn, & Lustman, 2014), although greatest benefits are observed when this domain is additionally targeted. In summary, the physical, mental and economic burden of the disease can be significantly reduced with effective self-management.

Adherence to regimens is a serious public health issue, since only half of all patients reportedly implement their treatment plans (Sabaté, 2003). To reduce the global burden of this disease, and enhance patient self-management, it is therefore essential that researchers and clinicians have a coherent understanding of the processes that underpin motivation for adherence and behaviour change. Consequently, interventions should be informed by this theoretical understanding. The central aim of this thesis was therefore to apply a novel health theory to the measurement and management of motivation in type 2 diabetes, and evaluate the efficacy of a web-based program in supporting adherence to management practices.

1.2 Type 2 Diabetes

1.2.1 Definition and aetiology

Type 2 diabetes is a chronic disease that develops when there is insufficient insulin production and/or ineffective insulin use in the body. Insulin is crucial for converting glucose contained in food into energy. Consequently, a diagnosis of diabetes is based on the concentration of glucose in the blood. A reading of 11.1 mmol/L on a random blood test or 7.0 mmol/L on a fasting blood test, with symptoms such as dizziness, increased thirst and fatigue is sufficient for a diagnosis (Colagiuri, Davies, Girgis, & Colagiuri, 2009).

There are multiple risk factors for the disease, including biological, environmental and behavioural contributors. There is evidence for genetic predisposition and a higher prevalence in lower socioeconomic areas (Birnbaum, 2005; Tanamas et al., 2013). However, critical modifiable determinants specifically found in the Australian population were overweight/obesity, and inactivity (< 149 mins were week) (Tanamas et al., 2013). For the patient, it is therefore important to target these domains.

1.2.2 Prevalence

It is estimated that 347 million people suffer from diabetes world-wide, with 90% of this population experiencing type 2 rather than type 1 diabetes (World Health Organisation, 2013). If current trends continue in the United States, and unhealthy lifestyle habits remain unchanged, it is anticipated that one in four people will have type 2 diabetes by 2050 (Boyle, Thompson, Gregg, Barker, & Williamson, 2010). An estimated 848,000 Australians suffered from Type 2 diabetes in 2011-12 (Australian Institute of Health and Welfare [AIHW], 2014). Since 1981, the number of cases has more than doubled, indicating a likely upward trajectory of incidence in this country (Tanamas et al., 2013). In an Australian longitudinal national population-based study (AusDiab Study), the prevalence of depression was 65% higher in patients with type 2 diabetes when compared to people without diabetes (Tanamas et al., 2013). Likewise, anxiety and stress are two-three times more prevalent in diabetes patients (Fisher et al., 2008).

1.2.3 Impact on physical and mental health

Diabetes is currently a primary cause of blindness, amputation and kidney failure in communities with inadequate medical facilities, and among individuals who are poorly educated about diabetes (WHO, 2013). Prolonged duration is associated with multiple negative health outcomes, including cardiovascular disease, stroke, and dementia (AIHW, 2015; Allen et al., 2004; Feil, Zhu, & Sultzer, 2012; Messier, Tsiakas, Gagnon, & Desrochers, 2010). There are also higher rates or mortality and in Australia, patients over the age of 60 with diabetes are more likely to have both cognitive and physical deficits than their peers without diabetes.

There is an association between co-morbid depression, anxiety and stress and inadequate self-management (Gonzalez et al., 2008), which increases the risk of diabetes-related complications (Anderson et al., 2002; de Groot, Anderson, Freedland, Clouse, &

Lustman, 2001). There appears to be a bidirectional relationship between depression and diabetes (Nouwen et al., 2010). Low mood may be secondary to receipt of the diagnosis due to awareness of disease progression or the demanding health regimen required to manage the condition (Renn, Feliciano, & Segal, 2011). Conversely, characteristics of depression such as inactivity from low mood may contribute to the development of diabetes (Golden et al., 2008).

Anxiety is associated with elevated blood pressure, and therefore may account for some of the fluctuation in glucose levels in diabetes. Indeed there is evidence for poorer control in patients with anxiety (Lloyd, Dyert, & Barnett, 2000), and that treatment of anxiety can improve overall glycaemic control (Lane, McCaskill, Ross, & Surwit, 1993). The relationship between anxiety and diabetes is likely bidirectional, but this is not as extensively documented (Grigsby et al., 2002). Management of mental health in diabetes is further complicated by the fact that medication for depression and anxiety can effect glucose levels (Lustman et al., 1995; Lustman et al., 1997).

Finally, stress can directly impact on glycaemic control through release of sugars into the blood, and indirectly through over-eating or inactivity in response to specific stressors (Cox & Gonder-Frederick, 1992). Navigating efficient self-care, coping with frustrations of fluctuating glucose despite adequate management, and anticipation of long-term negative outcomes are common occurrences for patients with diabetes, and each contribute to elevated stress in the individual (Morris, Moore, & Morris, 2011). The complex interrelationship between physical and mental health in patients with diabetes warrants an integrated approach to treatment.

1.2.4 Treatment

A seminal study by Tuomilehto and colleagues (2001) demonstrated the prevention of type 2 diabetes in high-risk patients through lifestyle modification. The results highlight the

importance of managing blood glucose through weight, diet and activity. Effective management prevents adverse outcomes and protects against diabetes-related health complications. In fact, mortality rate risks following intentional weight loss in obese patients with diabetes were reduced by 25% (Aucott et al., 2004). Since weight loss enhances the body's sensitivity to insulin, it is a critical feature of diabetes care, and can be targeted through nutrition and exercise (Dyson, 2008).

A healthy diet not only supports weight loss and modifies glucose tolerance, but also maintains stable blood pressure (American Diabetes Association, 2007). It is thereby an essential component of self-care. However, effective dietary interventions are heterogeneous, with nutrient targets spanning fat, carbohydrates, fibre, protein, fruit and vegetables (Povey & Clark-Carter, 2015). Behaviour change in this area has been achieved through education, meal planning, goal-setting and assessing barriers to a healthy diet (Glasgow et al., 1997; Perry et al., 1997; Tan, Yong, Wan, & Wong., 1997), and facilitation of health-promoting decision-making appears to be the critical feature of successful dietary interventions. This in combination with education should be integrated into nutrition-related diabetes management supports.

Outcomes from physical activity mirror many of the benefits associated with a healthy diet, including, enhanced insulin sensitivity improving glycaemic control, weight loss, and stabilising blood pressure (Hayes, Herbert, Marrero, Martin, & Muchnick., 2008). In addition, activity can reduce the severity of stress and anxiety (Albright et al., 2000). It is recommended that Australians undertake 30 minutes of moderate intensity activity most days of the week (Department of Health and Aged Care, 1999). Specifically, research suggests that 150 minutes or more of this sort of activity is sufficient for maintaining health (AIHW, 2003). Benefits have been found not only from structured exercise, but also from incidental activity, such as walking to the shops, and moderate activities such as gardening and house

chores (Pratt, 1999). These latter modes of activity may be more acceptable in diabetes cohorts, where common characteristics such as obesity and hypertension may prevent engagement in prolonged vigorous exercise. Overall, promotion of regular physical activity is essential.

Cognitive-behaviour therapy (CBT) techniques such as relaxation and behavioural activation have been shown to be effective in reducing symptoms of depression, anxiety and stress in patients with type 2 diabetes (Fisher et al., 1982; Penckofer et al., 2014; Surwit et al., 2002). Additionally, physical activity in isolation or in conjunction with CBT can have a beneficial impact on mental health for these patients (de Groot et al., 2012; Morris et al., 2011). Behavioural interventions can improve both biological markers of health such as HbA1c (3-monthly blood glucose readings) and weight, and psychological outcomes such as diabetes distress (Plack, Herpertz, & Petrak, 2010). However, there is a need for interventions that specifically target both behavioural and psychological health (Wang, Tsai, Chou, & Chen, 2008).

1.2.5 Adherence

Adherence in chronic disease management is the degree to which treatment recommendations are followed (Haynes, Ackloo, Sahota, McDonald, & Yao, 2008), where changes to target behaviours are determined by the patient and practitioner (Matthews, Arnedt, McCarthy, Cuddihy, & Aloia, 2013). This collaborative approach is distinguished from compliance, which implies passive adoption of professional advice (Matthes & Albus, 2014; Matthews et al., 2013). In developed countries, the World Health Organisation (WHO) estimates that 50% of patients do not adhere to their negotiated health regimens (Sabaté, 2003). Non-adherence impacts the trajectory of patient health (DiMatteo, Haskard, & Williams, 2007), and the high prevalence places a resource and financial burden on the public health system (Jones, Smith, & Llewellyn, 2014).

A number of factors contribute to non-adherence to treatment protocols. Complexity of the routine can impact upon the patient's ability to remember all requirements and their capacity to persevere (Haynes et al., 2008). The degree to which the regimen is perceived as interfering in daily life can influence motivation to follow procedures (Kääriäinen, Paukama, & Kyngäs, 2012). Additionally, patients who feel that the modifications have been imposed on them, rather than jointly constructed, seem less inclined to commit to the changes (Matthes & Albus, 2014). Non-adherence can also depend on the perceived importance of the modifications, and the perceived risk associated with a condition (Matthews et al., 2013). Similarly, anticipated benefits or costs associated with making a change can affect the extent to which suggested modifications are adopted (Matthews et al., 2013). Individual temperament, such as psychological health, or a propensity to engage in maladaptive behaviours, can also predict non-adherence (Mackin & Areán, 2007; Novicka et al., 2010). Finally, management fatigue may arise from minimal improvements despite attempts to adhere. This often leads patients to "self-blame" and discontinue with their regimen, despite an initial desire for change (Beverly et al., 2012).

Interventions for chronic disease management have found that addressing these factors can improve adherence. For instance, simple regimens elicit better adherence (Safren et al., 2014), as do routines that are integrated with usual daily structures are more likely to be completed (Kääriäinen et al., 2012). Patient input appears to be important when determining the course of treatment. This may be because involvement in the planning process promotes patient autonomy in managing their health (Matthes & Albus, 2014). Alternatively, it could be that the collaborative process allows the patient to feel supported, and a sense of illness-support has been shown to greatly enhance adherence (Nicklett & Liang, 2010).

In summary, type 2 diabetes is a chronic condition that requires adherence to a complex regimen. The process can therefore be taxing for individuals. A review of

interventions for diabetes (RCTs, controlled clinical trials, before-after, and epidemiological studies), found that none significantly increased adherence to treatment recommendations (Vermeire et al., 2005). As the authors suggest, this results may have been partly due to an exclusive reliance on biological markers, rather than directly measuring health behaviours. Thus, research on improving diabetes-care through self-management has to date produced variable results, with poor evidence for behaviour change (Pal et al., 2013). Further, current interventions have not appeared to successfully manage the emotional health of participants. Consequently, there is a need for the development of an intervention that offers emotional support and specifically targets and measures behaviour change in all domains associated with type 2 diabetes care: dietary choice and quantity of consumption, physical activity, and blood testing adherence.

1.2.6 Web-based interventions

Health support through web-based programs offers a unique opportunity for practitioners to assist a high volume of patients in a cost-effective and accessible format (Brownson, Hoerger, Fisher, & Kilpatrick., 2009). This mode of delivery may be particularly helpful for patients with mobility troubles or limited access to care. Web-based behaviour change interventions have been found to be as effective as face-to-face treatment across a range of domains (Goode, Lawler, Brakenridge, Reeves, & Eakin, 2015; van Bastelaar et al., 2011). In some instances, the addition of web-based treatment to usual care enhances clinical outcomes (Polzien, 2006). There is evidence for both short-term and long-term behaviour change following implementation of web supports that include health behaviour reminders (Naughton et al., 2014), health education (Kanera et al., 2017), and tailored decision-making (Friederichs et al., 2015). Greatest effects are observed when these elements are combined (Glasgow et al., 2010).

In diabetes, there is separate evidence for program effectiveness on physical (Ramadas, Quek, Chan, & Oldenburg., 2011) and emotional outcomes (van Bastelaar et al., 2011). Few studies provide integrated treatment for self-management and distress (Markowitz, Gonzalez, Wilkinson, & Safren, 2011). Diabetes education, self-monitoring and behaviour modification recommendations appear central to most web-based interventions (Glasgow et al., 2010; Lim et al., 2011; Quinn et al., 2008; Quinn et al., 2011; Wise, Dowlatshahi, Farrant, Fromson, & Meadows, 1986; Yoo et al., 2009). In online randomised controlled trials (RCTs), most studies have shown an improvement in glycaemic control, although this change was not always accompanied by significant modification to lifestyle behaviours (Lorig et al., 2010; Quinn et al., 2008). Interventions differ in treatment foci, and few studies have attempted to support psychological wellbeing, or examined the relationship between lifestyle modification and emotional health. There is a need for a web-based program that supports adherence through lifestyle modification, but also addresses psychological distress.

1.3 Motivation

Motivation is a construct poorly defined, measured and targeted in individuals with type 2 diabetes. It is involved in establishing and sustaining behaviours that bring about particular goals (Chen, Creedy, Lin, & Wollin, 2011; Senécal, Nouwen, & White, 2000), and this involvement makes it a key determinant of self-management. In diabetes, this management typically involves modification to diet and physical activity to increase the body's sensitivity to insulin and thus reduce glucose levels in the blood (Dyson, 2008; Hayes et al., 2007). Frequent blood glucose monitoring is also recommended to allow individuals to make behavioural adjustments according to their readings (Costa et al., 2012). Substantial and sustained effort is therefore required by patients who wish to effectively manage the

condition. The disease tends to be diagnosed in older adults (>50 years), and while average age of diagnosis may be lowering (Hessler, Fisher, Mullan, Glasgow, & Masharani, 2011), diabetes remains a disease most prevalent in older adults, whose lifestyle is likely to be well established. These habits may therefore be very difficult to break.

There are variable explanations of motivation offered in the literature, and in some instances it is not defined. Its conceptualisation often involves predictors of diabetes management behaviours that may include, but are not confined to constructs that map onto accepted definitions of the term in general use (Korkiakangas, Taanila, & Keinänen-Kiukaanniemi, 2010; Salamon et al., 2012). For instance, Salamon et al. (2012) attempted to extract common themes that constitute motivation in newly diagnosed adolescents with type 2 diabetes. These themes however, appeared to be a list of external factors that increased self-care, such as high blood pressure preceding a change in diet. Roessler and Ibsen (2009) assessed self-reported motivation after a 4-month physical activity intervention for patients with type 2 diabetes. While the question asked of participants was not reported, it appeared to relate to perceived factors that made them engage in physical activity. Such an attributional question may identify triggers or incentives for initiating behaviour, but it does not sufficiently encapsulate the concept of motivation. In research that claims to measure motivation, there is a need for a coherent definition of this construct that adequately captures the desire for change.

In diabetes research, prevalent theories used to examine motivation include Self-Determination Theory (SDT) (Deci & Ryan, 1985), the Information-Motivation-Behavioural Skills Model (IMB) (Fisher & Fisher, 1992), and Protection Motivation Theory (PMT) (Plotnikoff, Trinh, Courneya, Karunamuni, & Sigal, 2009; Rogers, 1983). SDT distinguishes between motivation that is self-initiated (intrinsic or autonomous) and motivation that is triggered by external punishment or reward (extrinsic or controlled). Motivation scales

modelled on this framework, such as the Treatment Self-Regulation Questionnaire (TSRQ) (Ryan & Connell, 2007) assess the reason (internal or external) for engaging in a health behaviour. SDT theory and these clinical studies imply that reason for action is in conscious awareness. For example, someone with intrinsic motivation driven by reward might think, "I will go for a run because I will feel stronger afterwards". However, people can be aware of desires without an accurate knowledge of their determinants, which may lie outside conscious awareness. SDT provides an explanation for behaviour, but it does not account for states of motivation that may constantly be in flux.

The IMB Model for Health Behaviour Change (Fisher & Fisher, 1992) suggests that behaviour is influenced by the possession of relevant information and skills, positive personal beliefs and attitudes about the target behaviour, and social support. This framework has informed the construction of the Diabetes Fatalism Scale (DFS) (Egede & Ellis, 2009) which reportedly measures personal motivation. The scale assesses perceived despair, hopelessness and powerlessness in relation to the management and impact of diabetes. Osborn and Egede (2010) used the DFS to measure what they termed "personal motivation", and the Medical Outcomes Study (MOS) Social Support Survey (Sherbourne & Stewart, 1991) to measure "social motivation". The DFS has 3 subscales: emotional distress, coping, and self-efficacy. Rather than assessing motivation as the extent to which a person has a desire for an outcome, the DFS appears to determine patient perceptions of the effect of diabetes on their life. Likewise, the items on the MOS social support survey seem to reflect the extent to which support makes self-care more manageable and tolerable, rather than how support motivates self-care.

Fatalistic attitudes and social support can impact upon motivation. Specifically, fatalistic expectations of negative health outcomes seem to decrease motivation (Bhattacharya, 2012). This can be in part due to a lack of success after previous attempts to

self-manage (Booth et al., 2013), or in part due to a general pessimism about one's capability to change behaviour (Bhattacharya, 2012). Indeed, individuals with a clinical diagnosis of depression can tend to feel out of control and incompetent, subsequently struggling with motivation to self-manage their condition (Egede & Osborn, 2010). Depression is also associated with social isolation, which reduces motivational input from others and worsens health outcomes (Egede & Osborn, 2010). Concerns about availability of social support can also reduce motivation, through impacts on self-efficacy and the perceived likelihood of social rewards (Bandura, 1986). However, fatalism and social support cannot be used interchangeably with motivation.

The DFS and other measurements of motivation grounded in the IMB model (Fisher, Kohut, Schachner, & Stenger, 2011) assess attitudes toward the health condition and the outcome of engaging in a self-care behaviour. While these attitudes and beliefs are likely to influence motivation, they do not directly measure it. As with SDT, IMB does not acknowledge the role of unconscious determinants, and it reduces the concept of motivation to an attitude.

Protection Motivation Theory (PMT) (Rogers, 1983) was initially developed to explain health behaviour motivation, and has recently been applied to diabetes research to examine the relationship between disease threat and coping appraisal and engagement in self-care behaviours (Plotnikoff et al., 2009; Plotnikoff et al., 2010). PMT assesses the individual's perception of disease risk and management. It describes motivation as a function of (i) perceived disease threat (ii) vulnerability to disease (iii) belief in management plan, and (iv) belief in ability to execute the management plan. Together these factors appear to describe a person's readiness for action. However in practice (iii – response efficacy) and (iv - self-efficacy) are the best predictors of change (Plotnikoff et al., 2009; Plotnikoff et al., 2010). The combination of a perceived disease threat and the personal applicability of the

threat are relevant to incentives for behaviour. Furthermore, belief in ability to make a change and belief in the effect of the change are clearly critical to motivation, since receipt of positive outcomes requires the ability to attain them (Bandura, 1986). However, they may not capture all the relevant incentives (e.g. relating to family welfare or other goals), and the combination of factors does not capture overall strength of current motivation.

In summary, previous theories of motivation to manage diabetes have portrayed motivation as a conscious process that provides a reason for, attitude toward, or a belief about executing self-care behaviours. The Elaborated Intrusion Theory of Desire (EI Theory) (Kavanagh, Andrade, & May, 2005) provides an alternative framework for understanding motivated behaviour. It describes a series of cognitive-emotional processes that underpin the desire for a target and subsequently prompt action. Applying this model to type 2 diabetes will promote a new understanding of motivation for clinicians and researchers. The theory offers a unique perspective on unconscious cognitive processes and mental imagery that can inform the assessment and enhancement of motivation in patients with type 2 diabetes.

1.4 Elaborated Intrusion theory in Diabetes

1.4.1 Theoretical tenets

Elaborated Intrusion (EI) Theory (Kavanagh et al., 2005) describes desire for behaviour (such as alcohol consumption) as a cognitive-emotional process. Desires may begin as a thought about a target which is automatically activated by internal or external cues. For instance, an advertisement for a vineyard may trigger a thought about wine. If the target (wine) elicits an affective response (e.g. joy), it is typically elaborated on, leading to a multisensory experience involving imagery. That is, the individual may start to visualise having a glass of wine, how that would feel, taste, smell, and the context in which it would happen. Through recognition of the absence of the target (they don't actually have the wine),

an individual is then motivated to pursue its acquisition. The theory initially explained craving for appetitive targets including psychoactive substances (Kavanagh, May, & Andrade, 2009), but has since been successfully applied to a wide variety of domains (May, Kavanagh, & Andrade, 2015). These include food craving (Andrade, Pears, May, & Kavanagh, 2012; Kemps & Tiggemann, 2007; May et al., 2014), and more recently, functional behaviours such as dietary control and physical activity (Andrade, Khalil, Dickson, May, & Kavanagh, 2016; Kavanagh, Connolly, May, Andrade, & Connor, in submission; Lennox, Andrade, Kavanagh, & May, in submission). Poor diet and low physical activity are implicated in the aetiology and disease severity of diabetes. These lifestyle factors are behavioural and thereby under the control of the patient. EI theory identifies critical psychological processes that may largely account for behaviour change. As outlined in section 1.3, previous research on motivation for diabetes management does not adequately capture these processes, limiting the specificity and thereby effectiveness of behavioural interventions grounded in such theories. Since motivation likely prompts modification to health behaviours required for diabetes care, and EI theory accounts for initial motivational processes in health behaviour change in the general population, it is important to research this theory in a type 2 diabetes context. If applicable, EI theory principles could contribute to greater accuracy in measurement and specificity in treatment of motivation in patients.

1.4.2 Applications of EI theory

EI theory provides an explanation for target-driven behaviour, and has not previously been applied to the treatment of diabetes. According to this theory, internal and external cues trigger image-based cognitions of a target. Desire for the target may then be further increased if sensory aspects are mentally elaborated. While this elaboration induces anticipatory pleasure or relief, it also accentuates acquisition of the target. When multiple desires are

elicited concurrently (e.g. craving for a food, or desire to stay healthy), the desires compete for attention and response priority.

Based on EI theory and research on the subjective experience of desires, a questionnaire was developed, measuring desire for alcohol (Alcohol Craving Experience, ACE; Kavanagh et al., 2009), which was subsequently generalised to assess desires for any consummatory target (Craving Experience Questionnaire, CEQ; May et al., 2014). These scales consistently showed a 3-factor structure comprising intensity of craving cognitions, frequency of craving imagery, and perceived intrusiveness of these cognitions. This scale has subsequently prompted the development of a new measure of functional activities in health – the Motivation Thought Frequency scale (MTF; Robinson, Kavanagh, Connor, May, & Andrade, 2016). The MTF conceptualises motivation as a temporary cognitive state that is characterised by multisensory imagery and varies in intensity and availability. The MTF assesses the frequency of thoughts/feelings about a behavioural goal over the past week. Like the CEQ, the MTF is a generic measure and thus has the capacity to be applied to various goals.

The MTF accounts for significant variance in the reason for and expression of unhealthy snacking (Andrade et al., 2016), alcohol misuse (Robinson et al., 2016), and physical activity (Lennox et al., 2016) in the general population. The MTF may thus be relevant to the measurement of motivation for lifestyle change in diabetes, which includes a healthy diet and increase in physical activity. Greater precision in the measurement of motivation for diabetes self-management could improve clinician understanding of patients' likely engagement in adherence. This in turn could be used to determine the extent to which clinician-based motivational support is required and to assess change in motivation over time.

These central tenets of EI theory, in conjunction with principles from motivational interviewing have informed the development of a new motivational intervention, functional

imagery training (FIT). FIT attempts to increase desire for lifestyle modification by training individuals to use mental imagery of goals, strategies, and past successes. Because health goals can be temporally perceived as far away, a sense of urgency to satisfy short-term desires can lead to non-adherence with health regimens (Andrade et al., 2016). A key goal of FIT is therefore to make these long-term goals more salient through development of vivid imagery, thus supporting the individual to make healthy choices at challenging times. To date, this intervention has had positive results, but only been trialled with eating behaviour and physical activity in university samples and the general community (Andrade et al., 2016; Lennox et al., in submission). Results revealed an increase in vivid imagery for the focal behaviour, and motivation to control the respective behaviour, as measured by the MTF. Additionally, snacking behaviour and weight was reduced in the first study, and gym attendance increased in the second.

Patients are well informed about the necessary dietary and activity changes once diagnosed with diabetes, but, motivation intervention protocols for these changes are not well documented. Adherence to diabetes regimens is poor (Dyson, 2008), and low motivation for lifestyle change is a potential contributor. Since there is evidence for the efficacy of FIT in dietary and activity modification, this intervention could be applied to a diabetes sample. If effective, use of FIT in clinical settings could improve adherence and health outcomes for patients, reducing costs for the individual and healthcare services.

1.5 Chapter Summary

This chapter has reported the high, and growing prevalence of type 2 diabetes, current standards for treatment and issues with adherence due to low motivation. Variable definitions of motivation in the literature may prevent adequate assessment and enhancement of this critical process in health behaviour change. Elaborated Intrusion theory has been successfully

applied to the measurement and modification of motivation for lifestyle targets that overlap with diabetes care requirements. The theory has not been applied to diabetes self-management, but could improve clinician assessment and treatment practices for regimen compliance. This chapter thus provides the rationale for the current thesis by outlining the need for a better instrument in diabetes motivation assessment, and a new protocol for enhancing motivation. .

1.6 Thesis Aims and Objectives

One aim of this thesis was to develop tools to assess motivation for diabetic self-care, examining their internal structure and predictive validity. A second aim was to develop and test an intervention for diabetic self-care and examine its efficacy in a randomised controlled trial. Both the assessment tools and intervention were grounded in Elaborated Intrusion theory, which had established empirical support. Since low motivation partly accounts for poor healthcare adherence, this research offered a novel approach to assessing and enhancing motivation. The application of this research was to reduce the burden of type 2 diabetes and increase patient agency in their health management. Specifically, the thesis objectives were:

1. To develop an assessment instrument grounded in EI theory that provides researchers and clinicians with a clearer understanding and superior method for measuring motivation for diabetes self-management
2. To improve adherence to dietary and activity regimens using an EI theory grounded motivation intervention and a web-based self-management support program
3. To evaluate the efficacy of both interventions through behavioural/physiological measures and qualitative analysis of feedback on perceived strengths and weaknesses

1.7 Thesis Rationale and Outline

Chapter 2 summarises the key treatment domains in diabetes care and identifies intervention characteristics that underpin effective self-management support. This literature review provides a rationale for features included in our type 2 diabetes web-based program - OnTrack Diabetes, which is subsequently described. Chapter 3 comprehensively describes Elaborated Intrusion theory and its application to assessment instruments and interventions. This chapter thereby justifies development of and EI-theory grounded measurement tool for motivation in diabetes (MTF – chapter 4) and use of FIT (chapter 5) to promote motivation for self-management.

Chapter 4 describes results from a Confirmatory Factor Aanalysis (CFA) with the MTF. This scale was validated in a diabetes sample so that it could be subsequently used in the randomised controlled trial (chapter 5) to assess changes in motivation over time and the effect of the motivational intervention - FIT. The fifth chapter reports physical and psychological outcomes from the 3-arm RCT (OnTrack Diabetes vs FIT vs control). The purpose of this report was to evaluate the efficacy of both treatments. Results indicated that OnTrack may benefit physical health, but FIT did not enhance motivation or modify self-care behaviours. Feedback on FIT was obtained to better understand the patient's perception of the treatment. Therefore, Chapter 6 describes a qualitative analysis of this feedback, in order to refine this intervention for future research. Chapter 7 discusses the findings from chapter 4, 5 and 6 in relation to EI theory and suggests modifications to the MTF, OnTrack and FIT before uptake in clinical settings.

CHAPTER 2

Effect of Web-based Programs on Behaviour and Glycaemic Control

Web-based interventions have been developed for a range of behavioural and psychological targets, including diet, physical activity, depression, anxiety and stress. Features of successful interventions include patient education (Fredericks, Martorella, & Catallo, 2015), goal-directed support and self-monitoring (Kuijpers et al., 2013). There is evidence for equivalent improvement in mental health between face-to-face therapy and online cognitive behavioural therapy (CBT), however a guided treatment is more effective than self-guided (Johansson & Andersson, 2012). Elements of effective online CBT programs include psychoeducation, learning to recognise mood states and symptom management (Penckofer et al., 2014). Additionally, involvement by a therapist seems to enhance program engagement in mental health interventions as well as across other health domains (Brouwer et al., 2011). This highlights the importance of not only program content, but also the nature of its implementation. Indeed, contact from the web-server or a therapist, such as automated emails and prompts to use the program, can reduce attrition (Eysenbach, 2005). Together, this research suggests a web-based approach to treatment of health behaviour and wellbeing is promising, however, user engagement may benefit from directed interventions and facilitator involvement.

2.1 Self-Management in Diabetes

2.1.1 HbA1c

Glycosylated haemoglobin (HbA1c) comprises the binding of glucose to red blood cell molecules (i.e. haemoglobin). HbA1c can be measured to assess the average amount of glucose in the blood over the past 3 months. Healthy individuals from the population

typically have HbA1c levels between 3.5% - 5.5%, while individuals with type 2 diabetes typically have levels of 6.5% or more. Patients are encouraged to keep their HbA1c levels below 7.0%, as this is considered effective glycaemic control, and subsequently effective management of diabetes (Colagiuri et al., 2009; Tanamas et al., 2013). For every 1% reduction in HbA1c there is an estimated 21% decrease in the occurrence of related complications (UKPDS, 1998). Common comorbidities include cardiovascular disease, renal disease, retinopathy, hypertension, and vascular dementia (Ahmad et al., 2013).

2.1.2 Diet

Consumption of sugars and carbohydrates directly affect acute levels of blood glucose and individuals with type 2 diabetes are frequently overweight or obese, which presents increased risks of cardiovascular complications (Tuomilehto et al., 2001). These patients may therefore benefit from a diet that promotes weight loss (Aucott et al., 2004). Diabetes diets usually attempt to reduce intake of total fat, saturated fat, and processed carbohydrates (Diabetes Australia, 2013; Dyson, 2008). Weight loss not only lowers blood pressure, reducing cardiovascular risk, but additionally promotes sensitivity to insulin within the body (Dyson, 2008). More effective use of insulin can in turn lower HbA1c, as it increases the level of metabolised glucose (Booth et al., 2013). Thus, promotion of a diet that reduces fat intake and increases consumption of healthy alternatives can assist in achieving glycaemic control and preventing long-term complications in type 2 diabetes (Aucott et al., 2004; Booth et al, 2013). However, adherence to a strict diet can be difficult for individuals with type 2 diabetes, and they commonly report dieting as a burden (Gorter et al., 2010), and in some instances have not made an association between their diet and their experience of diabetes (Nouwen et al., 2011).

2.1.3 Physical activity

As with a balanced diet, increased physical activity is associated with better health outcomes for sufferers of type 2 diabetes (Booth et al., 2013), as gross movement, including exercise, also promotes insulin sensitivity and thus contributes to better glycaemic control (Hayes et al., 2007). Indeed, even a modest increase in physical activity can reduce HbA1c levels (Dye, Haley-Zitlin, & Willoughby, 2003; Hays & Clark, 1999; Lawton, Ahmad, Hanna, Douglas, & Hallowell, 2006). However, physical inactivity is prevalent in people with type 2 diabetes (Hayes et al, 2007; Hays & Clark, 1999). Reported reasons for physical inactivity include frustration with apparent lack of short-term improvements (Booth et al., 2013; Nagelkerk, Reick, & Meengs, 2006), and a perception of lack of control over their condition (Lawton et al., 2006), both of which undermine motivation (Hays & Clark, 1999; Lawton et al., 2006; Nagelkerk et al., 2006).

2.1.4 Health routines

It is recommended that individuals monitor their blood glucose levels throughout the day and obtain an HbA1c reading every 3 months (Costa, Pereira, Pedras, 2012). Additionally, due to a growing resistance to insulin in type 2 diabetes, patients typically need to take medication to improve their glycaemic control at some point (Aikens & Piette, 2012). These behaviours can be classified as *health routines*, and lack of adherence to these routines can result in accelerated decline (Ahmad, Ramli, Islahudin, & Paraidathathu, 2013). Some barriers to medical adherence include the cost of medication, acquiring refills, and remembering to take the correct doses (Odegard & Gray, 2008). Improved medication adherence has been found when patients suffer from fewer or less severe comorbidities (due to fewer pills required), and when there is a greater understanding of the medication being prescribed (Ahmad et al., 2013). Regular self-monitoring of blood glucose allows patients to modify behaviour moment to moment, based on the readings obtained. It can be promoted

through positive partner support with words of encouragement, as well as through use of reminders (Costa et al., 2012).

2.2 Web-based Diabetes Self-management Interventions

A literature search of randomised controlled trials using online diabetes self-management programs was conducted using PsycINFO, PubMed, and Cinahl. Diabetes education, self-monitoring and behaviour modification recommendations were central to all interventions. In general, an improvement was observed in glycaemic control, although this change was not always accompanied by significant modification to lifestyle behaviours. Interventions differed in the focus of adherence behaviours, and few studies attempted to improve psychological wellbeing, or examined the relationship between lifestyle modification and emotional health. The interventions tended to be brief and follow-up ranged from 3-18 months. See Table 2.1 for a summary of the study samples, interventions and outcomes.

2.2.1 HbA1c

In all studies but two (Leu, Norris, Hummel, Isaac, & Brogan, 2005; Jennings, Vandelanotte, Caperchione, & Mummery, 2014 it was not measured), HbA1c was significantly lowered following an intervention. Interventions tended to focus on educating participants on diabetes-related symptoms and behavioural approaches to management (Lorig et al., 2010; McMahon, Fonda, Gomes, Alexis, & Conlin, 2012; Wise, Dowlatshahi, Farrant, Fromson, & Meadows, 1986), or provided patient-specific feedback based on clinical input from participants (Glasgow et al., 2010; Lim et al., 2011; Quinn et al., 2008; Quinn et al., 2011; Yoo et al., 2009). It is possible that Leu et al. (2005) did not obtain a significant result because the intervention group only received automated reminders about appointments, medication, blood glucose testing; and generic advice on diet, exercise, and meal times. This

approach appeared to lack personalised support and did not promote the autonomy of the patient. Minimising autonomy can reduce a sense of self-efficacy for behaviour change (Fox & Kilvert, 2003), and participants were not given an opportunity to generate and implement new personalised ways of behaving: rather, they were simply given generic advice on when to engage in the specified behaviours. The positive results from the other studies may reflect the benefit of tailored interventions that promote the autonomy of the participant.

However, a significant improvement to HbA1c was found at least 6 months following two interventions that did not provide personalised feedback, but only educated participants on diabetes and management (Lorig et al., 2010; Wise et al., 1986), emphasising that awareness of symptoms and options for self-management are important. Interestingly, a group assessed on their understanding of diabetes without receiving feedback, achieved better HbA1c results than the usual care group, despite failing to demonstrate an increase in knowledge (Wise et al., 1986). It was suggested that this group may have become motivated to change through increased awareness of the objectives of self-management, rather than explicit knowledge acquisition. These results are consistent with the proposition that the changes in health outcomes are not solely explained by understanding.

While education plays a role in improving glycaemic control, there is little evidence for education alone significantly modifying related adherence behaviours and diabetes symptoms. Lorig et al. (2010) initiated a 6-week online self-management program that educated participants on healthy living and provided a discussion centre to share difficulties and action plans for management of Type 2 diabetes. Although a significant decrease in HbA1c was found, this was not mirrored by changes to lifestyle behaviours or improvements to psychological outcomes. Limited exposure to a range of topics may have restricted intake of information and undermined the consideration and adoption of new behaviours. This study educated participants on a number of behaviours, but only measured change in exercise. No

observed change in exercise may therefore have occurred because of the program's lack of specific focus and elaboration on this topic. However, diabetes-related topics can elicit a small change in the key biological measure of self-care, HbA1c.

2.2.2 Diet

Six of the identified studies have targeted diet (Glasgow et al., 2010; Leu et al., 2005; Lorig et al., 2010; Quinn et al., 2008; Wise et al., 1986; Yoo et al., 2009), but only one measured subsequent behavioural changes to healthy eating (Glasgow et al., 2010). Significantly improved diet was observed in that study, with an increase to healthy eating and a reduction of fat intake. The program prompted goal setting, monitored progress, provided feedback on success, and motivation resources to enhance engagement. Goals were reset every 6 weeks and participants were encouraged to explore possible barriers to achieving these goals. The improvement to diet however did not appear to significantly reduce BMI or lipid concentration. Similarly, Yoo et al. (2009) found that despite sending daily recommendations on healthy eating, no significant reduction in weight, BMI or waist circumference was found. These results may indicate that factors in addition to diet, including energy expenditure, contribute to body composition (Orozco et al., 2008), although it is also possible that the recommendations did not elicit sufficient behaviour change. Management of clinical features of diabetes (i.e. weight) should therefore integrate a number of behaviour changes. Additional time and a more intensified adoption of these changes may also enhance these biological outcomes (Glasgow et al., 2010), but further research that measures the impact of dietary behaviour change on diabetes related symptoms is clearly needed.

2.2.3 Physical activity

Five studies attempted to increase physical activity using provision of recommended routines (Yoo et al., 2009), regular reminders to engage in activity (Leu et al., 2005), education (Lorig et al., 2010), goal setting and behaviour monitoring (Glasgow et al., 2010),

and self-management support (Jennings et al., 2014). Engagement in physical activity was not measured in Yoo et al. (2009), but HbA1c was found to be slightly lower in the intervention group. Leu et al. (2005) also failed to measure physical activity, but in that case, no significant improvement in HbA1c was seen. However, their participants were simply reminded when to exercise, and were not given directions on how this could be done. Similarly information on physical activity is not enough, as Lorig et al. (2010) found that education alone was not sufficient for increasing engagement in exercise. The studies that found a significant increase in physical activity were ones that provided patient-specific recommendations, goals, monitoring and reinforcement (Glasgow et al., 2010; Jennings et al., 2014). Engagement in regular physical activity therefore may be encouraged through education and specific recommendations, but seems dependent on eliciting motivation and practical planning rather than relying primarily on reminders.

2.2.4 Health routines

All studies addressed either medication adherence or blood glucose monitoring. Regular reminders to take medication did not appear to impact upon HbA1c results (Leu et al., 2005), although related education was associated with improved glycaemic control (Lorig et al., 2010; McMahon et al., 2012; Wise et al., 1986), as were recommendations on dosage (Glasgow et al., 2010; Quinn et al., 2008). However, this improvement may be attributable to factors other than medication adherence, as multiple behaviours were targeted in these interventions and one study with no change in medication routines still saw a reduction in HbA1c (Glasgow et al., 2010). At this stage it seems that the extent that adherence with medication accounts for a change in glycaemic control has not been clearly defined. Further research that specifically measures compliance with medication schedules seems necessary.

Use of medication in conjunction with strict blood sugar monitoring allows a rapid response to acute changes in blood glucose (Quinn et al., 2008). A study exclusively targeting

regularity of sugar monitoring found that a minimum of 8 tests a week significantly improved HbA1c (Lim et al., 2011). This effect was enhanced and remained more robust over time when personalised recommendations based on the blood results were provided to patients. These studies indicate that behavioural recommendations can complement disciplined blood monitoring. However, ongoing detailed feedback is not always feasible. Individuals who regularly monitor sugar levels, can learn to modify their own behaviour and gain independence in their management, if they notice factors that optimise glycaemic control. Indeed, the best outcomes may be achieved when patients use the blood sugar information to make behavioural changes that improve their control (Glasgow et al., 2010; Lim et al., 2011; Quinn et al., 2011; Yoo et al., 2009).

2.2.5 Emotional health

Two studies investigated psychological factors related to diabetes self-management. Lorig et al. (2010) found that self-efficacy was enhanced in participants who accessed a brief education intervention when compared to a usual care group. It is not surprising that an intervention that is designed to educate can also increase a sense of self-efficacy, as depth of understanding about symptomatology and behavioural management strategies is likely to empower patients (Wise et al., 1986). This intervention did not however reduce the perceived level of interference of diabetes, or diabetes-related distress. This is possibly because education does not typically address emotional concerns that may arise from diabetes, such as a sense of hopelessness, or anxiety over its likely impact and progression. Lorig et al. (2010) may not have observed a reduction in diabetes-related distress, because knowing about a condition does not prevent it from being present and contributing a problem for the patient.

Quinn et al. (2011) examined the effect a 1-year tailored mobile and web-based intervention on HbA1c, patient-reported diabetes symptoms, depression, diabetes distress, and clinical measures (i.e. blood pressure and lipids). A significant reduction in HbA1c was

observed in the intervention group, but no significant difference was found between the control and intervention on any other measures. As with Lorig et al. (2010), perhaps patients continued to feel that diabetes interfered with their life because they continued to experience symptoms associated with the disease, despite a reduction in HbA1c. This is likely to perpetuate an experience of depression or distress as it may feel like a state of health is unattainable. While this research demonstrated the efficacy of web-based self-management interventions for physiological change, the lack of improvement to psychological wellbeing suggests a need for programs that specifically target this domain.

However, a recent study has demonstrated that advice on insulin administration based on glucose monitoring did not elicit biological change but possibly indirectly improved psychological health (Barnard & Blatch-Jones, 2016). Specifically, authors found a significant reduction in diabetes-related distress and reduced fear of hyperglycaemia. This in turn reduced the number of medical appointments consumers attended. The authors conclude improving psychosocial functioning is an important feature of a self-management intervention, and it seems this was achieved by improving emotional health through self-care procedure education.

2.2.6 Summary

Diabetes education and patient-specific recommendations about diet, physical activity, medication adherence and blood glucose monitoring, have been shown to influence HbA1c results. The degree to which health behaviours are modified appears to impact upon the degree to which diabetes remains under control. The interventions described seemed to rely heavily on recommendations from health practitioners, and non-significant results were associated with the use of prescribed suggestions or generic reminders. These studies reveal that education in isolation does not necessarily elicit a desire to change behaviour; nor do regular prompts for change facilitate new routines. Tailored treatments appear to elicit the

best outcomes, therefore future self-management interventions may benefit from a greater emphasis on patient-generated options for care. Physiological change does not appear to alleviate diabetes related psychological distress. Therefore an intervention that targets and integrates lifestyle behaviours and psychological wellbeing is needed.

2.2.7 Qualities of Effective Treatments

Current treatment approaches for diabetes tend to favour strategies that improve adherence to these critical lifestyle factors. As noted in Chapter 1, interventions for chronic disease management that address adherence barriers have found that simple regimens seem to elicit better adherence (Safren et al., 2014), and routines that are integrated with usual daily structures are more likely to be completed (Kääriäinen et al., 2012). Patient input also appears to be important, perhaps because involvement in the planning process promotes autonomy (Matthes & Albus, 2014). Alternatively, it could be that the collaborative process allows the patient to feel supported, and a sense of illness-support has been shown to greatly enhance conformity to management plans (Nicklett & Liang, 2010). In order to create simple, convenient and patient generated treatment schedules, interventions can often include features such as goal setting, tracking health progress, and peer support. The mode of delivery of these interventions can range from clinical care settings to web-based programs. Regardless of delivery method (in health care settings, through computer-based programs, online, via telehealth and with motivational coaching), there have been mixed findings with respect to the effectiveness of self-management treatments.

2.2.8 Intervention Implementation

Content of web-based treatments is critical to efficacy, however, the implementation of the intervention impacts the extent to which the content is adopted (Hanssen, Norheim, & Hanson, 2017). For instance, limited time can prevent use of a program, even if the user can identify benefits from its use, and has a desire to engage (Wilhelmsen et al., 2014). A study

examining mental health support in the workplace found a significant increase in the adoption of the program when use of the intervention was monitored (Hanssen et al., 2017). Perceived non-response from facilitators of a web-based program can also discourage engagement (Hess et al., 2007). Together, this research indicates that an effective web-based program should not only comprise patient education and tailored goal setting, but also assist users with integration of program use into their schedule. Additionally, intermittent engagement with web users may increase uptake.

Table 2.1

Description of Web-Based Self-Management Interventions and Results

Study	Sample/Study Conditions	Intervention/Follow-Up	Outcomes	Effect Size
Barnard & Blatch-Jones (2016)	(i) Long-acting insulin glargine titration web tool (ii) Enhanced usual therapy with diabetes education	Group (i) received insulin titration advice from a rules-based algorithm. Group (ii) received education on glucose monitoring and readings **Follow-Up** 12-weeks	Metabolic outcomes not specified Group (i) had reduced fear of hypoglycaemia, diabetes-related distress, and mean number of visits to healthcare providers*	**HbA1c** Unable to calculate due to limited information
Glasgow et al. (2010)	463 Type 2 (i) Enhanced Usual Care (ii) Intervention (iii) Intervention + researcher follow-up calls and peer support	Group (i) received health risk feedback and recommendations for behaviour change. Group (ii) set goals and monitored progress for diet, physical activity and medication. Feedback, recommended behaviour changes and motivation tips were provided. Group (iii) received same as group (ii) with provision of 2 follow-up calls and invitation to attend peer support group. **Follow-Up** 4-months	**HbA1c** Lowered to a greater extent in intervention groups **Healthy Eating** Interventions improved diet but no difference between 2 intervention groups* **Physical Activity** Interventions improved physical activity but no difference between 2 intervention groups* **Medication** No difference among groups **BMI/Lipids/Blood Pressure** No difference among groups	**HbA1c** *d* = 0.06
Jennings et al. (2014)	436 Type 2 (i) Control (ii) Intervention	Condition (i) received modified access to website with health survey and contacts only. They were also provided with a pedometer. Condition (ii) received full website access which contained education social support, personalised feedback, positive reinforcement, goal setting and planning **Follow-Up** 12-weeks 36-weeks	**Physical Activity** Intervention condition increased activity and reduced sedentary behaviour at both follow-up assessments significantly more than control	**Physical activity** 12-weeks d = 0.27 36-weeks d = 0.11
Leu et al. (2005)	42 Type 1 and 2 (i) Usual Care (ii) Intervention	Intervention group received wireless pagers that sent reminders about appointments, medication, and blood sugar testing. Participants received generic reinforcement of meal times, diet and exercise. **Follow-Up** 6-months	**HbA1c** No difference between control and intervention	**HbA1c** *d* = 0.27

Lim et al. (2011)	144 Type 2 (i) Usual Care (ii) Usual Care + at least 8 blood glucose self-monitoring within a week (iii) Self-monitoring + SMS feedback	Participants in group (ii) were encouraged to test their blood sugar levels a minimum of 8 times a week. Participants in group (iii) were asked to do the same, however their results were then analysed and patient-specific recommendations were sent back via SMS. **Follow-Up** 6-months	**HbA1c** Reduction in group (iii) from baseline to 3 and 6-months*, Initial reduction in group (ii), however effect lessened over time. **Hypoglycaemia** Least prevalent in group (iii)* **Clinical Measures** Greatest reduction in BMI, body weight and cholesterol in group (iii)*	**HbA1c** Unable to calculate due to limited information
Lorig et al. (2010)	761 Type 2 (i) Usual Care (ii) 6-week Intervention (iii) 6-week Intervention + program reinforcement and peer support	Education program covering: general information on diabetes, clinical issues (e.g. weight), diet, exercise, glucose monitoring, medication, psychological health and managing social roles. **Follow-Up** 6, 18-months	**HbA1c** Lowered in both intervention groups but no difference between the 2 interventions* **Symptoms** No difference among 3 groups for diabetes distress, perceived level of interference in life **Exercise** No group differences **Self-Efficacy** Greater in intervention groups*	**HbA1c** $d = 0.16$
McMahon et al. (2014)	151 Type 2 with poorly controlled diabetes (>8.5%) (i) online care management (ii) telephone-based care management (iii) Web support minus care management support	Diabetes education and care management suggestions provided for groups (i) and (ii). Self-management resources only provided for group (iii) **Follow-Up** 12 months	**HbA1c** Lowered in all groups* and the extent of reduction did not differ among conditions	**HbA1c** Unable to calculate due to limited information
Quinn et al. (2008)	30 Type 2 (i) Usual Care (ii) Intervention	Intervention used mobile web-based program to provide real-time feedback about nutrition and medication to correct patient's blood glucose **Follow-Up** 3-months	**HbA1c** Intervention lowered*	**HbA1c** Unable to calculate due to limited information

Quinn et al. (2011)	163 Type 2 (i) Usual Care (ii) Healthcare Provider Support (iii) Healthcare Provider Support + access to unanalysed patient data (iv) Healthcare Provider Support + access to analysed patient data linked to evidence base care guidelines	Group (ii), (iii), (iv) could upload online clinical data, diabetes related symptoms and distress onto a mobile device. Healthcare providers in group (ii) would only see data if asked by participant. In group (iii) they would be sent unanalysed data. In group (iv), analysed data sent with recommendations for change. **Follow-Up** 12-months	**HbA1c** Intervention (iv) lower than usual care* **Related Physical and Psychological Outcomes** No difference was found between groups on reported symptoms associated with diabetes, diabetes distress, depression, clinical measures such as blood pressure.	**HbA1c** *d* = 0.41
Wise et al. (1986)	86 Type 1; 88 Type 2 (i) Usual Care (ii) 1hr Assessment (iii) 1hr Assessment + feedback (iv) 1hr Teaching, 1hr Assessment + feedback	Participants educated about glucose control, medication, blood/urine monitoring, complications, diet, and foot care by receiving multiple choice questions about these topics with feedback (iii), or being taught about these topics following a quiz with feedback (iv). **Follow-Up** 4-6 months	**HbA1c** Lowered in all groups except usual care* **Diabetes Knowledge** Increment in knowledge in group (iii) and (iv)*	**HbA1c** Unable to calculate due to limited information
Yoo et al. (2009)	123 Type 2 + hypertension (i) Usual Care (ii) Intervention	Personalised advice was sent by practitioners to group (ii) after they uploaded regular blood glucose levels, weight and blood pressure readings. Participants indicated if they had completed their predefined exercise routines and information about healthy eating was sent daily. **Follow-Up** 3-months	**HbA1c** Intervention slightly lower than control* (final HbA1c between 7.1% and 8.0%) **Blood Sugar Monitoring** Intervention lower daily readings than control* **Clinical Measures** Blood pressure and cholesterol lower in intervention*; no difference between groups in weight, BMI, waist circumference	**HbA1c** *d* = 0.22

Note. * Significant result ($p < .05$)

2.3 OnTrack Diabetes

The above considerations were used to develop a new program to promote self-management of type 2 diabetes. OnTrack Diabetes is grounded in social cognitive theory (SCT), drawing on cognitive-behaviour therapy (CBT) techniques and motivational interviewing (MI, Miller & Rollnick, 2002) to promote better diabetes control. Motivation enhancement was not the primary focus of the web program. Relevant issues are briefly addressed when participants are invited to consider the pros and cons of change, past successes and solutions to barriers to making a change, but the uncoached nature of the program meant that it could not fully comply with the spirit of motivational interviewing (resolving ambivalence in supportive therapeutic relationship), and there was no therapist to help participants make the most of the experience. So, they could complete all of the relevant web pages without sufficiently considering the issues and their importance or affective impact, and without eliciting related imagery. SCT (Bandura, 1986) suggests that humans have an innate capacity to shape their interactions with the environment and thus behaviour. It promotes self-reflection which can boost self-efficacy, and encourages monitoring of behaviour which can influence goal-setting. CBT promotes the agency of an individual in managing their situation, through awareness of thoughts and behaviours that prevent goal acquisition. MI enhances desire for change by allowing the individual to explore benefits of new behaviours and building their self-efficacy. Together, these theories support goal-directed behaviour and are therefore an appropriate foundation for a self-management intervention.

The program was developed by researchers at Queensland University of Technology. The program contains modules that facilitate consideration and implementation of behaviour change in diet, physical activity, health routines and emotional health. The program's structure attempts to address the limitations of previous research, by ensuring that modules

are self-guided, and allowing participants to generate individually tailored plans (e.g. a meal plan or type of exercise). Education on diabetes symptoms and management is offered in conjunction with generic and patient-initiated ideas for change, rather than relying on information alone. Diet, physical activity, medication adherence and blood monitoring are all featured, because of the individual and interrelated role each plays in diabetes control. Participants receive 24-hour access, allowing them to consult the program whenever support is needed. Participants receive reminders to access the program in order to promote user engagement. The program facilitates practical planning and integration of goals into daily structures to reinforce adoption of the target behaviour. Emotional wellbeing is targeted through CBT-based techniques (e.g. behavioural activation), developing social support and building resilience with emotional challenges.

The program can be found at www.ontrack.org.au/diabetes and is described in greater detail elsewhere (Cassimatis, Kavanagh, Hills, Smith, & Scuffham, 2014). The homepage contains 4 tabs. On the first is a brief summary of what OnTrack Diabetes offers, including information about Type 2 diabetes, steps to better manage the condition, guidance in building a support network, tips on simple lifestyle changes, and details on where to get help. A second tab contains details of the researchers involved. The third tab contains 5 optional quizzes about diabetes self-care, emotion, fat intake, fibre intake, and physical activity. These quizzes are a sample of what is offered in the program, and when completed they provide an indication of current health status. The fourth tab contains information and contact numbers of services that provide further support for specific areas of distress (for example mental health services or substance use and crisis phone lines). Once logged into the program there are 6 tabs: My Journey, My Diary, What I've Done, How I'm Doing, Tools, and Resources. Each will be described briefly below.

My journey. This tab contains the diet, physical activity, health routine and mood modules that participants can work through at their own pace. These modules are based on SCT, CBT, and MI principles. The participant generates ideas on how to change a behaviour, and the program then facilitates reflection on benefits of change, imagining the change eventuate, overcoming barriers that would prevent change, committing to decision, promotion of self-efficacy through reflection on past successes, and finally guides the development of a plan for each goal.

My diary. Participants can set daily health goals and reminders, with the option of scheduling specific times to complete an activity. It contains a section to record daily lowest and highest blood glucose readings, their worst and best mood for the day, and a nutrition/physical activity goal with a rating of the extent to which they reached those goals.

What I've done. This tab provides a table summary of pages in the program that participants have completed so far. It contains an option of viewing these completed pages to allow participants to print and use the summaries as a reminder of what activities to do in the future.

How I'm doing. This relies on the use of the "My Diary" tab, as it plots the participant's progress with mood (lowest to highest) and blood glucose results (lowest to highest), over the past month and over the past 3 months. Daily nutrition and physical activity goals can also be graphed based on the participant's rating of the extent to which they achieved those goals over the past month and over the past 3 months.

Tools. This contains signposts of the module activities to allow participants to repeat items as frequently as they desire. It contains content from the "My Journey" tab.

Resources. This tab is divided into *program resources* and *fact sheets*. The program resources contain an introductory video to mindfulness followed by audio recordings of strategies used in mindfulness training that were adopted throughout the OnTrack program.

The fact sheets are PDFs on Type 2 diabetes education, management goals and strategies, symptomology associated with the condition, and suggestions on how to best cope with these health issues.

Unlike some previous interventions, participants are not told what to do, but are encouraged to consider the potential cost and benefit associated with making a change. Patient autonomy is maintained, and once a decision is made, participants are directed to a module designed to build self-efficacy. This is achieved by helping the individual reflect on their capacity to change by drawing on past experiences and current resources. Participants then are encouraged to make a specific and detailed plan, and to finalise a goal for the specified area of health. See Figure 2.1 for an example of one page within a module.

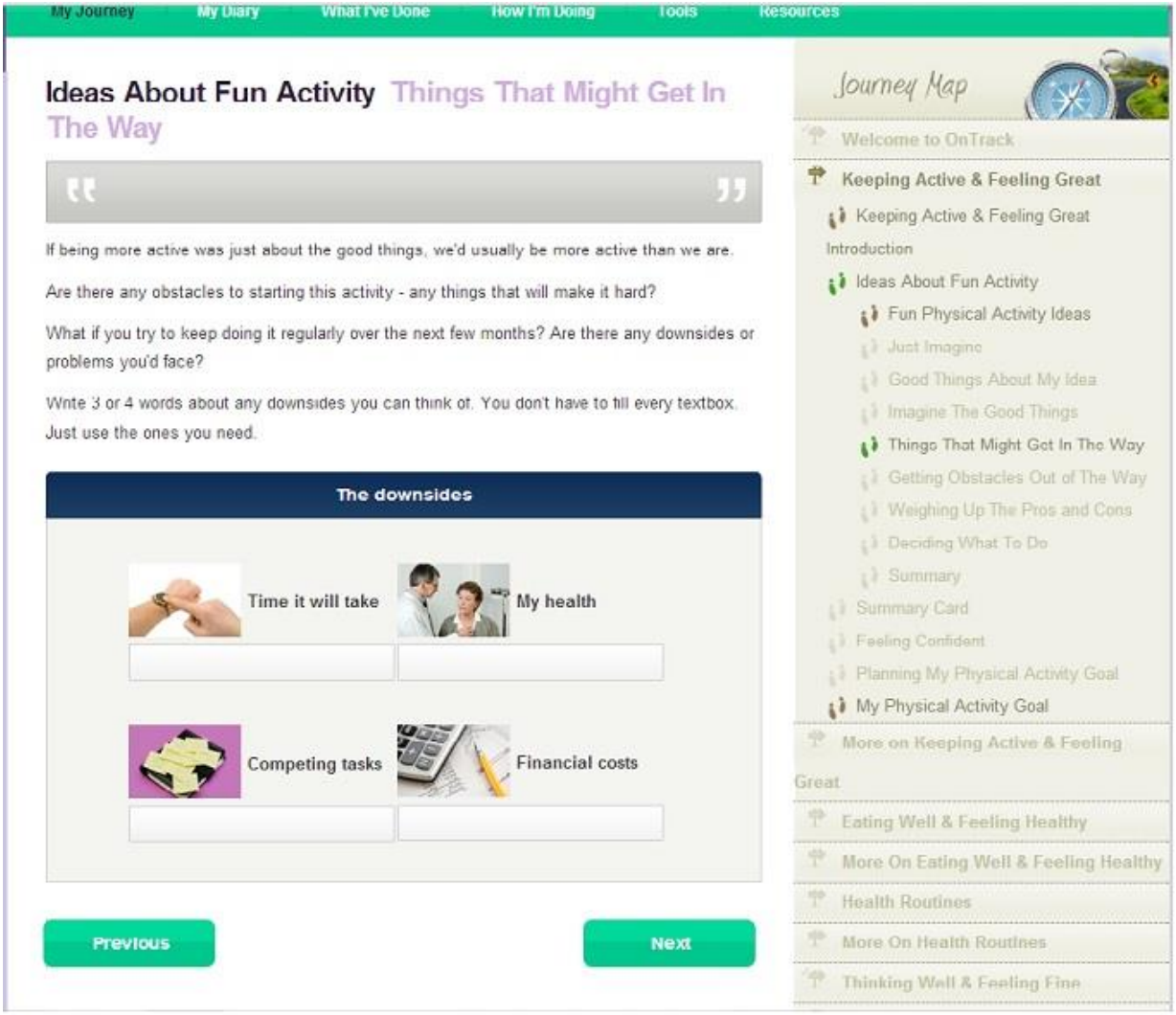

Figure 2.1. Screenshot of problem solving page within physical activity module

A 3-month pilot randomised controlled trial was conducted with OnTrack Diabetes by Cassimatis, Kavanagh, Hills, Smith and Scuffham (2013). Thirty-eight participants aged between 18-75 (M = 60.42; SD = 10.03) were divided into 3 groups. The first was a control group with no access to OnTrack Diabetes for 3 months. The second had access to only the physical activity module and the third could access all modules within the program: diet, physical activity, health routines, and emotional health. Cassimatis et al. (2013) found no statistically significant difference between the groups on HbA1c or secondary outcomes such as weight loss. However, this was largely attributed to the small sample size and minimal

engagement with the program by users. For the overall sample, the authors noted a small reduction in HbA1c, from 7.82% to 7.47%. Qualitative feedback on the program revealed that the full intervention group found it more helpful than those who could only access the physical activity module. In particular, the full access group appreciated the ability to generate individualised.

In summary, the pilot trial provided some evidence for the usability and acceptability of the full program, and indicated that small changes to HbA1c can be achieved with better self-management as fostered by OnTrack Diabetes. A major drawback of the study, as identified by the researchers, was the lack of significant engagement with the program. It was concluded that future research should incorporate regular email reminders, along with some sort of therapist support. These suggestions have been incorporated into the trial, that is presented in Chapter 5, where participants received fortnightly reminders to access the program, and one condition received phone calls aimed at further enhancing and sustaining motivation for behaviour change.

CHAPTER 3

Elaborated Intrusion Theory

Chapter 2 established that the effective treatment of type 2 diabetes involves modification to dysfunctional behaviours and reinstatement of health routines. In order to support these lifestyle changes, clinicians tend to conceptualise and therefore target treatment at the behavioural level. While behaviour change is ultimately the goal of diabetes management, the processes that facilitate these changes are complex. Recent research into the underlying mechanisms of motivated behaviour suggests that dysfunctional health choices may be prompted by cognitive multisensory imagery (Kavanagh, May, & Andrade, 2009). Emphasis on such cognitive antecedents to lifestyle choices will potentially enable more effective and tailored interventions. The theoretical paradigm within which imagery is a central tenet is the *Elaborated Intrusion Theory* (EI Theory) *of Desire* (Kavanagh et al., 2005). It provides a cognitive-emotional model of motivation and has informed new treatment protocols in substance use disorders (Kavanagh, May, Andrade, & Connor, 2014) and eating behaviours (Andrade et al., 2016) as well as measurement of motivation (May et al., 2014; Kavanagh et al., under review). Before the current research program, EI Theory had not been applied to management of specific chronic health conditions. In this thesis, the relevance of EI Theory to the measurement and maintenance of a healthy diet, regular physical activity and adherence to blood monitoring routines in type 2 diabetes is explored for the first time.

3.1 Elaborated intrusion theory of desire

3.1.1 Definition and background

The Elaborated Intrusion Theory of Desire is a cognitive theory with a focus on motivation. It describes how related cognitive-emotional processes develop, are maintained and are supplanted (Kavanagh et al., 2005). The theory classifies these cognitive-emotional processes as desires. Desires may begin as a thought about a target (e.g. cake) that is typically automatically triggered by internal or external cues (watching cooking show – external; or feeling distressed -internal), but can also be deliberately generated (thinking of cake). If thoughts about the target elicit pleasure or relief they may then be elaborated, for instance, the individual may imagine what type of cake they'd like to eat, how much, what it would be like to eat. This elaboration also draws attention to any current physiological need or emotional deficit that may be alleviated by acquisition of the target. For example, if the person is hungry they will imagine being satisfied after eating the cake, or, if cake usually alleviates distress, then the individual will focus on how much better they'd feel after consuming that food. This combination of affectively charged cognitions increases the likelihood that thoughts and response tendencies for target acquisition are then activated (i.e. the person is more likely to go to the cupboard or shops to acquire cake). An initial focus of some early publications was substance use (e.g. Kavanagh et al., 2009), but from its inception, EI theory was seen as being applicable to any desire (May, Andrade, Kavanagh, & Perfound, 2008; May, Andrade, Panabokke, & Kavanagh, 2004), and several publications have now addressed cravings for food (Andrade et al., 2016; May, Andrade, Batey, Berry, & Kavanagh, 2010; May et al., 2012). Desires to increase functional goals such as activity have also been addressed (Kavanagh et al., in submission; May et al., 2008). The key elements of EI theory are multisensory imagery, desires, intrusions and elaboration and so each will be discussed in more detail below.

3.1.2 Desire

EI theory proposes that behaviour is influenced by *desires*. The theory describes desire for a target as a conscious process that does not emerge because of learned associations, but because of mental elaboration (May et al., 2012). It suggests that desires are both cognitive and affective and that desires have a frequency and duration (Kavanagh et al., 2009). Desires are different from intentions and thoughts about consequences. For instance, with regard to intentions, – saying I want to do something is different from saying I am going to do something. With regard to consequences, – saying I want to do something is different from the reason for wanting it. Further, desire can be distinguished from metacognition (experiencing the desire is different from thinking about the desire), expectancies (likely consequence of target acquisition), behavioural indices (e.g. consumption rate), and antecedents (e.g. related thoughts or cues from the environmental) (Kavanagh et al., 2005). Desire begins with a thought of wanting or needing something.

Just as a target is often represented in the mind as an image, so too are the processes that follow. Together this constitutes desire. Emotional qualities of the target are simulated by mental imagery. These emotions are polarised. The individual experiences both pleasure and pain, alternatively or in combination - pleasure because they can imagine acquiring the target, but pain because the target is not actually accessed and so there is a sense of deficit, especially if a delay in acquiring it is envisaged (May, Andrade, Panabokke, & Kavanagh, 2004). The extent to which desires inform behaviour also depends on other incentives, availability of the target, and skills in acquiring it or resisting its acquisition.

In summary, EI theory suggests that desires are a motivating force that prompts both dysfunctional and functional behaviour (May et al., 2012). Desire occurs when the focus of attention is on a cognition that evokes emotion about an object or activity that would bring pleasure or relief from discomfort. It is therefore a cognitive-affective process where mental

imagery of a target is briefly rewarding. This however amplifies a sense of somatic and/or emotional deficit because the target has not actually been acquired. For example, thinking about cake can be enjoyable due to an association established in the past between cake and pleasure. However, it will soon become apparent that there is an absence of actual cake. This prompts cognitions about its acquisition and attempts to obtain it. Desires are held to be conscious, although unconscious processes are likely to facilitate them. The following section describes these unconscious processes in more detail.

3.1.3 Intrusions

There is a distinction between automatic intrusive thoughts and controlled elaboration of those thoughts (Kavanagh et al., 2009). When a desire enters conscious awareness it may seem to the individual as if the thought has spontaneously emerged (Kavanagh et al., 2005). There are however a number of unconscious processes that precede the subjective experience of desire. The processes that contribute to the occurrence of these intrusions include: (i) Semantic priming. This is when the desire cognition is conceptually related to another cognitions. It occurs because of the organisation of information in memory. (ii) Physiology. Biological triggers such as thirst direct attention to that target (or to another that is more salient at the time), and awareness of conditioned physiological reactions (e.g. salivation) may also act as a trigger. (iii) External cues. Other stimuli that are conditioned to elicit the desire may be encountered.

3.1.4 Elaboration

It has been established that unconscious associative processes trigger perceived intrusive thoughts about a target. In contrast, controlled cognitive processes lead to elaboration (Kavanagh et al., 2009). Because cognitions can involve visuospatial content or memories that involve other senses, these intrusions and the subsequent elaboration may also be in the form of mental imagery. Elaboration is a process that involves strengthening initial

desire images by adding new sensory information. The elaborated thought may thereby become more emotionally laden than the original intrusion because it creates a more salient multisensory experience (May et al., 2004). Elaboration places a cognitive load on working memory because it facilitates the retrieval of target-related information (Andrade, Pears, May, & Kavanagh, 2012). Therefore elaboration is a process that competes with other tasks that require access to limited working memory space (Kavanagh et al., 2005). Figure 3.1 summarises how automatic processes trigger intrusive thoughts which can lead to desire through mental elaboration.

3.1.5 Multisensory imagery

EI theory holds that strong desires typically involve sensory imagery and research evidence strongly supports this contention (May et al., 2015). Imagery simulates an event which can trigger an emotional response. If the elicited emotion is strong, and the person does not have other attentional demands, the image is likely to be elaborated. Elaboration involves holding the desired target in working memory, and integrating the original information with additional material that is associatively linked to it or is retrieved from long-term memory. While this information may include verbal material, it is likely to create a more detailed and multisensory image. Vivid imagery about the target is more closely linked to emotion than is verbal information (Holmes & Matthews, 2005). Therefore, the more emotionally loaded a desire for a target is, the more likely a person will be experiencing frequent and vivid imagery of that target.

In summary, the elaborated intrusion theory of desire offers a new perspective on the processes that underpin motivation to seek a target. It emphasises the role of multisensory imagery in initiating and strengthening a desire. This theory is directly relevant to the assessment of a subjective state of desire/motivation, as well as the development of interventions that target deficits in motivation.

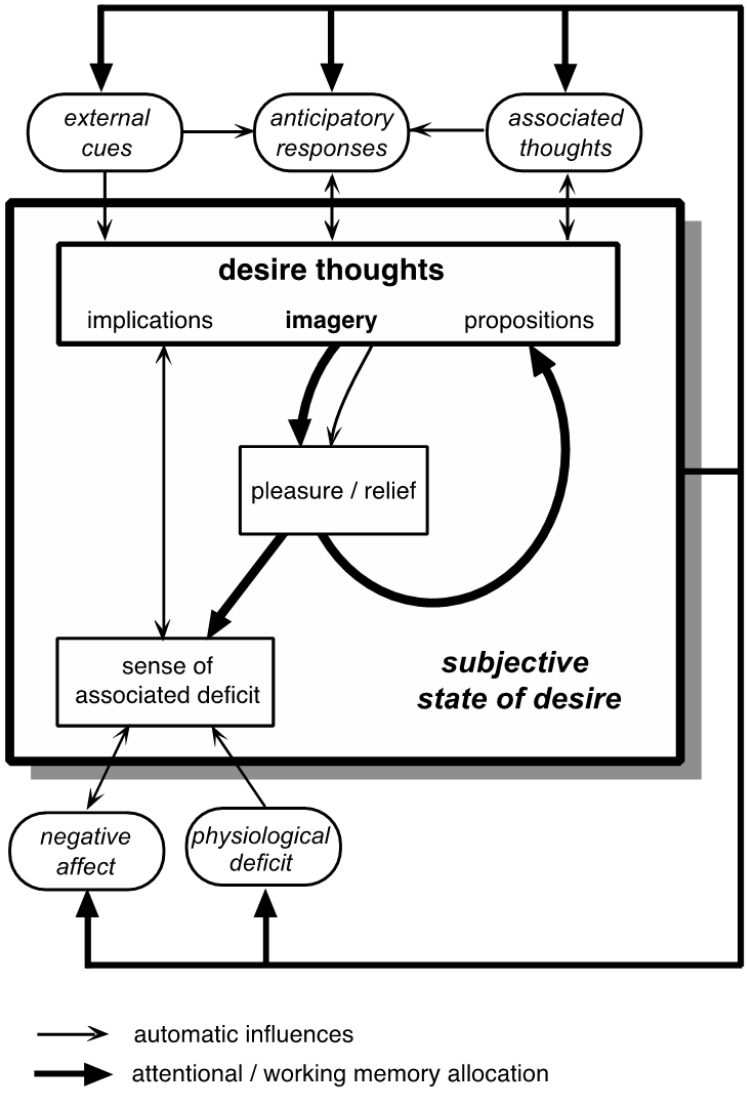

Figure 3.1. Elaborated intrusion theory of desire from Kavanagh et al. (2005) where internal or external cues (rounded external boxes) trigger desire thoughts which automatically elicit pleasure if the target is desirable and elicit a sense of deficit if the target is not acquired (thin arrow lines). Controlled elaborative process (thick arrow lines) enhance desire by increasing vividness of multisensory cognitive imagery.

3.2 Application of EI theory to behaviour measurement

3.2.1 Alcohol Craving Experience

In recent years EI theory has informed the development of scales that measure the desire for both functional and dysfunctional targets. The original scale, the Alcohol Craving Experience (ACE) questionnaire (Kavanagh et al., 2009; Statham et al., 2011) was designed to assess the subjective features of craving in individuals struggling with substance abuse or dependence. The authors applied principal component analysis to this scale and found that 3 factors emerged. 'Imagery' pertained to how clearly and often participants experienced a sensory image related to drinking. 'Thought suppression and intrusion' related to the regularity of spontaneous or unwanted thoughts about drinking. 'Intensity and duration' was the strength and length of the periods of alcohol craving (Kavanagh et al., 2009). The overall 11-item scale was internally consistent, with $\alpha = .76$.

Greater frequency of cravings (higher scores on the ACE) were associated with stronger craving. Frequency of non-imaginal thoughts were also associated with stronger craving, but this prediction was weaker than with imagery-based thoughts. Participants who reported using a greater number of senses in the 'imagery' factor had on average a longer craving duration, perhaps indicating that this imagery was elaborated on. Both imagery and non-imagery thoughts about alcohol contributed to craving frequency, but non-imagery cognitions did not relate to duration. Finally, not all intrusive thoughts were elaborated on. The ACE was a psychometrically sound scale that had clinical relevance to a substance use population. It facilitated the development of further measures that attempted to generalise it to other targets.

3.2.2 Craving Experience Questionnaire

May et al. (2014) developed the Craving Experience Questionnaire (CEQ) to assess consummatory cravings. The CEQ was administered across four targets; food, chocolate,

alcohol and cigarettes. Confirmatory factor analyses (based on the ACE) revealed the same internal 3-factor structure across targets. There were *intensity* of craving cognitions, frequency/strength of craving *imagery*, and perceived *intrusiveness* of these cognitions. Therefore the final version of this 10-item scale had two forms: the CEQ-Strength and CEQ-Frequency. Strength assessed the intensity of a current or recent salient craving, while frequency assessed how often cravings were experienced over a specified time. The CEQ demonstrated that EI theory is broadly applicable to the measurement of a wide range of appetitive desires.

3.2.3 Motivation Thought Frequency scale

The Motivation Thought Frequency scale (MTF) and State Motivation scales were recently developed to adapt the CEQ to desires for functional goals. Like the ACE and CEQ, the MTF considers motivation to be a temporary cognitive state that is characterised by multisensory imagery and varies in intensity and availability. The current program of research focuses on the MTF which assess the number of thoughts/feelings about a target over the previous week. Minor modifications were made to the wording of questions to reflect a focus on behavioural goals rather than a specific target. Imagery of engaging in or succeeding at a task replaced craving imagery related to the different senses. Like the CEQ, the MTF is a generic measure and thus has the capacity to be applied to various goals. To date, it has been investigated in physical activity (Kavanagh et al., in submission), alcohol use (Robinson, Kavanagh, Connor, May, & Andrade, 2016), and high- calorie snacking (Teixeira et al., in preparation).

The MTF for physical activity (MTF-PA) was administered to 674 adults linked to tertiary education (staff and students) who were considering or in the process of increasing their activity levels. Both the strength and frequency forms had a good fit with the 3-factor solution (intensity, imagery and intrusiveness) established in the CEQ. The intrusiveness

subscale however was renamed *availability* to reflect the occurrence of functional thoughts rather than the intrusion of unwanted thoughts. The frequency MTF-PA was significantly associated with the Exercise Imagery Inventory (EII), a measure of the frequency of exercise related imagery. The authors therefore concluded that the MTF-PA is a valid and relevant measure of physical activity motivation cognitions.

The MTF for alcohol (MTF-A) was administered to 417 adults from a convenience sample at a university and the general community. Participants were either attempting to control their alcohol consumption or had recently been involved in high-risk drinking. It elicited the same internal 3-factor structure as the MTF-PA (intensity, imagery and availability) and demonstrated concurrent validity with the AUDIT, a screening measure for substance use problems, and a questionnaire assessing readiness to control alcohol use (RCQ). The scale had high internal consistency. Together these findings indicate that the MTF is a psychometrically sound measure of motivation that may have relevance to a variety of health behaviours in clinical and non-clinical populations.

Recent analyses of these scales revealed that a 4-factor model may be superior to the originally developed 3-factors. This arrangement divides the imagery subscale into self-efficacy imagery and imagery for incentives. Confirmatory factor analyses demonstrated that the 4-factor model was appropriate for the MTF-PA and MTF-A. Self-efficacy imagery is cognitions about engaging in the behaviour, and incentives imagery refers to cognitions about outcomes of engaging in behaviour (e.g. feeling better from physical activity).

3.2.4 Implications

EI theory provides a coherent framework for the development of scales that are clinically relevant to specific populations and specific goals. The Motivation Thought Frequency scale (MTF) appears to be a good measure of an individual's desire to change their behaviour. Therefore EI theory and the MTF should be theoretically relevant to a

diabetes population, where a desire to adhere to management of diet, physical activity, blood glucose testing and medication is important for health outcomes.

3.3 Application of EI theory to interventions

EI theory has been shown to be effective at capturing the underlying mechanisms in craving and functional behaviours that require motivation (e.g. diet and exercise). If these mechanisms play a critical role in desire, then it is important to develop strategies that target them in order to modify behaviour and ultimately improve health. Limited research has explored the effect of psychological treatments on desire and behaviour. Recent interventions grounded in EI theory have focused on manipulating mental imagery to increase desire for a specific goal, and have had positive results in participants with poor snacking control and gym attendance (Andrade et al., 2016; Lennox et al., in submission).

3.3.1 EI theory grounded interventions: Imagery inhibition

Initial studies that target the mechanisms highlighted by EI theory have promising results. Kemps and Tiggemann (2007) applied EI Theory to eating behaviours to develop a technique that would reduce the frequency, intensity and duration of problematic food cravings. The authors focused on the modality of craving imagery and examined the effect of concurrent modality-specific tasks. While their participants did not specify the modality in which their original craving was experienced, the fact that visual and olfactory tasks reduced craving intensity more than auditory tasks supports the premise that cravings were experienced as both visual and olfactory. This was therefore the first study to extend EI theory-based interventions to another modality (i.e. smell not just sight), and it demonstrates that craving can be suppressed through multiple sensory modalities.

Andrade et al. (2012) conducted an EI-grounded trial, where tasks that competed with working memory capacity were explored. The authors found that use of a visuospatial task (clay modelling) reduced food-related cravings, while verbal working memory tasks did not.

It was concluded that this strategy was successful because cravings that were elaborated on evoked imagery. It was suggested that the craving imagery therefore competed with the modelling task in visual working memory stores.

Consistent with Andrade et al. (2012), Kemps and Tiggemann (2007) found that cognitive imagery tasks that match the modality of a craving are more effective at reducing craving intensity. For example, imaging the smell of rain rather than visualising rain will better interfere with an olfactory chocolate craving. This may both be because the task involves content that is incompatible with the craving content (i.e. content competition), or it may conceivably be because of competition for working memory resources (Andrade et al., 2012). Tasks that compete with working memory capacity are likely to interrupt retention and elaboration in working memory, and thereby reduce craving. However, the extent to which such tasks limit craving is unclear. Versland (2006) noted a "rebound effect" where working memory interference only inhibited the craving during the distractor task. This may indicate that competing working memory tasks are effective at lessening the intensity of desire for a target, but there is a need for an additional strategies that trains an individual to make functional decisions.

Interestingly, in the Kemps and Tiggemann (2007) study there was a significant correlation between imagery vividness of the target and craving intensity, but not between the imagery vividness of the distractor and craving intensity. That is, the clarity with which participants could imagine an unrelated target (e.g. rain) did not relate to the intensity of the craving experience for food. The authors argue that this shows that craving is predicted by imagery vividness of a target but not a general ability to imagine. Therefore people don't need to be necessarily "good" at imagining to benefit from this approach. Versland (2006) also demonstrated that cigarette craving was significantly reduced with a craving-relevant distractor imagery task, but the vividness of this task was not associated with craving

intensity. These findings may indicate that the critical mechanism in competing working memory tasks is the effect on elaboration (Versland, 2006).

In summary, the key findings from EI grounded interventions that inhibit imagery are that craving may involve equivalent frequency and intensity of olfactory and visual imagery and both forms can interfere with craving, therefore multisensory imagery likely to be involved in desire; there is a moderate relationship between imagery vividness and strength of craving, therefore stronger cravings are associated with more vivid imagery; and the vividness of distractor stimuli does not impact on the extent to which craving can be reduced, therefore interference tasks are not dependent on the quality of a counter-image; rather imagery inhibition is likely to be effective because of the interruption to elaboration.

3.3.2 EI theory grounded interventions: Imagery enhancement

EI theory posits that motivation to engage in a functional behaviour involves thoughts that are characterised by image-based and non-image-based information. Images are more affectively laden than non-images and therefore are more likely to capture attention (Holmes & Matthews, 2005). If the emotion elicited is strong and there are no other attentional demands, elaboration of target-related imagery is likely to occur. This increases desire for a behaviour. However, healthy goals can be temporally perceived as further away than dysfunctional desires (e.g. cravings). This can evoke a sense of urgency to act, leading to non-compliance to satisfy short-term desires (e.g. smoking during a time of abstinence) (Andrade et al., 2016). A goal for treatment is therefore to make these long-term goals more salient through development of vivid imagery. Indeed when visual and olfactory imagery are combined, there is a greater reduction in craving than imagery presented in a single modality (Versland, 2006), perhaps demonstrating the benefit of multi-sensory imagery in interventions.

3.3.3 Functional Imagery Training

Functional imagery training (FIT) is a new therapy that extends motivational interviewing and focuses on these EI principles of imagery and elaboration (Andrade et al., 2016). Individuals learn to use positive imagery-based representations of resisting an action to modify their behaviour. For example, they may imagine how it would feel to not act on a craving for a sweet food. This method is motivating because it promotes positive associations between cognitive/emotional responses and the target behaviour. EI theory informs the premise in FIT that desires (for example a food craving) come to mind due to learned associations. The desire often becomes heightened when attention is directed toward it, because it evokes an affective response (Kavanagh et al., 2005). In turn, the individual tends to 'elaborate' on the thoughts, and thus increase their chance of acting on the desire (for example eating due to a food craving). However, if an alternative course of action if brought to mind for the individual, the desire to satisfy these intrusive thoughts may be disrupted.

The following steps are involved. Individuals are taught to imagine a functional target (e.g. exercising), and continue using imagery to think about ways they can achieve their goals. Attention is given to the emotions that are likely to be elicited if the goal were achieved in order to strengthen the association between the image and the emotion, which increases the desire for it. Desires can be unconsciously triggered, therefore in FIT, pre-existing associations and new conditioned responses from external cues (i.e. washing hands) are developed to facilitate the "intrusions" of functional thoughts. FIT aims to increase self-efficacy by drawing on past experiences. Additionally individuals are supported in developing a way forward with their goal. Essentially if FIT if effective, then the more someone wants to do something, the more likely they would have had images associated with that behaviour. FIT attempts to elicit multi-sensory imagery of a goal because imagining typically involves more than one sense (May et al., 2015; Versland, 2006). Consequently

incorporating multiple senses makes image more salient. Acceptance-based interventions also inform the delivery of FIT in a clinical setting. Specifically, acceptance rather than thought suppression of the spontaneous automatic thoughts outlined in EI theory may reduce elaboration and subsequent desire (May et al., 2015). Suppression is a controlled cognitive process that can cause a paradoxical increase in the suppressed thought while the suppression is being attempted or immediately afterwards (Wegner, 1994a). Failure to suppress when it is being attempted is particularly prone to occur when the person is also attempting another task or when they worry about the suppressed thought occurring (which then triggers the thought) (Wegner 1994b). In contrast, inhibition is achieved by holding more highly preferred material in working memory, which does not require tracking for the occurrence of the problematic thought. It can occur during mindfulness, (May et al., 2012), or when imagery about a preferred functional behaviour is elicited. Mindfulness training techniques such as body scanning may divide attention and thus prevent elaboration through imagery inhibition but not suppression (May et al., 2012). FIT does not focus on non-adherence behaviours but looks to increase thoughts about adherence behaviours.

FIT includes the following steps: (i) Discussing good and bad aspects of current lifestyle, (ii) Selecting hypothetical behavioural goal, (iii) Education on multisensory imagery, (iv) Applying multisensory imagery to behavioural goal, (v) Building self-efficacy using multisensory imagery, (vi) Developing behaviour change strategies with imagery, (vii) Identifying barriers to change and solutions to these with imagery, (viii) Exploring aspects of current lifestyle they would miss, (ix) Planning for challenging situation with imagery and (x) updating goals.

The first published FIT trial was for individuals who had a desire to lose weight in a university sample (Andrade et al., 2016). The intervention therefore focused on reduction of unhealthy snacking. This was a RCT that compared an Immediate FIT group with a Delayed

FIT. Those in Immediate received the intervention during the first 2 weeks and those in Delayed received the intervention in the last 2 weeks. By conclusion of the study, all participants had received a 40-minute session, where the following elements were addressed. Long-term goals were broken down to smaller achievable ones. These goals and their likely benefits were imagined to make the goal as vivid as possible so it could compete with dysfunctional cognitions (e.g. cravings). Past successes were imagined to enhance self-efficacy and practical solutions on how to best achieve the goal were imagined. Finally, all imagery was paired with a daily routine to bring the goal into regular conscious awareness until it became habit. Participants were followed up with a 10-minute call a week later to review their progress and revise any techniques not adopted. At 2 weeks from baseline, weight, snacking, and motivation to control snacking were re-assessed. Over the first 2 weeks, participants in the Immediate FIT condition rated goal imagery as highly vivd, and they had greater increases in their self-efficacy and motivation to control snacking, and showed greater reductions in daily snacking than the Delayed participants. Over the full 4 weeks, both conditions had a small reduction in weight.

The second FIT trial was conducted with 48 gym members from the general community who had a desire to increase their gym attendance (Lennox et al., in submission). Similar to Andrade et al. (2016), this study was an RCT with an Immediate and Delayed condition. The Immediate group received the intervention in the first two weeks and the Delayed group in the last two weeks. Following one 30-45 minute FIT session with two SMS reminders to practice imagery, participants had significantly increased their frequency of gym attendance at a 2 week follow-up. Scores of the MTF for exercise paralleled this change, indicating greater motivation to engage in exercise.

These trials provide strong evidence for the efficacy of a FIT health intervention in the normal population. They also demonstrate the benefits that can be achieved over a short

period of time and with minimal therapist input. FIT aims to link vivid imagery of long-term goals to imagery of short-term temptations (i.e. the desire to snack) so that individuals automatically induce an alternative and more functional response to moments of weakness (Andrade et al., 2016). This will promote the maintenance of functional decision making when therapist support is removed. Thus FIT aims to promote change that is lasting. There is a need however to establish the long-term benefits of FIT and there is scope to apply this intervention to other clinical health populations.

3.3.4 Implications

EI theory has informed the development of interventions that inhibit dysfunctional imagery and enhance functional imagery. Tasks that compete with working memory can impair elaboration of unhelpful targets (e.g. cake) and thus reduce craving and acquisition of unhealthy items (Andrade et al., 2012; Kemps & Tiggemann, 2007; Versland, 2006). However reducing desire through this method may be transitory (Versland, 2006), therefore this method may be effective when delivered in conjunction with an intervention that increases desire for functional choices. Functional imagery training (FIT) is one such intervention. Preliminary findings suggest that FIT is an effective treatment for clinical outcomes, motivation, behaviour change and self-efficacy in dysregulated eating (Andrade et al., under review). FIT is currently also being applied to alcohol consumption (Kavanagh et al., in preparation) and physical activity (Lennox, Andrade, Kavanagh, & May, under review). It should be acknowledged that there is currently modest evidence for the efficacy of FIT in modifying diet and activity. In addition, its superiority over traditional motivational interventions such as MI is unclear, and further research is needed to establish its impact. Critical factors in the aetiology of type 2 diabetes are dysregulated eating and inactivity. Current treatment of diabetes involves patient education on these lifestyle changes, but motivational support is limited and inconsistently effective. There is a need for development

of motivational protocols that have greater efficacy in improving adherence in self-management. Functional imagery training is a highly relevant intervention for these health behaviours in diabetes that to date has not been examined. Additionally, imagery is more closely related to affective content such as cravings/desire than verbal content and is thereby relevant to motivation in diabetes (Holmes & Matthews, 2004).

3.4 Chapter summary

Previous motivation theories, measurement tools and interventions have focused on internal or external reasons for action without considering the role of unconscious processes or emphasising the importance of cognitive imagery. Elaborated intrusion theory addresses these gaps and offers a new understanding of the processes that trigger and maintain desire for functional and dysfunctional goals. It states that a desire may begin as a thought that is triggered by environmental cues, but it is then frequently elaborated on, allowing a sensory experience of the desire to be imagined and desire to increase. The theory is highly relevant to a range of health issues that require modification to desire/motivation in order to facilitate behaviour change. While previous research has focused predominately on cravings related to food or substance use, the theory seems applicable to type 2 diabetes, where effective self-management requires modification to maladaptive behaviours. In the current research, for the first time, this model has been applied to understanding motivation to manage diabetes.

EI theory posits that the more someone wants to do something, the more likely they have experienced images associated with that behaviour. Consistent with this view, measurement of diabetes motivation should assess the frequency of cognitions and imagery about diabetes management. It is well established that effective management involves three domains – diet, activity and blood glucose testing. Current measurement tools however typically focus on one aspect of management. There is consequently a need for a new

measure of motivation in diabetes that relates to all three domains and reflects the extent to which change is desired by an individual. The Motivation Thought Frequency scale (MTF) fulfils this need, and is therefore adapted to a diabetes context in the current research.

EI theory also underpins a new motivational interviewing technique, functional imagery training (FIT). FIT equips individuals to elicit multi-sensory imagery of functional goals that can improve adherence to health routines. There is an accumulation of evidence for imagery underlying motivated behaviour, and there have been positive preliminary findings in the application of FIT to a behavioural intervention for unhealthy snacking (Andrade et al., 2012). FIT is designed to not only increase motivation, but also interfere with unhealthy desires (e.g. craving) (May et al., 2015). This approach has never been applied to the critical health care behaviours in diabetes. Given its success in diet and promoting frequency of physical activity in gym users (Lennox et al., under review), it may also show benefits in diabetic self-care.

In summary, in the current research EI theory has informed the development of a new measure of motivation to manage type 2 diabetes (the Motivation Thought Frequency scales for Diabetes), and underpinned the development of a functional imagery training treatment protocol for type 2 diabetes. Chapter 4 outlines the assessment of the Motivation Thought Frequency scale for Diabetes and its utility as a predictor of health behaviour and outcomes. Chapter 5 describes a randomised controlled trial in which functional imagery training was applied adjunctively to a web-based self-management program for type 2 diabetes, and the MTF was used to assess motivation for management and the effect of FIT on motivation over 3-months.

CHAPTER 4

Manuscript 1: Applying EI Theory to Motivation Assessment

This chapter describes a Confirmatory Factor Analyses of the EI theory-grounded Motivation Thought Frequency scale in a diabetes sample. The purpose of this study was to validate the MTF as a measure of motivation for the key self-management behaviours in diabetes – glucose testing, physical activity and diet. These three scales were subsequently used in the randomised controlled trial (chapter 5) as a baseline and follow-up measure of motivation. Additionally, the MTF was used to assess differential change in motivation in those who received therapist support using Functional Imagery Training. Since EI-theory posits that imagery is central to desire, and the MTF measures frequency of imagery cognitions, it was essentially a measure of effectiveness of the FIT intervention.

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Assessment of Motivational Cognitions in Diabetes Self-Care: The Motivation Thought Frequency Scales for Glucose Testing, Physical Activity and Healthy Eating

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Abstract

Purpose: There is a need for improved measurement of motivation for diabetes self-care. The Elaborated Intrusion Theory of Desire offers a coherent framework for understanding and identifying the cognitive-affective events that constitute the subjective experience of motivation, and may therefore inform the development of such an instrument. Recent research has shown the resultant Motivation Thought Frequency scale (MTF) to have a stable factor structure (Intensity, Incentives Imagery, Self-Efficacy Imagery, Availability) when applied to physical activity, excessive snacking, or alcohol use in the general population. The current study aimed to confirm the 4-factor structure of the MTF for glucose testing, physical activity and healthy eating in people with type 2 diabetes. Associations with self-reports of concurrent diabetic self-care behaviours were also examined.

Method: Confirmatory factor analyses tested the internal structure, and multiple regressions assessed the scale's relationship with concurrent self-care behaviours. The MTF was completed by 340 adults with type 2 diabetes, and 237 from that sample also reported self-care behaviours. Separate MTFs assessed motivation for glucose testing, physical activity and healthy eating. Self-care was assessed using questions from the Summary of Diabetes Self-Care Activities.

Results: The MTF for each goal achieved acceptable fit on all indices after selected errors within factors were allowed to intercorrelate. Intensity and Self-Efficacy Imagery provided the strongest and most consistent correlations with relevant self-care behaviours.

Conclusions: Results provide preliminary support for the MTF in a diabetes sample. Testing of its sensitivity to change and its predictive utility over time is needed.

Keywords: motivation; diabetes; assessment; self-management; imagery; cognition

Substantial, sustained efforts in multiple domains are required to effectively manage type 2 diabetes. Management typically involves modification of diet and physical activity to increase insulin sensitivity and reduce blood glucose levels [1, 2]. Frequent blood glucose testing is also recommended, to allow immediate responses to glucose fluctuations [3]. Initiating and maintaining such a complex and demanding regimen is heavily dependent on developing and sustaining motivation, which is key to establishing goal-directed behaviours [4, 5]. While adjustments to health behaviours are not inherently motivating [6], autonomous self-motivation can play a crucial role in adherence to a dietary regimen in diabetes [7]. However, motivation is inconsistently defined, measured and targeted in individuals with type 2 diabetes.

Existing theories of motivation to manage diabetes have portrayed motivation as a conscious process that provides a reason for, attitude toward, or a belief about executing self-care. For instance, Self-Determination Theory (SDT) [8] distinguishes between motivation that is self-initiated (intrinsic or autonomous) and motivation that is triggered by external punishment or reward (extrinsic or controlled). Assessment instruments modelled on this framework, such as the Treatment Self-Regulation Questionnaire (TSRQ) [9] assess respondents' attributions of internal and external reasons for engaging in a health behaviour. Such attributions are likely to be relatively stable over time, as they reflect an individual's values or goals. However, motivation is arguably a state variable that may wax and wane. Critical to the proximal impact of motivational cognitions is likely to be their recent intensity and frequency, and insufficient attention to these attributes is likely to limit the utility of an assessment instrument such as the TSRQ, especially over the short term [10, 11].

The Information-Motivation-Behavioural Skills Model (IMB) [12] proposes that behaviour is influenced by the possession of relevant information and skills, positive personal beliefs and attitudes about the target behaviour, and social support. This framework has

informed the construction of the Diabetes Fatalism Scale (DFS) [13] which assesses perceptions of factors that may support motivation (e.g. that a particular action will produce a positive outcome), rather than directly measuring the strength of the person's motivation to engage in a particular behaviour. The DFS and other measurements of motivation grounded in the IMB model assess attitudes toward the health condition and the outcome of engaging in a self-care behaviour [14]. While beliefs in the ability to change and the effects of change are important, as argued in Protection Motivation Theory [15] and the Health Belief Model [16], they may be better conceptualised as precursors and correlates of motivation rather than indices of the degree of motivation itself.

This research proposes that motivation fluctuates in ways that are not accounted for by these theories and the scales based on them. The Elaborated Intrusion Theory of Desire (EI Theory) [10] provides an alternative framework for understanding motivated behaviour by focusing on motivational states over time. Desire for a goal is seen as an episodic experience involving cognitive elaboration of goal-related thoughts that in turn are determined by external cues, competing cognitive activities, and conflicting goals. EI theory was initially advanced in the context of psychoactive substance use [10, 17], but has been applied to a variety of other reward targets including food [18-20], and to behaviours such as physical activity [21]. It sees motivational states as affectively charged cognitions about a potential behaviour and its likely outcomes, which guide and sustain efforts toward a goal [18]. These cognitions are likely to have the strongest emotional charge, and be most effective at eliciting sustained efforts towards their target when they involve sensory imagery. The thoughts can be encoded in memory and retrieved later, giving a sense of motivational continuity. However, they are subject to renewed evaluation, and are therefore better conceptualised as states than traits. Since they comprise internal events, they are characterised by frequency, duration and availability or intrusiveness, and as affective

experiences, by their intensity and valence. These cognitive-emotional events are triggered by associations with cues or other thoughts, or by physiological deficits. Individuals often lack insight into the triggers of desire [19,20] but the resulting thoughts and imagery-based elaborations are key components of the conscious experience of desire and therefore accessible to self-report.

The Craving Experience Questionnaire (CEQ) [22] applied these insights to the assessment of desires for a range of consummatory targets. Two forms were created, to assess the frequency of cognitions over a specified time period (e.g. in a laboratory session, or over a week), and the strength of the cognitions at a particular time (right now, or when the desire was strongest). Separate confirmatory factor analyses on each form of the CEQ revealed a 3-factor structure that was stable across specific targets (e.g. food, alcohol, cigarettes) and time periods. These were the *Intensity* of desire-related cognitions, desire *Imagery*, and perceived *Intrusiveness* of the cognitions.

More recently, CEQ items have been adapted to assess motivational cognitions for functional targets [21]. The frequency of these cognitions is measured by the Motivation Thought Frequency (MTF) scale, which currently focuses on the previous week. Some modifications were required to reflect a change in focus from a reward target to a behavioural goal. So, items relating to *Intrusiveness* (e.g. 'how hard were you trying not to think about it?') were substituted with items that did not imply that the thought was unwanted (e.g. 'how often did thoughts about it come to mind?') and the subscale was given the more neutral label *Availability*. Instead of the imagery items focusing on different sensory modalities (e.g. picture, taste), they now assessed imagery about positive outcomes (*Incentives Imagery*) and about successful attainments or strategies to reach the goal (*Self-Efficacy Imagery*) [23].

To date, the MTF has demonstrated a stable 4-factor structure (Intensity, Incentives Imagery, Self-Efficacy Imagery, Availability) across physical activity (MTF-PA) [21], high-

calorie snacking (MTF-D [24]), and alcohol misuse (MTF-A [25]). MTF-PA subscales were strongly and positively associated with the Exercise Imagery Inventory Motivation subscale [26], a measure of the frequency of exercise-related imagery, with MTF imagery subscales showing particularly strong correlations (r = .62-.63, p < .001). Furthermore, the MTF-A total was positively associated with Action scores on the Readiness to Change Questionnaire (r = .55, p < .001) [25, 27]. In randomised controlled trials to reduce high-calorie snacking [28] and increase the frequency of gym attendance [29] the MTF-D and MTF-PA respectively showed sensitivity to change, and their change was positively correlated with changes in the relevant behaviour. These data suggest that the MTF is a psychometrically sound measure of motivation with potential relevance to a range of health behaviours.

The current study examined the performance of the MTF across 3 focal goals in type 2 diabetes. Specifically, the scales assessed the frequency of motivational cognitions for blood glucose testing (MTF-GT), physical activity (MTF-PA), and healthy eating (MTF-HE). The specific aims were to assess the MTF's internal structure and its degree of association with concurrent self-reports of diabetic self-care. MTF measures for diabetes were expected to each have the same EI theory 4-factor internal structure as established in previous research. Greater motivation, as indicated by higher scores on the MTF scales, was expected to be associated with greater concurrent adherence to relevant self-care behaviours, and to contribute additional predicted variance after control for gender and age. Collectively, these tests were expected to offer preliminary psychometric support for the application of the MTF scales to diabetes, and provide a foundation for subsequent tests of its sensitivity to change and ability to predict behaviours over time.

Method

Participants

A total of 340 participants with a self-reported health practitioner diagnosis of type 2 diabetes took part. Seventy percent of these (237) were recruited to participate in a randomised controlled trial examining the efficacy of a web program and related telephone intervention on diabetes self-care and dysphoria [30]. They were asked if they were trying to identify support to improve their diabetes self-management, and were promised self-guided modules to improve their diet, physical activity, health routines and mood, education and tips on self-management, and contact from researchers to support their self-management experience. The remaining 103 included ineligible RCT participants and adults with diabetes from the general community who were recruited through Australian diabetes support websites, and were invited to help the researchers find out their 'thoughts and feelings toward making lifestyle changes' by completing a survey. All participants reported receiving a diagnosis of type 2 diabetes at least 3 months previously, and facility with written English. Australian residency was a criterion for inclusion in the randomised controlled trial.

Materials

Motivation Thought Frequency (MTF). The MTF (Table 4.1) comprises 13 items, which were identical to those used in previous studies [21, 24, 25]. Each item assessed the frequency of motivational cognitions over the previous week, and used a 0-10 Likert scale ("never" to "constantly"). Items were administered with reference to glucose testing (MTF-GT), physical activity (MTF-PA) and healthy eating (MTF-HE).

Table 4.1

Items on the Motivation Thought Frequency Scales

Intensity
Over the last week, how often did you…
1. …feel you wanted to…
2. …feel you needed to…
3. …have a strong urge to…
Incentives Imagery
Over the last week, how often did you…
4. …imagine how good it would be to…
5. …imagine how much better you'd feel if you…
6. …imagine how much worse you'd feel if you didn't…
Self-Efficacy Imagery
Over the last week, how often did you…
7. …imagine yourself…
8. …imagine how you would…
9. …imagine succeeding at…
10. …picture times you did something like these in the past…
Availability
Over the last week, how often did…
11. …thoughts about…come to mind
12. …other things remind you about…
13. …thoughts about…grab your attention

Note. Each item related to testing blood glucose regularly, keeping active and eating healthily. Responses were rated from 0 (never) to 10 (constantly).

Summary of Diabetes Self-Care Activities (SDSCA) [31]. Glucose testing, physical activity and healthy eating questions from the SDSCA were used to assess the frequency of adherence to these self-care behaviours. Scores comprised the number of days in the previous week (from 0 to 7) participants reportedly: (i) tested their blood sugar, (ii) participated in at least 30 minutes of physical activity, and (iii) ate five or more servings of fruits and

vegetables. These questions were chosen due to their alignment with Australian National Health Guidelines, which recommend daily glucose testing [32], 2 serves of fruit and 5 serves of vegetables a day [33], and 30 minutes of moderate intensity activity (e.g. exercise, housework, gardening) on most days [34]. The baseline assessments for the RCT took approximately 1 hour to complete. Therefore, rather than administering the full scale, only selected questions from the SDSCA were included to reduce the burden of reporting on participants.

Short Fat Questionnaire [35]. Healthy eating was also measured by an Australian-normed 17-item survey about general consumption of fatty foods. Scores ranged from 0-63, with higher scores reflecting greater consumption of fat.

Procedure

Ethical clearance was obtained from Queensland University of Technology's HREC (1400000268, 1100000783) and Uniting Care Queensland (Cassimatis9111). The MTF survey link was posted on social media sites, in e-newsletters and on the homepages of Diabetes Australia and its state associations in Queensland, Western Australia, South Australia, Tasmania and Victoria. Online consent was obtained at the beginning of the survey, and responses were recorded and stored using Key Survey^{TM}. In addition to the key measures reported above, the survey asked demographic questions. A self-report of the most recent test of glycated haemoglobin (HbA_{1c}) in the previous 4 weeks was also obtained if available.

Statistical Analyses

Separate confirmatory factor analyses were applied to the MTF-GT, MTF-PA and MTF-HE using the lavaan package within R 3.2.4 [36]. To adjust for potential kurtosis and allow for missing item data, a robust maximum likelihood approach (MLR) was employed, and Yuan-Bentler adjustment was applied to correct for multivariate non-normality. Better fit was indexed by a reduced Akaike's Information Criterion (AIC), Standardised Root Mean

Square (SRMR) and Root Mean Square Error of Approximation (RMSEA), and by an increased Bentler's Comparative Fit Index (CFI), and Tucker-Lewis Index (TLI). Good fit was defined by CFI and TLI > 0.90, and SRMR < 0.08, with acceptable fit comprising results that approached these criteria. Given the tendency for RMSEA to give highly variable results in moderate sized samples [37], a rigid criterion for acceptable fit on that indicator was not set. Modification indices were consulted to maximise model fit, and selected error terms for items within a factor were allowed to intercorrelate until good model fit was obtained or no further gains to fit were seen.

Mirroring the procedure used in the development of the MTF-PA [21], tests of the internal structure of each scale compared a single-factor model with models that related to the hypothesized factor structure. Since the hypothesised subscales may have collapsed into larger units (e.g. Intensity with Availability), 2-factor combinations reflecting these relationships were tested. A 3-factor model (Intensity, Availability and a single Imagery scale) and a 4-factor model that separated Incentives Imagery and Self-Efficacy Imagery were then tested. Modification indices were examined, to see whether additional benefit could be derived by correlating error terms within subscales. This serial process stopped when modification indices were < 20 and acceptable model fit was obtained. Factors were allowed to correlate in all models, reflecting our view that the subscales all related to a broad motivation measure. Reliabilities of the subscales are reported by coefficient omega (ω3, [38]), which uses the latent variables and the observed covariance matrix. However, coefficient alphas on the manifest variables are also given.

A repeated measures MANOVA using Wilks' Lambda on average MTF item scores, with age as a covariate, and Scale (3 levels) and Subscale (4 levels) as within-subjects variables, examined whether mean scores differed across those variables. Multiple regressions with forced entry were conducted to assess if MTF scores predicted relevant

concurrent behaviour (glucose testing, physical activity, fruit/vegetable and fat consumption). Age and gender were controlled in these predictions and entered at the initial step, followed by the MTF subscales.

Results

There were no missing data on the MTF. Data screening revealed 29 multivariate outliers across the 3 scales using Mahalanobis *d*. These participants scored low on motivation in one MTF scale, but within the normal range in the other scales. In clinical practice it is not expected that patients will be highly motivated to manage all health behaviours, so these participants were included in the primary analyses.

Items tended to negative skew, indicating high average motivation. The MTF sample was aged between 27 and 84 (M = 59.5, SD = 10.4) and 58% were female. Average self-reported HbA_{1c} from the most recent blood test was 7.2%, or 55mmol/mol (SD = 1.6), 23% were insulin dependent, and 74% were taking oral diabetes medication.

The 237 participants who also completed the SDSCA were aged between 33 and 80 years (M = 59.4, SD = 9.7) and 54% were female. The average self-reported HbA_{1c} from the most recent blood test was 7.2% or 55mmol/mol (SD = 1.4), 21% were insulin dependent and 72% were taking blood glucose medication. Average SDSCA and Short Fat Questionnaire scores for the sub-sample are in Table 4.2. Older participant ages were weakly associated with greater self-reported adherence to fruit and vegetable guidelines (r = .24, $p < .001$), but all other self-care correlations were less than .15. Men (M = 3.5, SD = 2.4) had more days of physical activity per week than women (M = 2.7, SD = 2.2; $F(1, 235) = 7.46$, $p = .007$, $\eta^2 = .031$), but no other behaviours differed by sex.

Table 4.2

Descriptive Statistics for Baseline Motivation Thought Frequency Scales and Self-Care Behaviours

Measure		Total Score		
		Men	Women	Total
		M (SD)	M (SD)	M (SD)
Self-Reports of Self-Care				
Glucose Testing (days/week tested)		4.8 (2.7)	4.2 (2.7)	4.5 (2.7)
Physical Activity (days/week with 30 mins activity)		3.5 (2.4)	2.7 (2.2)	3.0 (2.3)
Fruit/Vegetable consumption (days/week with ≥ 5 serves)		4.4 (2.0)	4.7 (2.0)	4.5 (2.0)
Fat intake (usual consumption on Short Fat Questionnaire)		19.4 (7.0)	18.8 (6.4)	19.0 (6.7)
Motivation Thought Frequency (MTF) scale for diabetes		Mean (SD) item score (0—never to 10—constantly)		
Glucose Testing	Intensity	6.9 (3.0)	6.2 (2.9)	6.5 (3.0)
	Incentives Imagery	5.3 (3.3)	5.7 (3.3)	5.5 (3.3)
	Self-Efficacy Imagery	5.4 (3.3)	5.2 (3.1)	5.3 (3.2)
	Availability	4.9 (3.2)	5.1 (3.3)	5.0 (3.2)
Physical Activity	Intensity	7.2 (2.1)	6.8 (2.1)	7.0 (2.1)
	Incentives Imagery	6.0 (2.8)	7.0 (2.7)	6.5 (2.8)
	Self-Efficacy Imagery	5.6 (2.7)	5.9 (2.5)	5.8 (2.6)
	Availability	5.7 (2.7)	6.7 (2.5)	6.3 (2.6)
Healthy Eating	Intensity	7.3 (2.0)	7.6 (1.9)	7.4 (1.9)
	Incentives Imagery	5.9 (3.0)	7.0 (2.6)	6.5 (2.9)
	Self-Efficacy Imagery	5.4 (2.8)	6.3 (2.4)	5.9 (2.7)
	Availability	5.5 (2.7)	7.0 (2.3)	6.3 (3.0)

Internal structure of the MTF

The 4-factor internal structure that had been obtained in previous studies clearly provided better fit than the tested single, 2- and 3-factor models. Acceptable to very good fit was seen on all indices, especially when error terms within a factor were allowed to intercorrelate (Table 4.3).

Internal consistencies of the subscales were moderate to high for each MTF (Table 4.4), and while the single-factor model was not optimal, the total scales also had high internal consistency (MTF-GT: ω3 = .96, α = .95; MTF-PA: ω3 = .92, α = .92; MTF-HE: ω3 = .93, α = .92). Consistent with the latter result, MTF subscales showed moderate to high intercorrelations within each domain (Median *r* for MTF-GT = .74; MTF-PA = .62; MTF-HE = .62). In each case, the highest intercorrelations were between the two imagery subscales (Median *r* =.81). Table 4 also shows the intercorrelations between MTF subscales for different targets. The MTF-HE and MTF-PA subscales were the most closely related (Median *r* = .86), and among subscales, Incentives Imagery showed the strongest correlations across behavioural targets (Median *r* = .69).

Table 4.3

Confirmatory Factor Analysis of the Motivation Thought Frequency Scales for Diabetes

	Yuan-Bentler χ^2	df	CFI	TLI	AIC	SRMR	RMSEA	90%CI
Glucose Testing								
1 factor	571	65	.784	.740	20569	.078	.151	.143-.160
2 factors (Intensity/Availability, Imagery)	552	64	.791	.746	20516	.075	.150	.141-.159
2 factors (Intensity/Imagery, Availability)	507	64	.810	.769	20441	.076	.143	.134-.152
2 factors (Intensity, Imagery/Availability)	337	64	.883	.857	20169	.055	.112	.103-.122
3 factors (Intensity, Imagery, Availability)	276	62	.909	.885	20063	.052	.101	.091-.111
4 factors (Intensity, Incentives Imagery, Self-Efficacy Imagery, Availability)	225	59	.929	.906	19982	.050	.091	.081-.101
Correlating errors for Items 7/8, 12/13	185	57	.945	.925	19918	.042	.081	.070-.092
Physical Activity								
1 factor	554	65	.715	.658	20624	.103	.149	.139-.158
2 factors (Intensity/Availability, Imagery)	523	64	.732	.673	20564	.100	.145	.136-.155
2 factors (Intensity/Imagery, Availability)	487	64	.753	.699	20519	.101	.139	.130-.149
2 factors (Intensity, Imagery/Availability)	348	64	.854	.798	20317	.078	.114	.105-.124
3 factors (Intensity, Imagery, Availability)	287	62	.869	.835	20225	.076	.103	.093-.114
4 factors (Intensity, Incentives Imagery, Self-Efficacy Imagery, Availability)	217	59	.908	.878	20127	.069	.089	.078-.100
Correlating errors for Items 12/13, 7/8	177	57	.930	.904	20071	.061	.079	.068-.090
Healthy Eating								
1 factor	530	65	.736	.684	20205	.097	.145	.136-.154
2 factors (Intensity/Availability, Imagery)	504	64	.750	.696	20142	.093	.142	.133-.152
2 factors (Intensity/Imagery, Availability)	454	64	.779	.731	20086	.094	.134	.124-.143
2 factors (Intensity, Imagery/Availability)	316	64	.857	.826	19874	.070	.108	.098-.117
3 factors (Intensity, Imagery, Availability)	240	62	.899	.873	19765	.066	.092	.082-.102
4 factors (Intensity, Incentives Imagery, Self-Efficacy Imagery, Availability)	195	59	.923	.898	19697	.062	.082	.072-.093
Correlating errors for Items 12/13, 7/8	185	57	.928	.901	19680	.059	.081	.070-.092

Table 4.4

Internal Consistency and Intercorrelations of the Motivation Thought Frequency Subscales[1]

	Glucose Testing Imagery				Physical Activity Imagery				Diet Imagery			
Target	Intensity	Incentives	Efficacy	Availability	Intensity	Incentives	Efficacy	Availability	Intensity	Incentives	Efficacy	Availability
Glucose Testing												
Intensity	.92 (.92)[1]											
Incentives	.59***	.89 (.91)[1]										
Efficacy	.70***	.85***	.88 (.88)[1]									
Availability	.56***	.81***	.78***	.85 (.89)[1]								
Physical Activity												
Intensity	.36***				.86 (.85)[1]							
Incentives		.67***			.31***	.81 (.80)[1]						
Efficacy			.57***		.55***	.76***	.81 (.84)[1]					
Availability				.55***	.37***	.70***	.68***	.75 (.84)[1]				
Healthy Eating												
Intensity	.34***				.67***				.88 (.86)[1]			
Incentives		.69***				.92***			.39***	.77 (.77)[1]		
Efficacy			.62***				.86***		.57***	.81***	.89 (.90)[1]	
Availability				.54***				.86***	.37***	.68***	.67***	.76 (.83)[1]

*** $p < .001$

1. Reliabilities are on the diagonal. The first number is ω3 (Raykov, 2001), which uses the latent variables and the observed covariance matrix, and the number in parentheses is coefficient alpha on the manifest variables.

MTF average scores, and their relationships with gender and age

Mean scores for MTF subscales are displayed in Table 2. A repeated measures ANOVA with Gender as the between-subjects variable showed significant effects for MTF Scales ($F(2, 233) = 16.70$, $p < .001$, $\eta^2 = .125$), and Subscales ($F(3, 232) = 39.30$, $p < .001$, $\eta^2 = .337$), but not Gender ($F(1, 234) = 3.19$, $p = .075$, $\eta^2 = .013$). Glucose Testing had lower average cognition frequencies than Physical Activity or Healthy Eating, and Intensity subscales scored highest, while Self-Efficacy Imagery scored lowest. However, these effects were modified by significant interactions between each of the variables, reflecting the complex patterns in Table 2 (Scale x Subscale: $F(6, 229) = 9.64$, $p < .001$, $\eta^2 = .202$; Gender x Scale: $F(2, 233) = 8.79$, $p < .001$, $\eta^2 = .070$; Gender x Subscale: $F(3, 232) = 5.48$, $p = .001$, $\eta^2 = .066$; Gender x Scale x Subscale: $F(6, 229) = 2.62$, $p = .018$, $\eta^2 = .064$). Some statistically significant correlations were seen with age: these tended to be positive with Intensity (median $r = .17$), and negative with Availability subscales (median $r = -.14$), but none exceeded .20.

Table 4.5

Concurrent Predictions of Weekly Self-Management Behaviours

Predicted Self-Care Behaviour	Predictors	Univariate correlations		Changes at each Step				Equation at final step		
		r	*p*	R^2 Change	*F* Change	df	*p*	*β*	SE	*p*
Glucose Testing	Constant	…	…					.314	.891	.725
	Age	.113	**.041**					-.004	.013	.743
	Gender	-.106	.051	.021	2.495	2,231	.085	.006	.242	.979
	MTF-GT Subscales									
	Intensity	.757	**< .001**					.221	.019	**< .001**
	Incentives Imagery	.401	**< .001**					.064	.025	**.011**
	Self-Efficacy Imagery	.551	**< .001**					-.051	.021	**.014**
	Availability	.439	**< .001**	.568	78.31	4,227	**< .001**	006	.021	.793
Physical Activity	Constant	…	…					-.054	1.051	.959
	Age	.13	**.022**					.004	.014	.797
	Gender	-.18	**.003**	.042	5.10	2,231	**.007**	-.578	.273	**.035**
	MTF-PA Subscales									
	Intensity	.51	**< .001**					.191	.025	**< .001**
	Incentives Imagery	.05	.219					.014	.027	.596
	Self-Efficacy Imagery	.18	**.003**					-.018	.022	.428
	Availability	.09	.086	.240	18.93	4,227	**< .001**	-.005	.026	.841
Fruit/Vegetable Consumption	Constant	…	…					-0.847	.927	.362
	Age	.24	**< .001**					.044	.012	**< .001**
	Gender	.06	.168	.065	7.97	2,231	**< .001**	.219	.243	.369
	MTF-HE Subscales									
	Intensity	.39	**< .001**					.082	.024	**.001**
	Incentives Imagery	.07	.139					-.094	.025	**< .001**
	Self-Efficacy Imagery	.28	**< .001**					.072	.021	**.001**
	Availability	.19	**.002**	.185	14.00	4,227	**< .001**	.038	.024	.114
Fat Consumption	Constant	…	…					27.477	3.330	< .001
	Age	-.06	.196					- .013	.045	.765
	Gender	-.05[a]	.239	.006	0.71	2,231	.490	-.442	.874	.614
	MTF-HE Subscales									
	Intensity	-.32	**< .001**					-.279	.087	**.002**
	Incentives Imagery	-.11	.053					.107	.089	.232
	Self-Efficacy Imagery	-.24	**< .001**					-.162	.075	**.031**
	Availability	-.11	**.040**	.112	7.21	4,227	**< .001**	.054	.085	.530

[a] The displayed correlations are as used in the multiple linear regression. Tests for Gender using ANOVAs were, for Glucose testing: F (1, 235) = 2.69, p = .103; Physical activity: F (1, 235) = 7.46, p = .007; Fruit/vegetable consumption: F (1, 235) = 0.93, p = .337; and Fat consumption: F (1, 235) = 0.50, p = .479.
Probabilities < .05 are in bold type.

Concurrent prediction of self-care behaviours

Concurrent predictions of glucose testing, physical activity, fruit and vegetable and fat consumption from content-relevant MTF subscales are in Table 4.5. Addition of the MTF subscales to predictions from Gender and Age were significant for all self-care behaviours ($p < .001$), contributing an additional 57% to the predicted variance for glucose testing, 24% for physical activity, 19% for fruit and vegetable consumption and 11% to fat intake. The most consistent individual subscale predictors were Intensity and Self-Efficacy Imagery, which both significantly correlated with all four self-care behaviours. The least consistent was Incentives Imagery, which only had a significant correlation with glucose testing.

Discussion

Confirmatory factor analyses on the Motivation Thought Frequency scales for glucose testing, physical activity and healthy eating in type 2 diabetes strongly supported the EI theory's prediction of a 4-factor internal structure, and were consistent with results of previous research on the MTF-PA [21], MTF-D [24], and MTF-A [25] in the general population. When error terms within a factor were allowed to intercorrelate, particularly good fit was demonstrated. Addition of MTF subscales to the equation significantly added to the concurrent prediction of all self-care behaviours ($p < .001$).

Frequencies of cognitions about wanting, needing or having a strong urge to undertake self-care behaviours (MTF Intensity) contributed unique predictive variance to all of the behaviours. These cognitions were also the most frequently reported on the MTF, and require less self-awareness than the specific identification of mental imagery, which may partly account for their predictive power in the current study.

While Self-Efficacy Imagery was recorded less frequently, it was also associated with the four self-care behaviours, and uniquely contributed to the prediction of all but physical activity. Close relationships with imagery about undertaking the behaviour were highly

consistent with the predictive power of self-efficacy in diabetes [39, 40], and with the need to cue self-care behaviours by covert rehearsal.

While Availability had significant correlations with three of the self-care behaviours, it did not offer unique predictive variance, suggesting that its effects were better explained by other subscales. Furthermore, more frequent Incentives Imagery was only positively correlated with glucose testing. The lack of other significant predictions was unexpected, given the importance that imagery for incentives has in EI Theory and has shown in extensive related laboratory and clinical research on craving and desire [41]. The result may reflect a decreased power from Incentives Imagery over time, where repeated efforts to improve healthy eating or physical activity may not have resulted in substantial goal attainments (e.g. in weight or physical status). In contrast, incentives for blood sugar testing are more proximal and certain.

If the superior predictive effects from Intensity and Self-Efficacy Imagery are replicated in prospective research, assessment of motivations for diabetic self-care might perhaps be restricted to those subscales, which would substantially reduce the length of the assessment. However, effects from Incentives Imagery and Availability may be altered by an intervention that focused on elicitation of proximal and affectively strong forms of these cognitions.

The strongest concurrent associations of the MTF were with glucose testing. Ongoing monitoring of glucose is arguably the most critical aspect of self-care in diabetes, as it triggers subsequent self-care behaviours based on its results [3, 42]. However, while awareness of sugar levels is likely to trigger immediate actions to address hypo- or hyperglycemia, it may not always translate into improved self-care [43], so assessment of motivation for all three focal behaviours is preferable.

The weakest concurrent predictions involved dietary behaviours. The MTF-D used in previous research, which focused on high-calorie snacking [24], gave a more discrete focus than healthy eating. Additionally, increases in frequencies of cognitions about abstaining from high-calorie desserts, snacks and alcoholic drinks are associated with reductions in their consumption [28]. Neither of the dietary measures in the current study fully captured the concept of healthy eating; nor did they adequately capture the key components required to maintain stable glycaemic control. Refinement of the targets for dietary motivation and behaviours may provide stronger results in that domain.

The current study focused on the concurrent prediction of self-care behaviours, which prevents conclusions about the direction of any causal links. Research is therefore needed on the utility of the MTF as a prospective predictor of self-care. It is acknowledged that motivation can be unstable and that in this study the MTF focused on the previous week. Therefore it is expected that its primary predictive utility will involve proximal measures of self-care. Our predictions from the MTF may also have been enhanced by shared method variance, since both were by self-report. Future research should attempt to assess diabetes self-care more precisely and objectively (e.g., using event-cued recall of self-monitoring). Another limitation of the current study was that participants' self-reported diagnosis of diabetes and HbA_{1c} results were not verified by their treating clinician. In addition, time since diagnosis was not controlled. The absence of statistical control for disease duration may have restricted identification of associations between the MTF and self-care, among participants with relatively recent and more long-standing diabetes. The MTF may have greater relevance at critical stages of the disorder (e.g. soon after diagnosis or a glycaemic crisis) than at other times. Motivational cognitions may not be needed to sustain well-established habits (although they may retain importance when routines are interrupted or situational challenges to self-care are encountered). Accordingly, effects of both duration and recent diabetic events should

be measured in future research. Finally, participants were self-selected and most were already linked with support agencies, which may indicate higher than average motivation to manage their health. Performance of the MTF should also be tested in a random clinic sample where variability in motivation and diabetic status may be greater.

Unlike previous motivation scales, the MTF provides a measure of the frequency of recent motivational cognitions, regardless of the source of that motivation. In combination with existing research in the general population, this study suggests that the MTF may be applied to a variety of goals and in a wide range of contexts. In the management of diabetes, the MTF may be used in routine assessments in combination with measures of self-care, to alert patients to any deterioration, determine whether referral for adherence support is needed, and identify behavioural and motivational foci for intervention. Where motivation is strong but self-care is sub-optimal, treatment could primarily focus on strategies to improve self-care.

The present study provides strong preliminary evidence in support of MTF scales as measures of motivational cognitions about adherence to diabetes self-management regimens. If the MTF demonstrates similar sensitivity to change as it has demonstrated in other contexts [28, 29], it may also be used to measure the impact of motivational interventions in diabetes. Demonstration of these features will further substantiate the utility of the MTF scales in routine diabetic care.

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Compliance with Ethical Standards:

Conflict of Interest: The authors declare that they have no conflict of interest.

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

This article does not contain any studies with animals performed by any of the authors.

Informed consent: Informed consent was obtained from all individual participants included in the study.

CHAPTER 5

Manuscript 2: Applying EI Theory to Motivation Enhancement (RCT)

This chapter describes 3-month results from a randomised controlled trial that evaluated the effects of a web-based self-management support program (OnTrack Diabetes), telephone therapist motivational support using Functional Imagery Training, and a control on self-care behaviours, physical and mental health outcomes.

This manuscript was submitted to Diabetes Care.

Authors' contributions to this paper:

The candidate, who is the first author, recruited participants, conducted screening and baseline assessments, delivered the telephone intervention FIT, supervised the blind assessor with follow-up, and drafted the manuscript. The first and second authors developed the FIT manual and conducted data analyses. The remaining co-authors edited the paper.

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Statement of Contribution of Co-Authors for Thesis by Published Paper

The following is the suggested format for the required declaration provided at the start of any thesis chapter which includes a co-authored publication.

The authors listed below have certified* that:

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3. there are no other authors of the publication according to these criteria;
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Principal Supervisor Confirmation

I have sighted email or other correspondence from all Co-authors confirming their certifying authorship.

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Effects of a Diabetes Web-Based Program and Functional Imagery Training: A Randomised Controlled Trial

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Abstract

Objective: Low motivation may contribute to suboptimal adherence in diabetes treatment. Web-based self-management programs can reduce diabetes-related complications and improve wellbeing through adherence support, however clinical outcomes in this modality have been inconsistent and interventions are rarely holistic. Additional data on integration with therapist support to enhance motivation are required.

Research Design and Method: A randomised controlled trial assessed the effects of adding an imagery-based motivational intervention (Functional Imagery Training, FIT) to a comprehensive web program (OnTrack Diabetes). 239 Australian adults with type 2 diabetes (46% male; M_{age} = 59.41, SD = 9.70) from the general community participated. Effects of access to OnTrack Diabetes, with or without FIT, were compared with a Wait List over 3 months. Primary outcomes were diet, activity, and glucose testing. Secondary outcomes were motivational cognitions, self-efficacy, HbA1c, weight, depression, anxiety and stress. Analyses were by intention to treat, using linear mixed models.

Results: The only differential effect from condition was a decrease in weight for OnTrack participants without FIT. Participants who used the web program, with or without FIT, had a greater reduction in HbA1c than those who did not. Motivation cognitions at baseline were associated with behaviour changes at 3 months.

Conclusions: OnTrack Diabetes may improve short-term adherence, however disparate self-care deficits and goals dilute the ability to detect its efficacy, and this remains an issue for assessment of holistic web interventions. Targeting motivation to enhance adherence is likely important, although further modification to FIT is needed before clinical implementation.

Type 2 diabetes is a growing public health concern globally and is predicted to be the 7th leading cause of death by 2030 (1). Effective interventions that are easily accessible are needed to alleviate the individual and societal burden of the disease. Current treatment promotes lifestyle modification, where self-management is principally achieved through adjustments to diet, physical activity, and daily monitoring of blood glucose (2). However suboptimal management is common due to low motivation for these self-care behaviours (3, 4). Despite the high prevalence and impact of type 2 diabetes, access to effective support for self-management is limited, particularly in rural and remote regions, suggesting a need for alternative methods of healthcare delivery.

Technology-based interventions can potentially offer this support without time or geographical restrictions. Web-based interventions that have included patient education (5), supported behaviour modification (6), and enhanced desire for change (7) have significantly improved self-care, however, clinical outcomes are inconsistent (8). Additionally, personalised interventions are desired by patients (9) and appear to be more effective than prescribed regimens (10). Psychological distress may impair self-management (11). There is evidence for a bidirectional relationship between diabetes and depression (11), a higher prevalence of generalised anxiety disorder in patients with diabetes compared to the general population (12), and stress can influence blood glucose concentrations, thereby affecting glycaemic control (13). Few interventions have attempted to address both behavioural self-care and psychological wellbeing. This complex interrelationship between physical and mental health, together with inconsistent intervention outcomes, warrants an integrative and innovative approach to treatment.

The current research describes results from a randomised controlled trial of an integrated physical and mental health web-based self-management program and a novel motivational intervention. The trial examines the efficacy of the Social Cognitive Theory

(SCT) (14) grounded program - OnTrack Diabetes (15); and the added effects of a personalised telephone intervention based on the Elaborated Intrusion (EI) Theory of Desire (16) - Functional Imagery Training (FIT) (17). SCT provides a coherent framework for web-based interventions, through its emphasis on incentives, goal setting, and development of self-efficacy (18). These mechanisms are expected to empower the individual to initiate and maintain health behaviours. Cognitive-behavioural therapy techniques can improve mood and alleviate stress and anxiety in diabetes (19). These strategies in conjunction with health behaviour support are expected to promote emotional wellbeing.

EI theory provides a comprehensive explanation of cognitive-emotional processes underpinning motivated behaviour (20), but has not previously been applied to the management of diabetes. Although initially used as an explanatory model of dysfunctional desires (21, 22, 23), EI theory has more recently been applied to functional goals (24, 25), and thus has relevance to diabetes self-care. The theory asserts that vivid imagery about a target or goal is central to intense desires, and image vividness and desire intensity can be increased by mental elaboration. Pleasure or relief that is produced by the image helps to maintain this elaboration, and awareness of discrepancies between anticipated outcomes and the current state prompts action to reach the goal, guided by further imagery. These central tenets of EI theory, in conjunction with principles from motivational interviewing (26) have informed the development of FIT. FIT attempts to increase desires for health-promoting behaviours by training individuals to frequently use mental imagery of goals, past successes, and related strategies. To date, this intervention has had positive results in small randomised controlled trials to reduce unhealthy snacking (17) and increase gym attendance (25). Both trials compared immediate FIT with information and advice over 2 weeks. In the snacking trial, participants in the information and advice condition then received FIT and both groups were followed up at 4 weeks. Each trial showed a differential improvement from FIT on

motivation for the behaviour change goal and in the focal behaviour (reduced snacking and increased frequency of gym attendance).

Development of OnTrack Diabetes and adoption of FIT meet the need for a holistic approach to treatment and novel motivational support strategies in type 2 diabetes. The aim of this study was to evaluate the effect of OnTrack Diabetes and FIT over 3 months on self-care behaviours (diet, activity and blood glucose testing), clinical outcomes (glycated haemoglobin-HbA1c, and weight), and psychological outcomes (self-efficacy, depression, anxiety, stress and motivation cognitions). Three conditions were compared: access to the program after a 3-month delay ('Wait List'), access to the OnTrack Diabetes program alone ('Web Alone') or with additional telephone support using FIT ('Web+FIT'). The trial was described in detail in a protocol paper (27). Due to a predicted increase in motivation cognitions, greatest improvements in self-management behaviours, HbA1c and weight were expected in the Web+FIT condition, followed by the Web Alone condition, with the Wait List showing the least improvement. Since psychological wellbeing was addressed in the web program, amelioration of depression, anxiety and stress was expected to be similar for the Web+FIT and Web Alone conditions.

Secondary aims were to assess the effect of program engagement on self-care behaviours and clinical outcomes in the two groups with OnTrack access, and measure the effect of motivation cognitions in all participants on changes to self-care behaviours. Greater program use was expected to result in greater improvements to health outcomes. Changes to behaviour over 3 months were expected to correspond with frequency of baseline motivation cognitions.

Research Design and Method

Recruitment and sample

Recruitment occurred in six Australian states through online advertisements, radio broadcasts, flyer distribution to diabetes educators/general practitioners, and national/state health organisation e-newsletters or websites. Inclusion criteria were: (a) ≥ 3 month diagnosis of type 2 diabetes (b) clear command of written/spoken English (c) regular computer and internet access (d) contactable by phone. Exclusion criteria were: (a) diagnosis of a psychological disorder other than depression or anxiety (b) significant cognitive impairment such as dementia (c) physical limitation that would prevent an increase in activity (d) pregnancy or use of oral steroid medication (due to effect on blood glucose) and (e) concurrently involved in another intervention trial. A sample of 210 participants was required for detection of a small effect size of $f^2 = 0.046$. While HbA1c readings < 7 indicate optimal management, longitudinal glucose readings fluctuate, even for well-managed patients due to difficulty sustaining lifestyle changes. Therefore a diagnosis of type 2 diabetes was sufficient for inclusion, regardless of baseline reading.

Measures

Demographic questions were adapted from The Australian Diabetes, Obesity & Lifestyle Study (AusDiab Study) (28). Primary outcomes were dietary fat, fruit and vegetable consumption, physical activity and daily glucose testing. Dietary fat was measured by the 17-item Short Fat Questionnaire (29), an Australian-normed survey with high internal consistency ($\alpha = 0.85$), where scores ranged from 0-63, and higher scores reflected greater consumption of fat over an unspecified period. Fruit and vegetable consumption, activity and glucose testing were measured by the Summary of Diabetes Self-Care Activities (SDSCA) (30) items "On how many of the last 7 days did you…eat 5 or more serves of fruit and vegetables; …participate in at least 30 minutes of physical activity; …test your blood

sugar?". Scores ranged from 0-7, and higher scores reflected greater engagement in the respective self-care behaviour. This scale has moderate test-retest reliability over 3 months (r = 0.40). Single items from the SDSCA were administered instead of the full scale to reduce the burden of assessment on participants, and subsequently increase retention at follow-up. HbA1c was obtained from a blood assessment within the previous 4 weeks. Because participants were undertaking the study remotely, it was not possible to observe them directly, and it was not considered feasible to obtain current weight and glycemic control data from their doctor. Accordingly, assessment of weight and HbA1c were by self-report. However, participants were asked to use the same scales for each weight assessment, to address the potential for variations in measurement accuracy to affect results. Self-efficacy was measured by the 8-item Self-efficacy for Diabetes scale (31), which assessed confidence to seek professional support and control diabetes through diet, activity, and glucose management. This scale is highly reliable ($\alpha = 0.83$) and scores ranged from 1-10, and higher scores indicated greater self-efficacy. Depression, anxiety and stress were measured by the 21-item Depression Anxiety Stress Scale (DASS-21), a scale with high internal consistency that demonstrates both convergent and discriminant validity (32). Each subscale score ranged from 0-21 where higher scores reflected greater distress. Motivation was measured by the 13-item Motivation Thought Frequency (MTF) scales for Diabetes (33), which assessed frequency of cognitions about eating healthily (MTF-HE), keeping active (MTF-PA) and testing blood glucose regularly (MTF-GT). Each MTF scale had Intensity (3 items), Incentive Imagery (3 items), Self-efficacy Imagery (4 items) and Availability (3 items) subscales. Items were rated from 0-10, with higher scores reflecting greater motivation to manage the focal behaviour. Program use was measured by the number of OnTrack Diabetes pages completed out of a possible 240. These data were obtained from the OnTrack Diabetes website which recorded the frequency of clicking through screens.

Design

This was a 3-arm superiority study conducted by telephone and Internet. Randomisation was stratified (HbA1c < or ≥ 7) using random permutations in blocks of 6 or 9, undertaken automatically by a trial management program (Goji, 34), with the allocation concealed until eligibility was confirmed and baseline assessments were complete. Screening and baseline assessments were conducted by the FIT therapist. Follow-up measures were obtained by a blind assessor.

Intervention

OnTrack Diabetes is a self-guided management support web program that was provided at www.ontrack.org.au/diabetes. The program contained modules with a motivational unit, goal-setting and action-planning for diet, activity, monitoring behaviours and emotional health. Summaries of completed tools could be printed. Daily mood, blood glucose levels, activity and nutrition could be monitored and reviewed graphically. Additional resources included mindfulness audios and an extensive set of fact sheets on type 2 diabetes and management strategies. Further description of the program is provided elsewhere (15, 27).

***Wait List condition*.** Usual care following the baseline assessment.

Web Alone condition. Access to OnTrack Diabetes was provided immediately after the baseline assessment.

Web+FIT condition. Access to OnTrack Diabetes with telephone therapist support using FIT was provided after the baseline assessment. Session 1 explored participants' current lifestyle, the rationale for guided imagery (16), and a treatment focus. Session 2 confirmed a health goal, and used guided imagery to picture past success, strategies for change, and barriers/solutions to management. A commitment script was drafted if participants were willing to proceed with their goal. They were also encouraged to collect

goal-related images and set reminders for imagery practice, to increase engagement with cognitions about change. Session 3 addressed overcoming challenging situations using imagery and paired imagery practice with a daily task to make the process habitual. Sessions 4 to 7 were generic follow-up calls related to progress, updating goals, use of imagery and reminders. Use of OnTrack Diabetes and imagery were set as homework after each session.

Procedure

This study was approved by Uniting Care Health (Cassimatis9111), and the Queensland University of Technology Human Research Ethics Committee (1100000783). Participants enrolled online, were screened via telephone, and randomised to one of three conditions after reporting their HbA1c from the previous 4 weeks and completing the baseline assessment. Participants in the Web Alone and Web+FIT conditions received an automated email containing a username, password and link to OnTrack Diabetes. Users received 24-hour access to the program. If users did not login for 2 weeks, a reminder email was automatically sent containing the website link and encouragement to persist with health goals.

An FIT treatment manual for diabetes was developed and adapted from a previous FIT intervention (17). Participants received 7 FIT telephone calls over 3 months from provisionally registered psychologists. Calls 1 and 2 occurred in the first week of enrolment and were approximately 30-45 minutes. Calls 3 to 7 were conducted fortnightly from week 2, and were approximately 15 minutes. All participants completed a follow-up assessment at 3-months that was identical to baseline. After recruitment of 120 participants, a different therapist conducted FIT, there was an increased specification of the FIT manual, and follow-up procedures were made more assertive. An incentive of $20 was provided for participants who completed the 3-month HbA1c test and survey.

Analyses

Analyses were conducted using IBM SPSS version 21. Differences in baseline measures across conditions and phases of recruitment were analysed using χ^2 and a one-way ANOVA. Preliminary analyses checked for any effects of the changes to the protocol, but no interaction of phase by condition and time were detected. Accordingly, phase was omitted from the analyses reported below. Retention to follow-up was defined by completion of at least the primary outcome variables (self-management behaviours). Differences in demographic and baseline characteristics between completers and non-completers were assessed using t-tests. Intention-to-treat generalised linear mixed-models were applied to detect changes in outcomes from baseline to 3 months.

Secondary analyses examined changes in outcome from degree of program use, using intention-to-treat general linear mixed models. Multinomial logistic regression was used to predict program use from demographic and baseline characteristics. Changes in primary outcomes from baseline motivation were analysed using multiple linear regression.

Results

Baseline characteristics

A CONSORT diagram for the trial is presented in Figure 5.1 and sample characteristics are in Table 5.1. There were no differences between conditions at baseline on any variable.

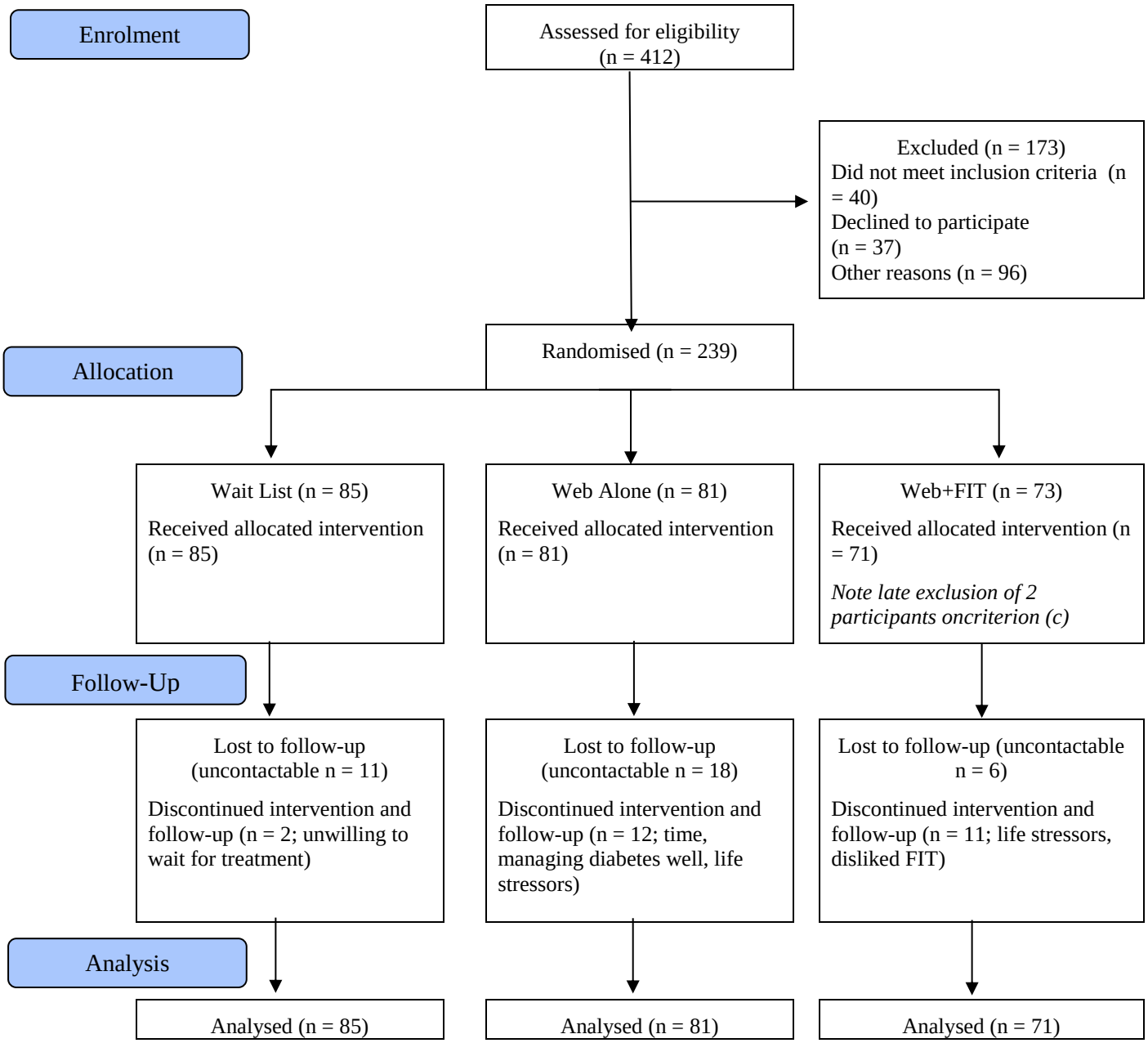

Figure 5.1. Randomised controlled trial CONSORT flow chart

Table 5.1

Baseline Characteristics

Parameter	Total Sample (n = 239)
Age (years)	59.4 (9.7)
Male (%)	46
Highest education (%)	
University or technical	71
≤ Secondary school	29
Employment status (%)	
Employed	56
Retired/Unemployed	44
Relationship status (%)	
Partnered	67
Not partnered	33
Fat consumption	19.0 (6.7)
Fruit/Vegetable (days/week)	4.5 (2.0)
Activity (days/week)	3.0 (2.3)
Glucose testing (days/week)	4.5 (2.7)
HbA1c (%)	7.2 (1.4) (55mmol/mol (15.3))
Weight (kg)	93.4 (23.5)
Self-efficacy	6.7 (1.8)
Depression Anxiety Stress Scale (DASS-21)	
Depression	5.1 (4.5)
Anxiety	2.9 (2.6)
Stress	6.0 (3.8)

Prediction of Retention

Over the 3 months, 172 participants (73%) were retained. Gender, condition, and relationship status accounted for 13.2% of the variance in participant retention. More males (81% vs. 67%, χ^2 (1) = 5.75, p = .02), participants in the Wait List condition (84% vs. Web

Alone 65%, Web+FIT 68%, χ^2 (2) = 7.90, p = .02), and those in a relationship (76% vs. 64%, χ^2 (1) = 5.07, p = .02) completed the 3-month assessment. For dietary fat, activity, self-efficacy, depression and stress, there was no difference in behaviour (Fat: t(235) = -0.77, p = 0.44; Exercise: t(235) = -1.10, p = 0.27), confidence (Self-efficacy: t(235) = 1.05, p = 0.29) and distress (Depression: t(235) = 0.29, p = 0.72; Stress: t(235) = 0.06, p = 0.95) at baseline between those lost to follow-up and completers.

Outcomes of Condition

A Toeplitz covariance matrix provided best fit for outcome analyses. Means and results from the mixed model analyses are displayed in Table 5.2 and Table 5.3. Across all participants, there was a reduction in fat consumption, depression and stress, and daily activity and self-efficacy increased. There were only two significant differential changes between conditions. Weight showed a greater reduction in the Web Alone condition (1.90kg), followed by Web+FIT (0.24kg), and no change in Wait-List control (F(2, 169.76) = 4.19, p = 0.02). Intensity of motivation for glucose testing on the MTF remained stable for the Web Alone and Web+FIT conditions, but reduced for the Wait-List condition after 3 months (F(4, 238.48) = 3.13, p = 0.02).

Table 5.2

Changes in Outcome Variables over 3 Months using Intention-to-Treat

Outcome	Wait List[a]		Web Alone[a]		Web+FIT[a]		Time			Time x Condition		
	Baseline	3 months	Baseline	3 months	Baseline	3 months	*F*	df	*p*	*F*	*df*	*p*
Fat consumption	18.9 (0.7)	17.3 (0.8)	19.2 (0.7)	17.2 (0.9)	18.9 (0.8)	16.9 (0.9)	**12.93**	**1, 194.62**	**<0.001**	0.08	2, 194.12	0.92
Fruit/vegetables[b]	4.4 (0.2)	4.3 (0.2)	4.6 (0.2)	4.7 (0.3)	4.8 (0.2)	4.9 (0.3)	0.37	1, 194.68	0.54	0.17	2, 194.20	0.85
Activity[b]	3.0 (0.3)	3.8 (0.3)	3.1 (0.3)	4.2 (0.3)	3.0 (0.3)	4.1 (0.3)	**22.93**	**1, 217.23**	**<0.001**	0.47	2, 216.82	0.63
Glucose testing[b]	4.3 (0.3)	4.2 (0.3)	4.5 (0.3)	4.6 (0.4)	4.7 (0.3)	4.5 (0.4)	0.10	1, 204.16	0.76	0.05	2, 203.75	0.95
HbA1c (%)	7.2 (0.1)	7.1 (0.2)	7.2 (0.2)	7.0 (0.2)	7.1 (0.2)	7.0 (0.2)	3.55	1, 158.94	0.06	0.21	2, 158.78	0.82
HbA1c (mmol/mol)	55 (1.1)	54 (2.2)	55 (2.2)	53 (2.2)	54 (2.2)	53 (2.2)						
Weight	92.0 (2.5)	92.0 (2.5)	92.5 (2.6)	90.6 (2.6)	96.0 (2.8)	95.9 (2.8)	**6.49**	**1, 169.77**	**0.01**	**4.19**	**2, 169.76**	**0.02**
Self-Efficacy	6.7 (0.2)	6.9 (0.2)	6.7 (0.2)	7.1 (0.2)	6.7 (0.2)	7.2 (0.2)	**13.03**	**1, 188.15**	**<0.001**	0.59	2, 187.89	0.55
Depression	4.4 (0.5)	4.6 (0.5)	5.6 (0.5)	4.3 (0.6)	5.2 (0.5)	4.1 (0.6)	**4.27**	**1, 197.70**	**0.04**	1.88	2, 197.23	0.16
Anxiety	2.7 (0.3)	2.6 (0.3)	2.9 (0.3)	2.3 (0.4)	3.1 (0.3)	2.9 (0.4)	0.94	1, 216.89	0.34	0.41	2, 216.38	0.66
Stress	5.5 (0.4)	5.3 (0.5)	6.4 (0.4)	4.9 (0.5)	6.2 (0.5)	5.5 (0.6)	**6.00**	**1, 207.27**	**0.02**	1.47	2, 206.78	0.23

Note. Mean and standard error values have been reported for outcome variables

[a]Wait List: Usual care; Web Alone: Access to OnTrack Diabetes web program; Web+FIT: Access to OnTrack Diabetes and 7 therapist calls using functional imagery training

[b]Number of days per week

Table 5.3

Changes in Motivation over 3 Months using Intention-to-Treat

Motivation Thought Frequency Scales	Wait List[a]		Web Alone[a]		Web+FIT[a]		Time			Time x Condition		
	Baseline	3 months	Baseline	3 months	Baseline	3 months	*F*	df	*p*	*F*	*df*	*p*
Healthy Eating												
Intensity	21.86 (0.62)	22.04 (0.65)	22.38 (0.63)	23.14 (0.74)	22.63 (0.67)	22.74 (0.77)	0.66	1, 194.10	0.42	0.42	4, 226.36	0.79
Incentive imagery	18.11 (0.92)	18.00 (0.98)	20.35 (0.94)	20.47 (1.10)	20.18 (1.01)	19.67 (1.15)	0.07	1, 188.53	0.79	1.13	4, 222.45	0.34
Self-efficacy Imagery	22.36 (1.12)	23.24 (1.18)	24.48 (1.15)	25.65 (1.33)	24.58 (1.22)	24.94 (1.39)	1.28	1, 192.25	0.26	0.76	4, 239.67	0.56
Availability	17.52 (0.85)	17.19 (0.91)	20.33 (0.87)	18.98 (1.03)	18.94 (0.93)	18.64 (1.07)	1.17	1, 201.35	0.28	1.46	4, 234.68	0.21
Physical Activity												
Intensity	20.56 (0.70)	20.41 (0.73)	20.91 (0.70)	21.74 (0.82)	21.41 (0.76)	21.93 (0.86)	0.87	1, 192.67	0.35	0.63	4, 262.39	0.64
Incentive imagery	18.24 (0.90)	17.23 (0.95)	20.64 (0.92)	20.46 (1.06)	20.27 (0.99)	20.03 (1.11)	0.73	1, 186.58	0.39	1.70	4, 264.00	0.15
Self-efficacy Imagery	21.43 (1.12)	22.37 (1.18)	23.79 (1.14)	25.30 (1.31)	24.55 (1.22)	25.29 (1.37)	2.47	1, 192.17	0.12	1.28	4, 275.93	0.28
Availability	17.05 (0.86)	16.41 (0.91)	20.10 (0.87)	19.31 (1.03)	19.24 (0.93)	18.57 (1.08)	1.38	1, 199.25	0.24	2.05	4, 231.56	0.09
Glucose Testing												
Intensity	18.54 (0.99)	16.25 (1.04)	21.00 (1.01)	21.06 (1.15)	19.16 (1.08)	19.99 (1.21)	0.63	1, 190.05	0.43	3.13	4, 238.48	0.02
Incentive Imagery	14.85 (1.09)	13.41 (1.15)	18.10 (1.11)	18.04 (1.28)	17.13 (1.18)	17.26 (1.34)	0.45	1, 187.48	0.50	2.29	4, 246.41	0.06
Self-efficacy imagery	19.52 (1.40)	18.24 (1.48)	22.69 (1.43)	23.43 (1.65)	21.51 (1.52)	22.17 (1.73)	0.002	1, 192.14	0.97	1.59	4, 236.23	0.18
Availability	13.45 (1.05)	13.05 (1.11)	16.69 (1.07)	15.18 (1.25)	15.00 (1.14)	15.22 (1.29)	0.69	1, 193.65	0.41	1.38	4, 229.78	0.24

Note. Mean and standard error values have been reported for Motivation Thought Frequency subscales. Intensity, Incentive Imagery and Availability subscales contain 3 items each and the subscale total is out of 30. The Self-efficacy Imagery subscale has 4 items with a total score out of 40.

[a]Wait List: Usual care; Web Alone: Access to OnTrack Diabetes web program; Web+FIT: Access to OnTrack Diabetes and 7 therapist calls using functional imagery training

Behaviour change in each health domain may not have been necessary for some participants. Consequently, secondary analyses on each self-care behaviour were undertaken, using only participants who were below the median on that behaviour. No substantive changes to the results were found on that sub-sample.

Outcomes of Program Use

Program use was divided into three categories for analyses due to highly positively skewed data. Categories included no use (0 pages accessed), and a median split of program use based on number of OnTrack pages completed: moderate use (1-23 pages), and high use (24+ pages). Only 16 participants (10 Web Alone and 6 Web+FIT) did not use OnTrack Diabetes at all.

There was a significant differential change in HbA1c between the degree of program use categories, $F(2, 91.85) = 3.13$, $p = 0.048$. HbA1c decreased at follow-up for participants with moderate and high engagement, and increased for non-adherent participants (Figure 5.2). However, fruit and vegetable consumption increased for non-adherent users and moderate engagement, but decreased for participants with high engagement $F(2, 114.55) = 3.40$, $p = 0.037$. There were no other differential changes associated with program engagement.

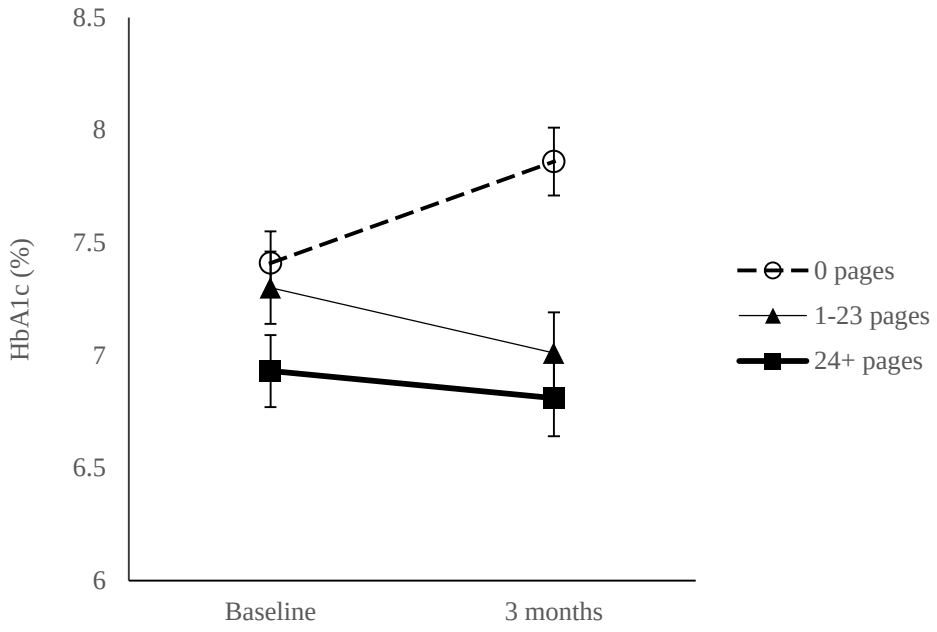

Figure 5.2. Differential change in HbA1c from baseline to follow-up across levels of OnTrack Diabetes program use

Prediction of Program Use

Separate multinomial regressions found no differences in program use due to condition (χ^2 (2) = 3.55, p = 0.17), gender (χ^2 (2) = 1.56, p = 0.46), relationship status (χ^2 (2) = 0.07, p = 0.97), education level (χ^2 (2) = 0.412, p = 0.81), or HbA1c (χ^2 (2) = 3.13, p = 0.21). Participants with high use of the program were more likely to be younger χ^2 (2) = 12.70, p = 0.002 (compared with no use, $OR_{moderate\ use}$ = 0.99, but $OR_{high\ use}$ = 1.06), unemployed or retired, χ^2 (2) = 6.89, p = 0.03 ($OR_{moderate\ use}$ = 1.88; $OR_{high\ use}$ = 2.57), have a lower weight at baseline, χ^2 (2) = 8.10, p = 0.02 ($OR_{moderate\ use}$ = 1.00; $OR_{high\ use}$ = 0.98), and consume more fruit and vegetables at baseline χ^2 (2) = 6.46, p = 0.04 ($OR_{moderate\ use}$ = 1.07; $OR_{high\ use}$ = 1.31). When entered together, these variables accounted for 16% of the variance in degree of program use.

Prediction of Outcome from Motivation

Baseline to 3-month changes in the outcome variables were predicted from baseline MTF scores using multiple liner regression after controlling for condition. The MTF-GT predicted 25% of the variance in glucose testing, F Change (4, 163) = 13.43, $p < 0.001$. Correlations between MTF-GT baseline subscales and changes in glucose testing ranged from $r = 0.25$ to 0.49, $p \leq 0.001$. The MTF-D significantly predicted unique variance in fat consumption (7%, F Change (4, 165) = 3.13, $p = 0.016$) and fruit and vegetable intake (9%, F Change (4, 164) = 3.95, $p = 0.004$), and the MTF-PA contributed 7% to the predicted variance in physical activity (F Change (4, 164) = 2.94, $p = 0.02$). However, correlations between subscales and change scores for respective behaviours did not exceed 0.25. In all instances the intensity subscale was the strongest correlate with the change scores.

Conclusions

This study is one of few randomised controlled trials of a web-based program that addresses both physical and mental health outcomes, and is the first to examine the effects of FIT on motivation and behaviour in a type 2 diabetes sample. Results indicated physiological benefits from program use, but there was no change in psychological wellbeing. FIT did not appear to enhance motivation, however motivation at baseline was a predictor of behaviour change.

OnTrack Diabetes

Analysis of adherence to the web intervention revealed an improvement in HbA1c for those who accessed the program. Participants who engaged with OnTrack could have had better diabetic control and a greater desire to improve their health. Indeed, adherent users tended to weigh less and consume more fruit and vegetables, perhaps reflecting more proficient self-care. However, self-efficacy and motivation did not predict overall use of the program. Further, participants in the Web Alone condition lost the greatest amount of weight

at follow-up. Since HbA1c improved with program use, worsened without use, and was not clearly associated with self-efficacy and motivation, it seems unlikely that self-care aptitude is solely responsible for this change. Rather, these results potentially support the efficacy of OnTrack Diabetes in improving glycaemic control, a critical biomarker of diabetes care (2).

This change in HbA1c likely reflects behaviour modification during that period, although this was not mirrored on the behavioural measures. Instead, reduced dietary fat consumption and increased activity were seen across the total sample. The latter results were not due to greater attrition of those with a poorer diet and more sedentary lifestyle at baseline. Therefore, the improvements may reflect (i) readiness for change implicit in a cohort that is help-seeking, (ii) that the baseline measures prompted behaviour change through increased health awareness, or (iii) regression to the mean. Poor detection of behaviour change may also be attributable to the program's broad scope. The diversity in treatment foci, which distinguished this program from many other interventions, together with the self-guided and flexible nature of the program, may have detracted from the ability of the program to display a substantial impact on any specific behaviour. However, it has been suggested that simultaneous multiple behaviour change is equivalent (James et al., 2016), if not superior (Hyman, Pavlik, & Taylor, 2007), to traditional sequential counselling. A reason for this may be that diet and physical activity share behavioural mechanisms that in turn influence food consumption (Mata et al., 2009). A longitudinal (12-month) study comparing simultaneous to sequential counselling for diet and exercise found sustained improvement at 12-months in the simultaneous behaviour counselling condition only (King et al., 2014).

Lack of differential program effects on most self-care behaviours may rather suggest that the behavioural measures in this study were insufficiently sensitive. Aside from the short fat questionnaire, self-care questions related to behaviour from the previous week. Initial improvements or trends over time could therefore have been missed. There were also

potential ceiling effects, given the limited scale range (0-7). Assessment of behaviour in multifaceted interventions will likely be a critical issue for future research. Measurement of specific daily or weekly behaviour may be more effective (6), however, this process in itself can alter behaviour.

Interestingly, a differential change in fruit and vegetable consumption was detected in participants with moderate levels of program engagement (1-23 pages). Users who accessed the largest number of web pages did not share this increase, perhaps because they scanned the program, superficially processing the material, but not sufficiently implementing its strategies. Google analytics can provide information on overall usage of the website, including the extent that particular pages were visited, but those data are not restricted to participants from this study, and so could not be used. Nor do they provide information on usage by individual participants, which is what was reported in the thesis: those data were obtained from the study's database. Additional information on times participants used the site could have been obtained from that database, but were not reported in the thesis. This is a limitation. This notion is further supported by the greatest improvement to HbA1c also occurring in moderate program users. The result suggests that structured program use may increase the impact of OnTrack Diabetes.

Functional Imagery Training

It should not be surprising behavioural change was not detected in the Web+FIT condition, given that motivation according to the MTF diabetes subscales was not differentially enhanced on most measures. In previous research, FIT has effectively decreased unhealthy snacking (17) and increased exercise (25) in the general population, and changes to these behaviours have been paralleled in enhanced MTF scores. These interventions were 2 weeks and therefore the long-term effects of the training were not assessed. In the current study, behaviours may similarly have improved in the initial weeks, but not have been

sustained for the full 3 months. Alternatively, given the limited engagement with OnTrack, FIT participants may similarly have had low engagement with techniques outside the therapy sessions. Or, perhaps participants were deterred by the repetitive nature of imagery practice (35). A measure of imagery practice would clarify these adherence issues, and future research should consider the potential burden of engagement in multiple interventions concurrently, as well as the burden of imagery practice. Longer term results from studies in diabetes or other domains may clarify whether FIT can demonstrate sustained differential changes.

The sample was self-selected and thus may have had heightened baseline motivation compared with the general diabetes community. This appears to be reflected in initial scores (5.0 – 7.4 out of 10.0), and therefore it may have been difficult to enhance already elevated motivation, or detect significant changes over time. While motivation may not have been successfully targeted, greater frequencies of motivational cognitions at baseline did predict greater changes in glucose testing, healthy eating and physical activity over the 3-month trial. This result suggests that interventions targeting the constructs posited by the MTF subscales (e.g. intensity of desire, imagery of incentives and self-efficacy, and availability of health-related cognitions) may indeed be important for behaviour change in diabetes care. Suggested modifications for FIT include use of imagery on updated goals, provision of written summaries and more effective distraction techniques (35).

Psychological Outcomes

Treatment of depression or anxiety in people with diabetes is effective with cognitive-behavioural therapy techniques that were adopted in the program, such as behavioural activation (36) and mindfulness training (37). While the holistic nature of OnTrack was a strength, effective interventions have had psychological health as the primary treatment target. Psychological distress was not an inclusion criterion, and baseline results indicated that the sample only experienced mild symptoms of depression, anxiety and stress on

average, limiting the ability to detect change. Greater awareness of the relationship between physiology and mental health through concurrent mood and glucose monitoring, can foster better management of symptoms (38). While participants in this RCT also had the opportunity to monitor mood, glucose, diet and exercise concurrently, this was not a requirement. In future research, concurrent monitoring should perhaps have greater emphasis, together with targeted use of the mood-related module.

Limitations

Details of usual care in the Wait List control condition were not recorded. It is therefore difficult to determine if this cohort may have received similar support to that of the intervention conditions, leading to equivalent health improvement (39). As noted above, some measures potentially limited the detection of behaviour change. User engagement in the program was limited, which is a common issue for web-based interventions (40). Increased program structure and greater attention in coaching sessions to optimal program use and to home practice could substantially increase the program's effects (6). Additionally, specialised training for delivery of FIT may prevent wide-spread implementation of this intervention. Future web-based research should use data analytics that examine online scanning to determine its influence on intervention efficacy

Implications

OnTrack Diabetes appeared to improve HbA1c and weight, and thus probably impacted on management behaviours, although the assessments used in this study did not detect differential effects on self-care. If the program were adopted in clinical practice, supplementary therapeutic support may be needed to obtain wide-ranging impacts, especially in distressed patients.

This study was the first imagery-based motivational training in diabetes. However, further refinement to this intervention is needed before its application in the clinical care of

patients. Targeting motivation as defined by the MTF constructs appears important, since baseline MTF subscales predicted change, especially in glucose testing.

Effective assessment of the impact of complex, multi-faceted programs remains a challenge for both researchers and people with diabetes. Sequential focus on one behavioural goal of high priority for an individual is likely to have greater effect than the simultaneous targeting of multiple behaviours. Future revisions of OnTrack Diabetes and associated motivational treatment should take these considerations into account.

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CHAPTER 6

Manuscript 3: Improving Functional Imagery Training in Diabetes

This chapter analysed participant feedback on FIT using inductive thematic analyses to better understand why the intervention may not have improved health outcomes or behaviour in the RCT described in chapter 5.

This manuscript has been submitted to Psychology & Health and is under review.

Authors' contributions to this paper:

The candidate, who is the first author, conducted the qualitative interviews, transcribed the interviews, conducted thematic analysis of participants' responses, and drafted the manuscript. Author three independently analysed the data. Authors two, four and five provided editorial suggestions.

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Principal Supervisor Confirmation

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Qualitative analysis of feedback on Functional Imagery Training: A novel motivational intervention for type 2 diabetes

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Abstract

Objective: To improve a novel type 2 diabetes motivational intervention, (Functional Imagery Training, FIT) based on participant feedback and results from a diabetes self-management randomised controlled trial. FIT extends on motivational interviewing, and is grounded in Elaborated Intrusion theory.

Design: Qualitative inductive thematic analysis of semi-structured interviews.

Main Outcome Measures: Open-ended questions on participant experiences of the FIT intervention content, process, most/least helpful features, suggestions for improvement and general feedback.

Results: Eight themes emerged. Participants perceived that FIT promoted autonomy and self-awareness. They found the intervention interesting and helpful in keeping their health on track through accountability provided by regular phone calls. However, boredom with repetitive use of imagery, feeling inadequately equipped to manage unhealthy cravings, and difficulty with the time commitment was reported by some. Supplementary written material was recommended.

Conclusion: Several well received features of FIT overlapped with those from traditional motivational interviewing. FIT sessions should ensure content is regularly adapted to new health-enhancing goals. After a self-management behaviour becomes habitual, imagery practice could be restricted to challenging contexts. Provision of a written rationale and use of mindfulness for cravings is recommended. With these improvements, the impact of FIT on diabetic control may be substantially enhanced.

Keywords: self-management, Elaborated Intrusion Theory, telehealth, thematic analysis, health care

Introduction

Type 2 diabetes is a chronic condition that requires adherence to a complex self-management regimen. In developed countries, around 50% of patients do not adhere to their negotiated health regimens (Sabaté, 2003). Non-adherence impacts the trajectory of patient health (DiMatteo, Haskard, & Williams, 2007), and the high prevalence places a resource and financial burden on the public health system (Jones, Smith, & Llewellyn, 2014). Motivation for adherence can be affected by the anticipated costs/benefits of making a change (Matthews, Arnedt, McCarthy, Cuddihy, & Aloia, 2013), the degree to which the regimen is perceived as interfering with daily life (Kääriäinen, Paukama, & Kyngäs, 2012), and when modifications are not jointly negotiated by practitioner and patient (Matthes & Albus, 2014). Thus, health interventions that are integrated into daily routines, explore and clarify the prospective impact of change, and prioritise patient/practitioner collaboration are likely to enhance motivation and subsequently improve self-management.

Motivational interviewing (MI; Miller & Rollnick, 2002, 2013) embodies these characteristics, and is commonly used in the treatment of maladaptive behaviours. There is evidence for the efficacy of MI in addictive behaviours such as smoking (Hettema & Hendricks, 2010) and alcohol dependence (Beckman, 2007). In lifestyle interventions, MI has been used to change diet and exercise, and assist in weight loss in overweight/obese populations (Armstrong et al., 2011; Burke, Arkowitz, & Menchola, 2003). In diabetes self-management, however, there are mixed findings for both behavioural adjustments and blood glucose control (Chen, Creedy, Lin, & Wollin, 2012; Heinrich, Candel, Shaper, Vries, 2010; Welch, Zagarins, Feinberg, & Garb, 2011). Further refinement of motivational approaches may be needed in diabetes.

A new understanding of the determinants of goal-directed behaviour is offered through the Elaborated Intrusion (EI) theory of Desire (Kavanagh, Andrade, & May, 2005).

EI theory proposes that mental simulation of goal achievement elicits a sense of reward or relief that elicits additional cognitive processing about these outcomes and their acquisition. Discrepancies between the anticipated and actual benefits of goal achievement accentuate awareness of any current physiological or emotional deficits that may be relieved by the goal's attainment, building the affective importance and urgency of the goal even further. This process is only halted by the goal attainment or by other cognitive tasks taking and retaining priority in working memory space. Over the past decade since the initial publications about EI Theory, substantial research support has been given to its propositions about the key role of imagery in motivation, and its potential vulnerability to interference from concurrent tasks that require similar working memory space (May, Kavanagh & Andrade, 2015).

People who are striving to attain functional goals such as healthy eating are commonly dealing with competing desires (e.g. attractive high-sugar foods). Key goals for interventions are therefore to help people enhance the affective intensity, salience and frequency of mental imagery about the functional goal, and in particular, maintaining and elaborating that imagery in conscious awareness at critical behavioural decision points (e.g. when deciding what to eat). This imagery is expected not only to increase the attractiveness of the functional goal, but to also interfere with the elaboration of less functional imagery in working memory, which will reduce its power as a temptation. These central tenants of EI theory have informed the development of a novel motivation intervention, Functional Imagery Training (FIT) (Kavanagh, Andrade, May & Connor, 2014; May, Andrade & Kavanagh, 2015).

The first phase of FIT adheres to the currently described principles and practice of motivational interviewing (Miller & Rollnick, 2013; Moyers, Rowell, Manuel, Ernst, & Houck, 2016), but elicits imagery throughout, to accentuate the affective power of the

interview. Once the person expresses commitment to the functional goal, they develop a series of images that express their concrete plans for the coming days. These images are of specific events and evolving situations, capturing preparations, strategies to initiate and maintain the action, successful completion and likely outcomes. Imagery of past successes is used to increase self-efficacy and aid planning for obstacles and barriers. They are asked to make the images as vivid as possible, using multiple senses, and exploring the emotions they experience in response to the anticipated success. They are encouraged to practise this imagery immediately prior to the situation where the action is required, and whenever they undertake a particular routine task (e.g. washing their hands), in order to enhance the availability of the change imagery.

Trials of FIT have already been undertaken on high-caloric snacking (Andrade, Khalil, Dickson, May, & Kavanagh, 2016), and increasing gym attendance (Lennox, Andrade, Kavanagh & May, in submission). Andrade et al. (2016) compared FIT that was received immediately or after 2 weeks. At 2 weeks, the group that was randomised to receive FIT immediately had a greater reduction in high-calorie food and drink than the delayed group, and in the next 2 weeks, the effect was replicated in the delayed condition. Lennox et al. (in submission) found equivalent effects on increases in gym attendance. In both studies, improvements were associated with an increased frequency of motivational imagery. Strong effects of FIT that are well maintained at 6 months have also been obtained in two uncontrolled pilot trials in people with alcohol misuse (Kavanagh et al., unpublished data).

A recent randomised controlled trial in type 2 diabetes (Parham, Kavanagh, King, Andrade, May, & Gericke, under review) added FIT to a web-based intervention for diabetic self-management, and compared its effects with the web program alone and a usual care control. In that study, FIT was focused on a self-management goal (diet, physical activity or glucose monitoring) that was selected by the individual participant. Differential changes in

motivation cognitions, self-management behaviours and glycemic control were not observed across the sample from the addition of FIT. Greater reductions in HbA_{1C} were seen in participants who accessed more pages of the web program, but that was neither the primary focus nor the effect of participation in FIT within this study. Two potential reasons for the limited additional effect of FIT were: (i) a diluted impact of intervention due to variability in individual participants' management needs and personal targets, and (ii) given that greater use of the web program was related to improvements in glycaemic control, effects of FIT might have been more readily seen if it had focused on program use rather than on a specific behavioural goal.

However, there may have been other potential reasons for the lack of additional benefit from FIT. Accordingly, the present paper explored participants' experience of FIT through qualitative analysis of semi-structured interviews, to develop additional hypotheses about determinants of our results, and inform the refinement of FIT for diabetes.

Method

Design

Qualitative analysis was applied to open-ended feedback questions on FIT to understand participant perceptions of treatment strengths and weaknesses, to improve this intervention for future application in diabetes.

Participants

Participants were recruited from the FIT condition of a web-based self-management randomised controlled trial in Australia (Parham et al., under review). For this RCT, eligible participants were diagnosed with type 2 diabetes at least 3 months prior to trial enrolment, had clear command of written/spoken English, regular computer and internet access, and were contactable by phone. They did not have a diagnosis of a psychological disorder other than depression/anxiety, significant cognitive impairment, or any physical limitations that

would prevent ability to increase activity, and were not taking oral steroid medication due to its effect on blood glucose. Of the 239 participants who were eligible for randomisation, 73 were allocated to FIT. This study recruited until there was a redundancy of themes, resulting in 37 participants.

Procedure

This study was approved by Uniting Care Health (Cassimatis9111), and the Queensland University of Technology Human Research Ethics Committee (1100000783). The FIT manual was adapted for diabetes from previous imagery research (Andrade et al., 2016; Kavanagh et al., 2014), and administered via telephone. FIT participants were scheduled to receive 7 phone calls at even intervals over a 3-month period. At conclusion of the final session, participants were invited to provide feedback on the FIT intervention. Those who discontinued the intervention or were lost to follow-up did not provide feedback. Feedback interviews averaged 15 minutes and were in response to five open-ended questions and an opportunity for general comments (Table 6.1).

Data Analysis

Interviews were recorded and transcribed verbatim. Inductive thematic analysis according to the Braun and Clarke (2006) method was applied to identify repeated themes within the feedback. Since the FIT therapist conducted the feedback interviews, an independent researcher conducted a second, independent analysis. Codes were produced from grouped recurring content from all interviews. While the FIT therapist was aware of the intervention's theoretical background, the second assessor was not familiar with either the theory or nature of the intervention, and therefore provided a control against theory-driven analysis. Codes were defined and named separately. The FIT researcher derived a draft set of themes, which were modified in discussion between the assessors. Integrated, consensus results are reported.

Table 6.1

Qualitative Feedback Questions Administered after 3-month Functional Imagery Training Intervention

	Question
1	What are your thoughts on the content of this intervention?
2	Tell me about how you found the process of using imagery?
3	What was most helpful about receiving these calls?
4	What aspects of the intervention were least helpful?
5	What might have helped you get more out of the sessions?
6	General comments

Results

Sample

Of the 37 participants who were approached, 29 Australian adults (55% males) with a mean age of 58.31 (*SD* = 10.24) provided feedback. Eight themes emerged from the data.

1. Promotion of autonomy over health

Participants reported freedom to direct the content of sessions, which made the intervention personalised and empowering. Further, they felt the treatment was teaching them skills they could apply independent of the therapy.

> *Taking back ownership and not relying on someone else to make the decisions for me was the best thing of the lot. (F08)*

> *There's been enough freedom on my side to choose what to focus on (M27)*

I think making the person talk about it and think for themselves about the specifics that can work. You put the concepts there but then it's starting that person thinking about how the concept can work for them (F20)

2. Increasing self-awareness of health behaviours

Some found reflection on their lifestyle the most helpful aspect of the intervention. This appeared to highlight unhealthy habits that otherwise would have been ignored. For some, this self-reflection was a confronting process.

[The most helpful aspect of the intervention was] prompts to start thinking about/highlighting an issue and making them a focus in my weekly or daily life (M18)

It's been an interesting eye opener for me about how defensive I was of the way things were and what I was doing and how I didn't really see the need for change, although it hasn't just changed me it's given me a completely different way of looking at something (M12)

For me what we were focusing on and talking about were things that I had in my mind but I never brought them forward to act on them (F06)

3. The intervention was interesting and helpful

All participants reported that engagement in this treatment was worthwhile. A recurring strength of the intervention was its non-judgemental approach, especially when patients lapsed during the week. Overall the intervention was perceived as gentle, supportive and understanding, as well as giving encouragement to persevere.

I think the calls were very good, informative and helpful (F07)

It's not aggressive, it's not assertive, it's gentle prodding (F01)

People need to be aware that at times we do fail, and I think you've been very positive in approaching, in your manner, it's good to have that (M21)

I think the visualising and me being able to see that you're guiding me, not judging or berating, it was just a guidance. Yep we all have days that we fall down, but let's see if we can work on this again (F13)

4. The intervention helped participants follow through with goals and keep on track

Participants appreciated that there was regular contact with someone who was invested in their health. The follow-up calls seemed to provide motivation to persevere because they would need to disclose their behaviour from the previous fortnight. This assisted participants in prioritising their health goals. A mechanism by which goal follow-through was achieved seemed to be accountability to the therapist and connection with someone.

The calls are reinforcing because I know you're going to call me and ask, reinforcing that there is an issue that needs to be addressed. It's quite easy to live your life and realise there's a problem but not do anything about it. But knowing that you will ask me how this is going makes me stay on track (M02)

One of the good things about the calls is it keeps you mentally focused. One of the things that can happen is lack of follow up, and you can roll along for a certain period of time and then all of a sudden you get a nasty shock. And that's where I think talking to someone independent gives you that feedback which is a good thing (M27)

Some people can do it on their own but some people actually need someone to report back to, so I think that's been great (F04)

It helped me to give a priority to doing the imagery because I knew that I would need to report back on how I was going, so you know that's always good to have a reason to be doing something first up when it's new and different (F10)

5. Acceptability and utility of imagery varied with time and age

The process of learning the intervention was reportedly simple and some found it easy to integrate into their lives. Participants generally felt that the imagery was helpful but the duration of its utility was unclear. Because the techniques were regularly practised, some reported boredom with the strategies. One older participant reported that content was vague, and that the intervention was therefore undesirable.

[To] see in your mind's eye the end result of something, rather than just thinking this is going to take ages or I don't think I can really lose this much belly fat. If you can actually see it in your mind that it's already done, it seems to make the process easier and automatic. You sort of automatically do things that are for your own benefit (F26)

The guided imagery when you first told me about it was really good…but after a little while it got a bit tedious. It was positive at first; it ruled me on to continue to do good stuff about my health. Not that it's not doing it now, I'm still doing well but…doing it daily became tedious (F28)

It probably was a bit way out for me. If you like, too different. I'm at the stage of life where reality is far more influential than anything else (M09)

6. Difficulty with unhealthy imagery and overcoming physiological drives

Initiating healthy imagery was more successful than inhibiting imagery. Some participants who used distraction techniques to reduce desire for unhealthy behaviours reported difficulty.

In some instances the imagery practice led to heightened attention on unhealthy content. This paired with hunger made it difficult to achieve dietary goals for some.

> *The problem was I suppose…I have very strong mental imagery, but it tends to associate with the wrong things. I think about something that I want to have to eat, whereas I needed… [to think of] the benefit of not having anything. And that's where the interruption probably worked with me, because it broke the train of thought, and I think that was probably something that was hard for me (M17)*

> *[The imagery is] doable and it works, but sometimes it doesn't work. It's all well and good to think about yourself as being a 90kg weakling, but at the time if you're hungry, well it tends to be pushed to one side for food (M22)*

> *The problem is that you can try to put one [image] forward but there is a counter image. Try to imagine fruit and the benefit of it or whatever but then the enjoyment of a nice biscuit, a negative one can appear which can seem more appealing. And when that happens with feelings of hunger, that [unhealthy] image can be reinforced (M14)*

7. Need for written material

A number of participants suggested that a summary email with what was covered after each session would have helped them remember the content and the homework better. Written documentation with more prescriptive homework was asked for.

> *[To get more out of sessions] when we started, probably some written material. One of the things you might consider is providing some outline material and let people read through… as an introduction (M02)*

> *I think I'm a person that likes to read things, so having that visual reminder a couple of days later would probably help cement that knowledge for me (M11)*

8. Time Commitment

Some reported that the frequency of calls was somewhat disruptive and difficult to integrate into their schedules.

Sometimes it was a bit difficult fitting the calls in (M22)

Fitting it in around my schedule was a bit difficult (F15)

Discussion

The themes that emerged from this feedback indicate that with further revision, Functional Imagery Training will be an acceptable approach to motivational support in type 2 diabetes. Overall, FIT participants appear to have appreciated the promotion of autonomy, its gentle therapeutic approach, the development of greater self-awareness, and the accountability provided through follow-up phone calls. However, these features are ones that are shared with a motivational interviewing approach (i.e. promotion of autonomy, gentle therapeutic approach, greater self-awareness; Miller & Rollnick, 2002, 2013) and with the provision of any therapist follow-up (accountability), rather than being specific to FIT. Issues with FIT included difficulty with competing imagery, lack of clarity from no supplementary written material, boredom with overuse of imagery and difficulty with time commitment to the intervention.

Patient autonomy is associated with effective self-management (Williams, McGregor, Zeldman, Freedman, & Deci, 2004). Autonomous decisions involve choice, while controlled decisions typically arise from pressure to behave a specific way (Fox & Kilvert, 2014). In type 2 diabetes self-management, patients must hold these in tension. They must choose *how* to have a healthy diet, keep active and when to monitor their blood glucose, and in the health system they are continuously advised on how to adopt a better lifestyle to avoid deterioration (Bartol, 2012). Williams et al. (2004) found that when patient autonomy was supported by health care practitioners, self-motivation was increased in patients and this predicted a change in glycaemic control. Conversely, when autonomous support is not provided, for example

through prescribed diets and activity plans, patients can lose motivation (Bhattacharya, 2012). FIT emphasises a collaborative approach to treatment, and that emphasis was recognised and appreciated by participants in the current study. Its autonomy support included acknowledging patient perspectives, offering choices in the management process, providing targeted information and minimising pressure. Conversely, this gentle approach may have contributed to minimal change, due to a lack of urgency conveyed by the therapist. Some individuals may instead prefer a strict approach to treatment.

The process of using FIT appeared to enhance participant's self-awareness. This is likely because the intervention guided self-reflection in every session and enabled confrontation with unhelpful habits. Increasing self-awareness contributes to helpful rumination on a patient's agency in their own health (Jutterström, Isaksson, Sandström, and Hörnsten, 2012). It is therefore likely an important mechanism in motivation. A non-judgmental approach, particularly to problems with adherence and goal attainment, was also strongly valued by the participants. Their report of this characteristic of the intervention suggests that their experience was consistent with the 'spirit of motivational interviewing' (Miller & Rollnick, 2002, 2013), and with the formation of a collaborative approach to treatment (Matthes & Albus, 2014).

Accountability for maintaining health was reportedly provided through the regular telephone contact with participants. This is consistent with the literature on health maintenance and social support. Significant changes to health behaviour are notoriously difficult to sustain (Oftedal, Karlsen, & Bru, 2010). Ong, Chua, and Ng. (2014) used semi-structured interviews with type 2 diabetes patients to ask about blood glucose monitoring behaviours. They found that individuals were initially motivated, but this diminished over time. Additionally, participants reported that family support in the management of diabetes helped motivate them to persist with behaviour changes. It seems that initiation of self-care

activities was autonomously motivated, but external factors (i.e. social support) contributed to the maintenance of this motivation, as noted in other studies (Bhattacharya, 2012; Egede & Osborn, 2010). While the accountability in the intervention was a strength, if adherence were attributed to this external accountability, intrinsic motivation may be undermined, and withdrawal of therapist support at the end of the treatment would induce significant vulnerability (Deci & Ryan, 2008). While FIT emphasises intrinsic motivation, the high valuation of accountability may therefore present a potential weakness. In addition, frequency of calls was perceived as problematic by some. Less dependence on the therapist and fewer sessions may improve efficacy and desirability of the intervention.

Some of the other themes were more specific to FIT. Most participants found the intervention imagery relatively easy to learn and incorporate into their usual routines. This ease of use may assist with the uptake of the intervention if it were delivered widely, as simple regimens seem to elicit better adherence (Safren et al., 2014), and routines that are integrated with usual daily structures are more likely to be completed (Kääriäinen et al., 2012). However, highly engaged participants also reported gradual boredom with the imagery tasks due to the repetitive nature of their cognitions. The FIT protocol recommends that participants regularly refresh their imagery, by focusing on new events, which incorporate their experiences of positive outcomes and effective control strategies. Once a behaviour is becoming established, participants are also encouraged to consider new goals that support their original ones, but have a changed focus (e.g. if the original goal was physical exercise, they may now focus on ensuring their dog has a walk, or on improving their tennis game). The evolution of goals is increasingly becoming an essential feature of FIT, and these reports by participants suggest that it may not have been sufficiently fostered in the current study.

Some other modifications to FIT may further assist with this issue. Frequent daily practice is now typically focused on the first 2 weeks, in order to establish the habitual use of

imagery. Subsequently, imagery is primarily used before situations where control is needed. Over time, behaviours related to a particular goal would hopefully become embedded in routine sequences that require less constant deliberate and effortful control. This would mean functional imagery was then only required for occasions when that control is under threat, the person faces an infrequent or novel situation or they want to establish behaviours related to a new goal.

While FIT focuses on increases in functional imagery, that imagery is also expected to compete for working memory resources with dysfunctional craving imagery, and assist with moderating the latter's intensity. However, some participants reported difficulty with particularly challenging situations, where they experienced vivid dysfunctional imagery and strong craving, despite attempting to use the functional imagery. Competing working memory tasks, including imagery that is unrelated to the temptation, have been reliably shown to reduce the vividness and affective intensity of craving imagery (Andrade, May, & Kavanagh, 2012). 'Break-through' intrusions of craving images are still expected to occur, especially if the craved target is physically present and a relevant physiological deficit is in awareness (e.g. if they are hungry and a chocolate cake is in front of them). Furthermore, rehearsal of functional imagery may sometimes trigger craving imagery, when the content is similar (e.g. sharing a focus on eating). Future research could perhaps apply meditation to assist users to accept and disengage from the craving images, if they are intruding into consciousness and causing discomfort or undermining self-efficacy, since meditation is known to moderate craving (Hamilton, Fawson, May, Andrade, & Kavanagh, 2013).

Functional imagery training was delivered via telephone in the current study. While our pilot studies on alcohol misuse have not found any difference in effects when all sessions were by telephone, the absence of any face-to-face sessions may have been an issue in this sample. While the imagery strategies were reportedly easy to acquire, there was a large

volume of content covered, there were often 2 weeks between sessions, and a minority of participants appeared to struggle to comprehend the overall rationale for the intervention. These problems may have been exacerbated by the age and physical status of the participants, some of whom may have had difficulty with comprehension or recall of the session content. As some respondents suggested, supplementary written material may have increased the impact of the FIT sessions. Since FIT was delivered in conjunction with a web-based intervention, this information could have been integrated into a section of the site for convenience. In a current alcohol trial on FIT, participants are asked to make written summaries during the telephone sessions using worksheets, and a phone application gives a brief rationale and instructions on imagery for review between sessions. These tools may also be needed in FIT for diabetes and should be trialled in future research.

A limitation of this study was that feedback was only provided by participants who completed all FIT sessions. Valuable insights may have been gained from those who discontinued the intervention, who may well have been more critical. Furthermore, the therapist who conducted the intervention obtained the participant feedback. Responses may therefore have been biased to reflect a positive experience in the trial, although this therapeutic alliance may also have allowed participants to be more open in reporting both strengths and weaknesses. Since a number of limitations were outlined by the patients, it seems that they were comfortable in disclosing negative reactions.

Conclusion

While functional imagery training was well received by participants, it did not successfully enhance motivation for a healthy lifestyle or initiate behaviour change in this sample. The intervention appears to have effectively maintained elements of motivational interviewing such as autonomy support and sensitivity around failure, which was appreciated by participants. Improvements to the FIT protocol in type 2 diabetes may include providing

supplementary written material, and ensuring that ongoing imagery practice is more varied and targeted to situations where it is most needed. If intrusive craving cognitions continue to be a major issue, despite appropriate use of the functional imagery, an increased emphasis on mindfulness may be needed, or alternative competing working memory tasks provided. Since use of other resources, such as our web program (OnTrack Diabetes) appear critical to enhanced glycaemic control, FIT could be targeted to use of the program rather than specific management behaviours. Following these adjustments, FIT may show a greater impact on diabetic outcomes.

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CHAPTER 7

General Discussion

Type 2 diabetes is a major public health concern, with inadequate adherence perpetuating the burden of the disease. Limited development of motivation assessments and interventions that support adherence is preventing effective patient care. The Elaborated Intrusion Theory of Desire (EI theory) provides a cognitive-emotional explanation of motivation and functional behaviour that has clinical relevance to the management of health. Prior to the current research programs, EI theory had never been applied to a type 2 diabetes sample. EI theory has informed the development of new assessment instruments for craving, and motivation to control snacking and physical activity; and it underpins the novel motivation intervention Functional Imagery Training (FIT). It is therefore a highly relevant theoretical framework for investigation in a diabetes context, where patients are required to make substantial lifestyle adjustments.

Accordingly, the aim of this thesis was to explore the clinical relevance of the central tenets, imagery and elaboration, to diabetes management motivation, and improve patient adherence through a novel intervention. This work involved modifying and conducting a confirmatory factor analysis on the EI theory-grounded Motivation Thought Frequency (MTF) scale (Study 1). An FIT manual for diabetes was developed and administered in a randomised controlled trial (Study 2). Finally, to identify strengths and weaknesses of FIT for type 2 diabetes, and improve upon its administration, a qualitative analysis of participant feedback on the acceptability and effectiveness of this intervention was conducted (Study 3).

There are limited holistic web-based diabetes interventions that promote self-management, and do not rely on input from practitioners. A secondary aim of this thesis was to assess the efficacy of OnTrack Diabetes, a program that was designed to meet this need.

OnTrack Diabetes was evaluated through the randomised controlled trial (Study 2). The current chapter interprets the current findings and discusses implications of this work for clinical practice, future research, and EI theory.

7.1 Study 1: The Motivation Thought Frequency Scales for Diabetes

Study 1 demonstrated that the 4-factor model for the MTF, which that was predicted by EI Theory, gave acceptable fit in a type 2 diabetes sample. These factors were Intensity (strength of desire for a target), Self-Efficacy Imagery, Incentives Imagery (mental representation of achieving target) and Availability (accessibility of these cognitions). This means that motivation for dietary control, increase in activity and monitoring glucose likely begins with awareness of a related cognition (intrusion) that is subsequently elaborated on using imagery of engagement in these respective behaviours, or imagery of the outcomes likely to ensue. The results from study 1 were thus consistent with the proposition that motivation for diabetes management involves the cognitive-emotional processes of intrusion and elaboration, and that imagery is a key component.

Higher scores on all subscales except availability in the MTF-PA were associated with better concurrent self-care behaviours. Interestingly, research on the MTF subscales for control of alcohol had moderate positive correlations with the AUDIT, a screening measure of engagement in problematic drinking (Robinson et al., 2016). In that case, higher motivation to cut down or stop drinking was associated with greater problematic drinking, presumably because motivation to change was not required in the absence of a problem. This indicates that elevated motivation, as measured by the MTF, is not necessarily associated with functional behaviours. For alcohol use, a greater desire for change reflected greater difficulty restricting drinking. Prediction of concurrent behaviour from the MTF may thus be

dependent on context, and the individual. For some, higher motivation will translate into action, for others, it may reflect difficulty with mastery of the goal.

In the randomised controlled trial presented in Chapter 5, a strong prediction of improvements in self-care from baseline MTF assessments was not seen, and while a prediction over 3 months may be difficult for a state measure of motivation, the lack of such a prediction clearly limits the clinical utility of the measure. This result may reflect that the scale is not sensitive to change. EI Theory holds that relationships between desires and actions are subject to a number of other determinants, including the strength of competing desires, self-efficacy, skills and situational difficulty (Kavanagh et al., 2005). Consistent with the view that relationships between motivation and performance are complex and likely to be moderated by other variables, previous research has demonstrated that maintenance of a healthy diet was desired by patients with eating disinhibition, but their most engaged self-care activity was exercise (Gorter et al., 2010).

The intensity subscale consistently predicted concurrent self-care behaviours after control for age, gender and the other subscale scores. A possible explanation for a lack of unique predictions from Imagery (when self-efficacy and incentives are combined) and Availability may have been the duration of self-care behaviours in a sample with chronic disease. In diabetes, lifestyle changes are implemented upon diagnosis. As these changes are introduced, the frequency of imagery and the availability of desire cognitions are likely to be especially important. Subsequently, as the health behaviours become habitual, preoccupation with the goal and vivid imagery may be less relevant (affecting correlations with availability and imagery). Individuals with higher frequencies on the Intensity items—wanting, needing or having a strong urge to reach the behavioural goal—may still be undertaking the behaviour in a more mindful way, being consciously aware of their motivation as they do it. Retaining a degree of mindful action may help in maintaining the behaviour. However, the relationship

may also be in the reverse direction—i.e. undertaking the behaviour more often may trigger awareness of (or be attributed to) wanting, needing or having a strong urge. A different picture is seen in studies on more acute behaviour change. A study examining FIT to increase gym attendance and the MTF for activity found that increases in intensity from baseline to post-intervention did not significantly correlate with changes in frequency of gym attendance, but imagery and availability did (Lennox et al., in submission). This result could demonstrate the difference in importance of intensity between a healthy sample and those with diabetes.

A weakness of the current studies was that data on duration of the condition was not collected. This meant that analyses did not discriminate between those instigating change and those maintaining health. To test whether imagery and availability have a larger role in those commencing behaviour, rather than sustaining it, the MTF for diabetes could be tested in a sample of newly diagnosed patients. Alternatively, future research could adjust for condition duration to determine the differing role of intensity across disease trajectory. If all subscales were found to predict subsequent behaviour in newly diagnosed patients that would provide strong support for the utility of the full MTF scales for diabetes in clinical settings. This in turn could inform the likely projection of the individual's health.

The MTF for glucose monitoring appeared to have the strongest relationship with its corresponding behaviour. This may be because testing blood sugars is more discrete and perhaps more dependent on motivation for the readings, while control of diet and exercise is influenced by multiple factors other than motivation. So, energy, sleep quality, perceived physical disability, social companionship and time can alter the likelihood of engaging in physical activity (Booth et al., 2000; Plotnikoff et al., 2011). Likewise, eating can also be affected by emotional states, externalised self-perceptions, food supply, and hunger (Frank & Thomas, 2003; Wallis & Hetherington, 2009). While factors such as pain thresholds and funding may influence engagement in daily glucose monitoring, overall there may be fewer

extraneous determinants of that behaviour. If motivation explains considerable variance in blood glucose monitoring, then it will be a critical domain to target in interventions.

Glucose monitoring assumes particular importance in the management of diabetes, because it alerts the person to the presence of hypo- or hyperglycaemia (Klonoff, 2007), and hence to the need for actions to reassert glycemic control (Costa et al., 2012). However, there is evidence for a differential impact of monitoring on HbA1c between insulin and non-insulin dependent patients with type 2 diabetes (Malanda et al., 2012), with little clinical benefit or management satisfaction being observed for non-insulin patients who tested blood levels more regularly. Furthermore, a 4-year longitudinal study found a difference in HbA1c between patients adopting regular glucose monitoring for the first time, and those with previously established regular monitoring (Karter, 2006). HbA1c was significantly reduced in those initiating blood glucose monitoring, but for those maintaining it, an improvement was only observed in patients concurrently using medication or insulin. Similar to the above arguments on motivation, it may be that blood glucose monitoring is of particular importance when establishing new dietary habits, but that it may become less critical once those habits are in place. In people with at more advanced stages of the disease who are on medications or insulin, reliance on habitual behaviours may be more risky, and accurate blood glucose readings may become more critical.

It was argued above that EI theory tenets may be most relevant to those commencing a behaviour, due the particular importance of frequent and vivid imagery at that point. Therefore, it was suggested that the MTF would best reflect motivation and concurrent management in the newly diagnosed or those wishing to instigate a habit. Of the three MTF scales tested, the MTF for glucose explained the most variance in its corresponding behaviour. It was subsequently established that glucose monitoring is most helpful for patients who have not adopted this practice before, and those receiving other pharmacological

support for diabetes management. Taken together, these propositions suggest that the assessment of motivation using the MTF-G may have particular clinical utility when blood glucose testing was being initiated or in medicated or insulin-dependent patients. In the current study, 72% of the sample was on medication and 21% on insulin, which may help to explain the relationship between the MTF-G and concurrent monitoring.

The MTF is different to other motivation scales used in diabetes research, as it is the first cognitive measure of the recent frequency of motivational states. Previous research has likened motivation to beliefs and attitudes toward health and management (Edge & Ellis, 2010; Fisher et al., 2011; Plontikoff et al., 2009; Rosenstock et al., 1988). These models therefore describe motivation as a relatively stable trait, and may align better with related but distinct concepts such as self-efficacy and health values. In contrast, EI theory attempts to account for fluctuations in motivational states and therefore proposes a model that may hold regardless of intrinsic characteristics. Interestingly, MTF scores in the randomised controlled trial were relatively stable across 3 months, despite their focus on the previous week. This high degree of stability may provide a further indication of the extent that this sample was reliant on habitual behaviour and cognition rather than focusing their attention on initiating new changes, despite their involvement in the trial. More optimistically, the degree of stability may provide an opportunity in future trials of detecting reliable changes in motivation.

A recent study examining motivation for alcohol control not only measured the MTF, but also the State Motivation Scale (SM-A), an alcohol-specific EI theory-grounded state motivation measure. Questions on the SM-A relate to “right now”, in contrast to the past-week focus of the MTF-A. The authors therefore argued that the SM-A might be suitable for assessing session-by-session changes, while the MTF-A could be useful as a predictor of alcohol consumption control (Robinson et al., 2016). Future research on diabetes could

examine whether diabetes versions of the SM may be sensitive to within-session changes in treatment. If so, future research could examine the sensitivity to change of the SM in a diabetes cohort during a motivational intervention such as FIT.

In summary, this research has verified the EI theory predicted internal structure for measures of motivation in type 2 diabetes self-care. The scales may be useful as concurrent predictors of behaviour and likely reflect superior management. The MTF-G appeared to have greatest clinical relevance in the current research, as it was shown to be the strongest predictor of its corresponding behaviour. It is expected that it will demonstrate greatest utility in people who are initiating glucose testing and or are taking medication or insulin. The MTF-D and MTF-PA have previously been examined in the general population, but this is the first study to examine the MTF for glucose monitoring. This research therefore contributes a new measurement instrument of motivation that is specifically relevant to type 2 diabetes.

7.2 Study 2 and 3: Functional Imagery Training

Strengths of the current FIT protocol identified by participants were autonomy support, accountability, an interesting and gentle therapeutic approach and promotion of self-awareness. All are intervention qualities of motivational interviewing (MI; Miller & Rollnick, 2013). The 'spirit of MI' fosters the agency of the client in resolving ambivalence, and is characterised by empathy, warmth, and patient empowerment (Dellasega et al., 2012; Miller & Baca, 1983). This therapeutic style is the foundation of functional imagery training, and now has a greater focus in FIT trials (Kavanagh et al., in preparation), compared to this and previous FIT studies (Andrade et al., 2016; Lennox et al., in submission). Participant feedback therefore suggests that this study effectively adopted the spirit of MI. This was a

strength of the manual and treatment approach in the current trial, although some other aspects of the intervention were seen as needing improvement.

Highly engaged participants reported gradual boredom with the imagery tasks due to the repetitive nature of the cognitions. This demonstrates the importance of updating goals in FIT to maintain health and prevent relapse, as is emphasised in MI (Miller & Rollnick, 2002). Follow-up calls (sessions 4-7) directly inquired about goal progress and desires to modify or change specific targets. While helpful, this feature was possibly limited in its scope. Current FIT procedures require integration of health goals into fresh and general lifestyle goals (Kavanagh et al., in preparation). For instance, an original goal for healthy eating could subsequently be incorporated into the patient's value of social connectedness, thus establishing a new goal of attending community healthy cooking classes. This integration was not adequately adopted in the diabetes trial, and may partly account for the lack of behaviour change.

Habituation to imagery also raises an important issue regarding the optimal frequency of motivation cognitions. While EI theory posits that an increase in intensity, frequency and availability of goal imagery corresponds to a rise in motivation, the current RCT found that changes in intensity of desire rather than frequency of target imagery formed the strongest predictor of behaviour change. As previously discussed, the current results may reflect the different implications of EI theory tenets to chronic disease management, where a longer duration of the condition is characterised by habit and not affectively laden cognitions. Consequently, FIT has now been amended, such that imagery is practised regularly in the initial fortnight and subsequently is primarily employed in challenging situations (Kavanagh et al., in preparation). However, these changes do not address the issue of potential limited imagery in diabetes care due to the need in that context to focus on maintenance rather than initiation of health behaviours. If the intensity of motivation turns out to be the critical

component of EI theory in diabetes management—as may be suggested by the MTF results—then FIT may not be an appropriate therapeutic tool. Exploration of techniques that specifically enhance intensity could be an important avenue for future research in chronic disease. However, given the evidence for a shared underlying process in desire for healthy and unhealthy targets in the general as well as clinical populations, this seems unlikely (Andrade et al., 2012; Andrade et al., 2016; Kavanagh et al., 2009; Kavanagh et al., in preparation; Kemps & Tiggemann, 2007; Lennox et al., 2016; May et al., 2014; May et al., 2015; Robinson et al., 2016; Versland, 2006). Targeting imagery through FIT should indirectly enhance intensity and availability as well. This was demonstrated in FIT for gym attendance (Lennox et al., 2016), and suggests that factors other than the limited impact of imagery may account for the current results.

In the RCT, FIT was delivered via telephone. There was no supplementary material, and participants were not expected to take notes. While the imagery strategies were reportedly easy to acquire, sessions were fortnightly and a large quantity of content was covered. Impaired recall of the relevant material between sessions may therefore have limited the effectiveness of the intervention, especially in diabetes where patients are typically older (Allen et al., 2004). Supplementary worksheets or a summary email of key session points may benefit future telephone FIT interventions, and were recommended by participants. A current telephone FIT trial for alcohol is supplemented by a mobile phone application that provides a brief rationale and instructions, as well as an audio guide and photos to cue imagery practice.. Additionally, participants are encouraged to make written summaries of sessions. These features could be adopted in future research of FIT in diabetes.

Some participants in the RCT reported enhanced craving for unhealthy food following mental imagery practice of dietary goal attainment (e.g. resisting high-calorie food or preparing healthy alternatives). Since semantically related information is stored in networks

(Collins & Loftus, 1975), it is not surprising that rumination on a healthy target would activate thoughts of goal competitors. Participants were taught to engage in distraction tasks such as mental arithmetic, evoking pleasant memories and imagining/pursuing a hobby/chore, which were designed to compete with craving cognitions in working memory and allow the intensity of desire to subside. However, while concurrent tasks are expected to provide temporary relief from craving-related imagery, they may not always terminate craving episodes, and in some contexts, a return to baseline craving may be seen after cessation of the task (Versland, 2006). Even during the task, some high-intensity intrusive cognitions may still break into consciousness. Furthermore, since EI theory posits that craving is characterised by imagery, the modality of the competing task is important. Visual material is retained in working memory via the visuospatial sketchpad (Baddeley & Andrade, 2000). Therefore interference of imagery should occur within this short-term memory system, rather than the phonological loop (Andrade et al., 2012). In the current study, adoption of mental arithmetic was therefore potentially a weak strategy. While it may have temporarily distracted participants and prevented further elaboration, the limited efficacy in reducing craving fits with previous research that has found no effect from verbal memory tasks, despite significant benefits from spatial tasks (Andrade et al., 2012; Tiggemann, Kemps, & Parnell, 2010).

An alternate distraction task did target the visuospatial sketchpad through imagery of pleasant memories and hobbies. However, these broad instructions differed from those used in controlled laboratory settings, where specific visuospatial tasks such as Tetris®, clay modelling, visualising specific objects, and forehead tracking, have been assigned (Andradre et al., 2010; Kemps & Tiggemann, 2007; McClelland, Kemps, & Tiggemann, 2006; Skorka-Brown, Andrade & May, 2014). There may be a need to specify the competing image to strengthen the interference in working memory. Together, these findings may indicate that

concurrent modality-specific cognitive tasks may provide temporary relief from craving, but they should not be expected to eliminate it. Increased behavioural control will still usually be required to avert the risk of lapsing into dysfunctional behaviour.

Thought suppression or avoidance can ultimately enhance desire for the unhelpful target (Erskine, 2008). Acceptance of food desires produces longer lasting effects (May et al., 2012). While EI theory acknowledges the role of environmental cues in craving, such as the presence of food and physiological hunger, it emphasises the mediating role of cognitions (May et al., 2004). Acceptance involves acknowledgement of thoughts and feelings related to a target, without requiring a behavioural response. Principles from acceptance-based therapies therefore complement EI theory, specifically intrusive cognitions. Mindfulness teaches patients to acknowledge distressing thoughts, feelings and urges without reacting. In an FIT context, rather than focusing primarily on enhancing imagery cognitions, the intervention could teach acknowledgement of and distancing from intrusive craving thoughts.

Since participants in the current RCT reported difficulty resisting food items at home, it is important to consider the role of the environment in conjunction with cognitions for this group. A study examining food craving and consumption in undergraduate students found that those most sensitive to their food environment (as measured by the Power of Food Scale) benefited from an acceptance-based intervention (Forman et al., 2007). This result has been replicated in overweight and obese women (Forman, Hoffman, Juarascio, Butryn, & Herbert, 2013). Due to environmental temptations reported by participants, treatment that incorporates acceptance training may be suitable for a type 2 diabetes sample. For instance, “defusion” strategies such as “I’m having the thought that…I need unhealthy snack” could increase awareness of an intrusion, and minimise reactivity to it.

EI theory posits that negative emotions elicit a sense of target deficit, if the target is associated with alleviation of distress (Kavanagh et al., 2005; May et al., 2015). This means

that craving and consumption can be triggered by a desire for comfort (May et al., 2012), as was reported by some participants in the current trial. Management of negative emotions and acceptance strategies were not incorporated into the FIT diabetes manual (Appendix D). This could partially account for the present results, as participants may not have been adequately equipped to manage their diet. Interestingly, an alternative to avoidance or acceptance is utilisation of the unhelpful food cognitions. A recent study demonstrated a reduction in consumption of M&Ms® and cheese following repeated imagined consumption of each item respectively (Morewedge, Huh, & Vosgerau, 2010). The authors attribute this to stimulus habituation, which mirrors real consumption over time. Given that reduced intake was achieved with an unhealthy target, this method may be relevant to the FIT protocol in type 2 diabetes (May et al., 2015).

In summary, there are a number of factors that may have limited the efficacy of the diabetes FIT manual. Overall, the intervention was perhaps too simplistic, with a narrow focus: to increase the frequency of imagery for diabetes-specific health behaviours (diet, activity, and glucose monitoring). Sessions should instead establish new goals that integrate elements of the original objectives, such that health management is integrated into broader lifestyle values. Use of visuospatial tasks or personal imagery with greater specificity is recommended for future craving distraction tasks. Obesity is associated with diabetes, and there is a higher proportion of individuals who report eating in response to their emotions in obese samples compared to the normal population (Richardson et al., 2015). In FIT, it may also be important to address eating in response to negative affectand acceptance of food desires. These could be addressed through strategies such as mindfulness, where distance from emotions and thoughts is achieved, allowing acknowledgement of distress or craving without action (Gregg, Callaghan, Hayes, & Glenn-Lawson, 2007; Hartmann et al., 2012). The “interruption” component of FIT could thus be expanded to include distraction from

negative affect, in combination with acceptance the emotions. A mobile phone application to support FIT incorporates meditation to promote acceptance and disengagement from cravings. Use of this app in conjunction with the recommended changes should be investigated in a type 2 diabetes sample to further establish the usefulness of FIT in chronic disease management. However, it should be noted that the telephone delivery and specialised training required for implementation of FIT may prevent the dissemination of this intervention.

7.3 Study 2: OnTrack Diabetes

A randomised controlled trial examined effects of OnTrack Diabetes over a 3-month period on behavioural, clinical and psychological outcomes. Participants in the Web Alone condition had a significantly greater reduction in weight than those in other conditions. While there were no other differential changes from condition, moderate engagement with the program in both the web alone and web+FIT conditions was associated with significantly lowered HbA1c and increased weekly fruit and vegetable consumption. However, no improvement in mental health from program use was observed. These findings suggest that focused engagement with OnTrack Diabetes facilitated some behaviour change that was sufficient for improvement in biological indicators of health.

OnTrack Diabetes shared features with other web-based programs that have similarly improved health. These include education on the condition and appropriate management behaviours (Lorig et al., 2010; Wise et al., 1986), goal setting, action planning, and problem solving (Glasgow et al., 2010), and support for mental health (Wang et al., 2008). Additionally, the program had a broad focus, targeting diet, activity, health routines and psychological wellbeing. Weight loss has been shown to be more successful in interventions that include an exercise component (Povey & Clark-Carter, 2007). HbA1c reduction is

associated with programs that encourage regular glucose monitoring (Lim et al., 2011), and promote better nutrition (Quinn et al., 2008). A strength of the current design was its multifaceted approach to treatment. Although the program did not appear to offer differential benefits in psychological wellbeing, interventions with combined emotional and lifestyle support are known to be more effective than lifestyle interventions alone (Harkness et al., 2010). Addressing these mental health topics may have contributed to the overall improvements in physical health, and is worthy of further attention in research on the On Track Diabetes program.

As discussed in Chapter 5, limited detection of behaviour change in other domains may be attributable to varied goals and not accounting for different treatment foci among participants. However, detection of improvements over 4 months in diet and exercise in a multifaceted intervention have been reported (Glasgow et al., 2010). Notable differences between this online intervention and OnTrack Diabetes were specific instructions to participants to initially set easily achievable goals, automated feedback on progress, and re-setting of goals every 6 weeks. This directive program contrasts with OnTrack Diabetes, which prompted reflection on broad changes (e.g. "try a new recipe") within which specific goals could be set. There was opportunity to record daily progress, but this was not enforced, and the web program did not cue a follow-up of goals at any set time. Consequently, users may not have set manageable goals, and lack of accountability may have led to disengagement from the program. Integration of immediate feedback could be added to OnTrack Diabetes to improve behavioural modification.

Interestingly, it was moderate use of the program (as indicated by pages accessed) that was associated with the greatest health benefits. Accessing large numbers of pages might usually be expected to reflect greater engagement, but in the current case, it may have involved a more superficial skimming of the program's pages, rather than having a deep

engagement with one or two key behavioural goals. If this were the case, it may indicate a need to limit the rate at which modules can be accessed. Retention of a multifaceted program remains important, however, as it reaches a wider audience and provides opportunity for the user to tailor their management and address multiple behavioural issues.

OnTrack Diabetes provided patient education, and focused on goal setting, barrier identification, and problem solving. While it is likely to be suitable for patients who are wanting to initiate change, long-term benefits are dependent on subsequent engagement in identified goals. A lack of improvement in health over time may be due to poor implementation of skills and adherence to objectives. An adjustment that appeared to be required in FIT was more frequent updating of goals and integration of these into broader lifestyle aspirations. As already noted, this may also have been a limitation of OnTrack, and seemed to be a helpful feature of the Glasgow et al. (2010) study. Modules could be repeated in OnTrack, which was designed to promote new goal setting, however this was not mandatory. Further, setting new goals is different to updating them, and the latter may be more beneficial for holistic treatment. Indeed a meta-analysis of computer-based interventions found that long-term non-significant changes to HbA1c were linked to programs that focused primarily on goal setting, problem solving and barrier identification (Pal et al., 2013). While HbA1c was improved in the current study, this was over a relatively short period of time. Longer term effects of the program remain to be established.

Changes to both behavioural and clinical outcomes have typically been observed in studies with participant and practitioner correspondence, where tailored advice is provided according to patient uploaded data (Quinn et al, 2008; Tildesley et al., 2014). Programs like OnTrack Diabetes guide participants in their health choices, and thus may have limited benefit because of the non-directive nature of the support. In contrast, the former approach directly dictates the actions that should be taken by the consumer. Since health professionals

are prompting behavioural responses in these studies, it is not surprising that they elicit significant change. However, this method seems to be undermining the primary goal of self-management: to make the patient the principal agent in their health care (El-Gayar et al., 2013). In the long-term, directive interventions may limit the capacity of the patient to make health enhancing decisions without their practitioner, however the positive outcomes on health currently outweigh this limitation. While the benefit from OnTrack Diabetes was limited, it is important to continue investigating models of care that emphasise self-management, since their long-term implementation may be greater, and their lower reliance on practitioners renders them potentially more cost-effective (Brownson et al., 2009).

In summary, this research provides preliminary support for the use of OnTrack Diabetes in the management of physical health in the short-term. The key strength of the program, and something that differentiated if from past research was the broad treatment focus. The program also attempted to address mental health alongside diabetic self-management, and while specific psychological benefits from program use were not observed, attempts to integrate emotional and physical health issues in interventions is worthy of further attention. A limitation of the current intervention may have been a simplistic approach to goal setting, and greater integration of goals into longer-term lifestyle objectives and personal values may have enhanced its impact. While the overall influence on behaviour is unclear, presumably some modifications were made, given the changes in weight and HbA1c, suggesting that an issue may have been an insufficiently sensitive set of behavioural assessments. Further research into perceived usability of OnTrack and other web-based self-management programs remains important, given the implications for health care accessibility and cost.

7.4 Implications of the Research Program

This research provides a theoretically sound measure of motivation for glucose monitoring (MTF-G) that could be adopted in clinical practice as a measure of health routine adherence. Its usefulness in estimating the likely trajectory of HbA1c is yet to be determined, following research on prospective predictions of the MTF. The limited variance in self-care behaviours accounted for by the MTF, and minimal benefits provided by FIT have implications for our understanding of the role of motivation in type 2 diabetes management. While it is critical in establishing a new behaviour, long-term maintenance of a chronic condition, such as diabetes, may not require ongoing motivation, as it is described by EI theory, but instead may need the establishment of highly routinized behaviours.

The research also demonstrates that primary focus on elaborative processes using imagery may not be as effective as emphasis on intrusive processes in a diabetes context. This could mean that patients with a chronic condition have a greater sensitivity to intrusive thoughts, or that EI-grounded interventions should place greater emphasis on initial cognitions. Additionally, in chronic disease behaviours become more habitual, and associatively determined. Elaborative processing may still be applicable to refresh motivation or deal with new challenges, but may not be as readily accepted or adhered to, than when the person is starting an attempt to engage in a functional behaviour. The current research demonstrates that frequent engagement in functional imagery may not be essential for behaviour maintenance.

OnTrack Diabetes is a web-based program that facilitates lifestyle changes through goal setting, problem solving and action planning. This research provides preliminary support for its effectiveness in the management of weight and HbA1c.. It may therefore be a valuable resource in the management of type 2 diabetes for Australians, especially in rural and remote regions, and with people whose other commitments make it difficult to attend appointments.

7.5 Strengths and Limitations of Research

Randomised controlled trials with the inclusion of a wait-list control provide a robust research design for evaluating intervention effectiveness. This design controls for individual differences through randomisation, and for the current study, assignment of conditions based on HbA1c encouraged equivalent glycaemic control at baseline. While it does not control for expectancy effects, it gives the best opportunity to detect changes from treatment. Use of a blind assessor to reduce follow-up bias represented a further strength of the research. The modality of delivery was perhaps a weakness, as anecdotal feedback from participants indicated a reduced desire to access the program following computer use at work during the day, which may have contributed to a low engagement with the program and have limited its demonstrated efficacy.

The qualitative study greatly contributed to an understanding of the apparent ineffectiveness of FIT. However, while the six phases of thematic analysis as outlined by Braun and Clarke (2006) were followed, participants were not re-contacted for cross-checking the researchers' inferred meaning of their feedback responses. Additionally, the FIT therapist conducted the qualitative interviews and was one of the two researchers who undertook the thematic analysis. Consequently, the extrapolated strengths and weaknesses of FIT may have been influenced by clinical impressions developed during the therapy. Some participants may also have felt reluctant to disclose negative impressions of the treatment to the therapist, although the number of critical comments suggested that any such reluctance did not substantially affect the results, and the therapeutic alliance may actually have enhanced the quality and range of the feedback.

The concurrent predictions of motivation and behaviour that are described in Chapter 4 make it difficult to determine whether higher motivation contributed to greater engagement in the respective behaviour or vice versa. Early stages of a disease management may have

greater relevance to EI theory because a patient is initiating behaviour change and thus requires motivation. Long-standing conditions require maintenance which is perhaps more dependent on habit. Not accounting for disease duration in the current study could have prevented adequate evaluation of the MTF scales' utility, as there was no differentiation between maintenance and initiation. In Chapter 5 it was noted that the usual care undertaken by the wait-list condition was not controlled. Patients in this condition probably received variable support across the study, and in some instances may have experienced equivalent care to OnTrack Diabetes or FIT, making it more difficult to detect differential changes from condition. Additionally, use of BMI categories may have better indicated whether there was a need for participants to lose weight at baseline, and thus if those overweight or obese benefited from the program. In chapter 6, there were two participants who withdrew from FIT due to disliking the intervention. Some participants received part of the intervention but were lost to follow-up. Therefore valuable feedback is missing from the qualitative analyses. As already mentioned, in OnTrack Diabetes and FIT there was only limited integration of health goals into overarching values and priorities. This likely reduced the degree of maintenance of any behaviour change.

7.6 Future Research

There is growing evidence for the acceptability and preference for mobile applications, rather than computer-based supports. In addition, web accessibility has been shown to limit engagement in online interventions for diabetes (Yu et al., 2014). To better understand engagement with the OnTrack program, frequency of website login, times this was done, and length of site stay would have been useful analytics to obtain, and could be examined in future studies. An OnTrack Diabetes application (or at the minimum, optimisation of the program for multiple platforms) may facilitate greater uptake and elicit

stronger results than that of the current research. In assessing the efficacy of the mental health module, additional inclusion criteria could involve a clinical diagnosis of depression or anxiety, or at least the presence of some distress. Alternatively, future analyses should differentiate patients with adequate health to those with suboptimal outcomes, for both physical and mental health.

Length of diagnosis should be recorded, as this has implications for the assessment of motivation and focus of interventions. Comparison of the MTF to other motivation measures in diabetes will better determine its superiority in predicting desire and behaviour over other assessment instruments. It could also be used for prospective predictions, to determine the direction of the concurrent relationship. Additionally, the SM (EI-grounded state motivation measure) could be validated in a type 2 diabetes population and subsequently tested against the MTF to determine which scale better detects changes in motivation and better predicts control of diabetes.

Finally, the FIT manual for diabetes could be updated and trialled again. Recommended changes are: provision of a written rationale for the treatment, use of the FIT application for mindfulness and acceptance-based techniques during food cravings, use of specific visuospatial or imagery based distraction tasks, and greater cohesion between health and general goals. If further feedback is obtained by participants to assess acceptability of the intervention, it is recommended that those lost to follow-up be recontacted and discontinued users be asked for feedback at the time of withdrawal. Insights from those who disliked the intervention may provide greater scope for improvement.

7.7 Conclusion

In this thesis it was hypothesised that EI theory would provide a novel and effective framework for understanding motivation in type 2 diabetes. This theory therefore informed

the development of a new assessment instrument and treatment manual for motivation. A secondary hypothesis was that OnTrack Diabetes would improve self-management behaviours, and subsequently enhance physical and mental health. The Motivation Thought Frequency scales had the EI theory predicted 4-factor model of intensity, imagery self-efficacy/incentives and availability. This scale was related to concurrent self-care but predictions were not strong. The EI-theory grounded intervention, functional imagery training, did not elicit any health benefits but was well received by participants, partly due to the motivational interviewing format of the treatment. Physical determinants of health improved from use of OnTrack Diabetes, but adjustments to behaviour were unclear and there was limited evidence for enhanced psychological wellbeing. If the critical component of long-term diabetes management is development of habits rather than boosting motivation, then it makes sense that use of OnTrack Diabetes was a better predictor of health improvement than FIT. This research therefore perhaps demonstrates the importance of targeting routine support in conjunction with motivation in type 2 diabetes.

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Appendix A

Ethics Approval for Randomised Controlled Trial from QUT

Project Title: Evaluation of the OnTrack Diabetes Program: An automated, web-based intervention aimed to improve Type 2 Diabetes self-management and dysphoria

Approval Number: 1100000783
Clearance Until: 31/12/2012
Ethics Category: Human This email is to advise that your application has been reviewed by the Chair, University Human Research Ethics Committee and confirmed as meeting the requirements of the National Statement on Ethical Conduct in Human Research. We note ethics clearance has already been obtained from another institution. Whilst the data collection of your project has received ethical clearance, the decision to commence and authority to commence may be dependent on factors beyond the remit of the ethics review process. For example, your research may need ethics clearance from other organisations or permissions from other organisations to access staff. Therefore the proposed data collection should not commence until you have satisfied these requirements. If you require a formal approval certificate, please respond via reply email and one will be issued. This project has been awarded ethical clearance until 31/12/2012 and a progress report must be submitted for an active ethical clearance at least once every twelve months. Researchers who fail to submit an appropriate progress report may have their ethical clearance revoked and/or the ethical clearances of other projects suspended. When your project has been
completed please advise us by email at your earliest convenience. For information regarding the use of social media in research, please go to:
http://www.research.qut.edu.au/ethics/humans/faqs/index.jsp For variations, please ensure that approval has been sought from the lead university before completing and submit the QUT online variation form:
http://www.research.qut.edu.au/ethics/forms/hum/var/variation.jsp Please do not hesitate to contact the unit if you have any queries. Regards Janette Lamb on behalf of the Chair
UHREC Research Ethics Unit | Office of Research Level 4 | 88 Musk Avenue | Kelvin Grove
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Appendix B

Ethics Approval for Randomised Controlled Trial from Uniting Care Health

UnitingCare Queensland

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14 June 2011

Ms Mandy Cassimatis
Wesley Research Institute
Level 8, East Wing, Wesley Hospital
451 Coronation Drive
AUCHENFLOWER QLD 4066

UNITINGCARE QUEENSLAND HUMAN RESEARCH ETHICS COMMITTEE
Reference Number: Cassimatis9111
Study Title: Evaluation of the OnTrack Diabetes Program: An automated, Web-based intervention aimed to improve Type 2 Diabetes Self-Management and Dysphoria

Dear Mandy

Thank you for your responses to the issues raised in our Outcome letter to you dated 6 June 2011.

The Committee has granted approval for you to proceed with the study and would like to wish you well with this important work.

If you have any further questions, please contact: Ms Pat Patterson, UCQ HREC Coordinator on 07 3025-2000 or (patricia.patterson@ucareqld.com.au).

Yours sincerely

Ms Colleen Geyer
Chair, UnitingCare Queensland Human Research Ethics Committee

Appendix C

Motivation Thought Frequency Survey Completed by Non-OnTrack Participants

Q1

What is your age?
(in years - e.g. 67)

Q2

What date were you diagnosed with Type 2 Diabetes from a health professional?
(month & year is sufficient - e.g. April 2011)

Q3

What is your most recent HbA1c reading (if known)?
(please record as a % e.g. 6.8)

Q4

When was this HbA1c reading obtained?

	DD	**MM**	**YYYY**
Date:	/	/	

Q5

Are you currently on medication for your diabetes?

Q6

Are you currently insulin dependent?

Q7

In the last 3 months, roughly what % of days have you...

...eaten healthily?

...done your recommended level of physical

activity?

...regularly tested your blood sugar levels?

Motivation Thought Frequency Scale

The following items are about your motivation to control your diabetes, by eating healthily, keeping physically active, and testing your blood sugar regularly.

Over the last week, how often did you feel you wanted to…

	NEVER									**CONSTANTLY**
…eat healthily	0	1	2	3	4	5	6	7	8	9	10
…keep active	0	1	2	3	4	5	6	7	8	9	10
…regularly check your blood glucose	0	1	2	3	4	5	6	7	8	9	10

Over the last week, how often did you feel you needed to…

	NEVER									**CONSTANTLY**
…eat healthily	0	1	2	3	4	5	6	7	8	9	10
…keep active	0	1	2	3	4	5	6	7	8	9	10
…regularly check your	0	1	2	3	4	5	6	7	8	9	10

Over the last week, how often did you have a strong urge to…

	NEVER										**CONSTANTLY**
…eat healthily	0	1	2	3	4	5	6	7	8	9	10
…keep active	0	1	2	3	4	5	6	7	8	9	10
…regularly check your	0	1	2	3	4	5	6	7	8	9	10

Over the last week, how often did you imagine yourself…

	NEVER										**CONSTANTLY**
…eat healthily	0	1	2	3	4	5	6	7	8	9	10
…keep active	0	1	2	3	4	5	6	7	8	9	10
…regularly check your	0	1	2	3	4	5	6	7	8	9	10

Over the last week, how often did you imagine how you would…

	NEVER										**CONSTANTLY**
…eat healthily	0	1	2	3	4	5	6	7	8	9	10
…keep active	0	1	2	3	4	5	6	7	8	9	10
…regularly check your	0	1	2	3	4	5	6	7	8	9	10

Over the last week, how often did you imagine how good it would be to…

	NEVER										**CONSTANTLY**
…eat healthily	0	1	2	3	4	5	6	7	8	9	10
…keep active	0	1	2	3	4	5	6	7	8	9	10
…regularly check your	0	1	2	3	4	5	6	7	8	9	10

Over the last week, how often did you imagine how much better you'd feel if you…

	NEVER										**CONSTANTLY**
…eat healthily	0	1	2	3	4	5	6	7	8	9	10
…keep active	0	1	2	3	4	5	6	7	8	9	10
…regularly check your	0	1	2	3	4	5	6	7	8	9	10

blood glucose

Over the last week, how often did you imagine how much worse you'd feel if you didn't…

	NEVER										**CONSTANTLY**
…eat healthily	0	1	2	3	4	5	6	7	8	9	10
…keep active	0	1	2	3	4	5	6	7	8	9	10
…regularly check your	0	1	2	3	4	5	6	7	8	9	10

Over the last week, how often did you imagine succeeding at…

	NEVER										**CONSTANTLY**
…eating healthily	0	1	2	3	4	5	6	7	8	9	10
…keeping active	0	1	2	3	4	5	6	7	8	9	10
…regularly check your	0	1	2	3	4	5	6	7	8	9	10

Over the last week, how often did you picture times you did something like these in the past?

	NEVER										**CONSTANTLY**
…ate healthily	0	1	2	3	4	5	6	7	8	9	10
…kept Active	0	1	2	3	4	5	6	7	8	9	10
…regularly checked your blood glucose	0	1	2	3	4	5	6	7	8	9	10

Over the last week, how often did thoughts about the following come to mind?

	NEVER										**CONSTANTLY**
…eating healthily	0	1	2	3	4	5	6	7	8	9	10
…keeping active	0	1	2	3	4	5	6	7	8	9	10
…regularly check your	0	1	2	3	4	5	6	7	8	9	10

Over the last week, how often did other things remind you about...

	NEVER										**CONSTANTLY**
…eating healthily	0	1	2	3	4	5	6	7	8	9	10
…keeping active	0	1	2	3	4	5	6	7	8	9	10
…regularly check your	0	1	2	3	4	5	6	7	8	9	10

Over the last week, how often did thoughts about the following things grab you attention?

	NEVER										**CONSTANTLY**
…eating healthily	0	1	2	3	4	5	6	7	8	9	10
…keeping active	0	1	2	3	4	5	6	7	8	9	10
…regularly check your	0	1	2	3	4	5	6	7	8	9	10

Please read each statement and choose a response from the drop-down menu which best indicates how much the statement applied to you OVER THE PAST WEEK. There are no right or wrong answers. Do not spend too much time on any statement.

The meaning of each response is below:

NEVER - Did not apply to me at all
SOMETIMES - Applied to me to some degree, or some of the time
OFTEN - Applied to me to a considerable degree, or a good part of time
ALMOST ALWAYS - Applied to me very much, or most of the time

I found it hard to wind down

I was aware of dryness of my mouth

I couldn't seem to experience any positive feelings at all

I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion)

I found it difficult to work up the initiative to do things

I tended to overreact to situations

I experienced trembling (e.g. in the hands)

I felt that I was using a lot of nervous energy

I was worried about situations in which I might panic and make a fool of myself

I felt that I had nothing to look forward to

I found myself getting agitated

I found it difficult to relax

I felt down-hearted and blue

I was intolerant of anything that kept me from getting on with what I was doing

I felt I was close to panic

I was unable to become enthusiastic about anything

I felt I wasn't worth much as a person

I felt that I was rather touchy

I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat)

I felt scared without any good reason

I felt that life was meaningless

Self-Efficacy Scale

1. How confident do you feel that you can eat your meals every 4 to 5 hours every day, including breakfast every day?

   not at all confident 1 2 3 4 5 6 7 8 9 10 totally confident

2. How confident do you feel that you can follow your diet when you have to prepare or share food with other people who do not have diabetes?

   not at all confident 1 2 3 4 5 6 7 8 9 10 totally confident

3. How confident do you feel that you can choose the appropriate foods to eat when you are hungry (for example, snacks)?

   not at all confident 1 2 3 4 5 6 7 8 9 10 totally confident

4. How confident do you feel that you can exercise 15 to 30 minutes, 4 to 5 times a week?

   not at all confident 1 2 3 4 5 6 7 8 9 10 totally confident

5. How confident do you feel that you can do something to prevent your blood sugar level from dropping when you exercise?

   not at all confident 1 2 3 4 5 6 7 8 9 10 totally confident

6. How confident do you feel that you know what to do when your blood sugar level goes higher or lower than it should be?

   not at all confident 1 2 3 4 5 6 7 8 9 10 totally confident

7. How confident do you feel that you can judge when the changes in your illness mean you should visit the doctor?

   not at all confident 1 2 3 4 5 6 7 8 9 10 totally confident

8. How confident do you feel that you can control your diabetes so that it does not interfere with the things you want to do?

   not at all confident 1 2 3 4 5 6 7 8 9 10 totally confident

Appendix D

Functional Imagery Training (FIT) Manual

PROTOCOL

Week 1: Baseline survey and 2 x 45 min calls

Weeks 2, 4, 6, 8, 10: 1 x 15 min follow up call

Week 12: 3-month survey (no intervention)

SESSION ONE – 45 min call, week 1

1. Session Overview
2. Building Rapport/Identifying Values
3. Baseline Survey Feedback
4. Pros/Cons Current Behaviour
5. Hypothetical Goal
6. Imagery Psychoeducation
- Lemon exercise
- Imagery rationale
7. Diabetes Goals using Imagery
8. Summary & Homework

1. Session Overview

- Thank participant for involvement in study and completing baseline survey
- Check if available to speak for 45mins and in a place free from distraction
- Explain that as part of their participation, I will be contacting them for an extended discussion twice this week, and then fortnightly over the next 10 weeks for shorter calls – check if they are happy with this and what days/times would be most suitable/if they'd like to book in advance the times of these calls
- Offer that they have signed up for the study to help with the management of their diabetes – ask if that's right and if they'd be happy to explore their thoughts and feelings about this a bit more today

- Explain that a key component of these calls is the use of imagery – imagining the things you would like to do – ask participant if they'd be happy to discuss this approach to treatment a bit later and how it might benefit them
- Summarise – goal for today is to get to know you a bit better and what changes you'd like to see if your life. It is also to introduce you to a new technique that may help you to make these changes. Does this structure sound ok for today's discussion? (if participant hesitant or disagrees – follow up on concerns/requests)

2. Building Rapport/Identifying Values

- Apart from the initial phone call a few weeks ago, this is the first time I've been able to properly speak with you, and I was wondering if you'd feel comfortable telling me a little bit about yourself?
- Gauge comfort with disclosure – ask about work, family, hobbies – what's important to them?

3. Baseline Survey Feedback

- Recently you completed a survey that asked about how you feel you are going in managing different aspects of your diabetes. I was just wondering what stood out for you were answering the questions related to diet?
- Content raised by participant – what was it about 'x' that stood out for you, how did you feel about it?
- I'm wondering if for today's discussion you'd like to talk in a bit more detail about this?
- Establish single or compound target

Complete treatment expectancy question:

"I'd like to ask you about your current expectations for treatment, just how you're feeling at the moment about it all:

What do you think the chance is that the treatment will work for you, from 0 for 'the treatment will not work for you at all' to 100 for 'the treatment will definitely work for you'? What would you rate it?"

4. Pros/Cons of Current Behaviour

Imagery-based Review of Motivation
MI principles - Collaboration, autonomy, empathy, choice within a specific negotiated agenda - For participant to think/talk reasons for change, how this could happen (goal: for person to consider change as a positive/feasible option) - Elicit emotional response to targets and deepen their understanding of these reactions - Only provide information to reinforce statements, answer questions or correct misinformation - 'Roll with resistance': about exploring what they want and supporting this **FIT principles** - Every step conducted via imagery - Regardless of commitment to change, a plan is developed (hypothetical/actual) - Focus

Note. Imagery not elicited at this stage

- Positive aspects of current lifestyle (x, y, z)
  - Can we start by talking about the things you enjoy about …?
  - If you weren't able to do … would there be anything you feel you'd be missing out on?
  - Summarise good things about …
- Negative aspects of current lifestyle
  - Are there things about … that are not so good?
  - (Make personal, especially if generic): How does that effect you?
  - For each downside elicit concern > Does that concern you, why?
  - Is that really so bad? – help participant to decide if perhaps concern is not such a big deal, or if it is something that is really quite distressing and why
  - If there were to be a change in … do you think this would not be such a concern?

[Focus on content that touches on aspects of lifestyle that are likely to improve if they made the changes]

- Summarise reasons for change
- Check for more reasons: Is there anything else that isn't so good about doing …?

- Prioritise if more reasons given: So it sounds like making a change would allow a, b and c, which of these is most important to you at the moment do you think?
- Overall summary/Check if agree:
    - things they like about lifestyle
    - things they don't like and what would improve if they changed
    - reason they're concerned about current lifestyle
    - highlight their main reason (the one they prioritised) for change
- Do you think that is a fair summary of how you're feeling about x, y, z?
- Do you have any thoughts about any of this/what we've talked about so far?

5. Hypothetical Goal

This section asks the client to think concretely about a particular action and its likely effects. At this stage, it is purely hypothetical. NO PRESSURE ON THEM TO ADOPT A GOAL, but this allows them to consider what life might be like if things were different. Try to create a realistic context for the review of positive outcomes, and to generate a concrete focus for consideration between sessions.

- Hypothetically, if you were to look at changing this aspect of your diabetes management, what do you think you would aim to do?
- Help participant make goal concrete – e.g. for diet, eating less take away
- If they are concerned about reaching goal ask: How practical do you think that would be?
- Is there perhaps another goal you'd like to consider?

(If client reluctant to discuss goals, remind them that this is hypothetical discussion and encourage about fact that it can be difficult thinking about these things. Do not push.)

- Before we talk more about that idea, would you be happy if we spoke briefly about the use of imagery in treatment?
- I'll suggest that you use mental imagery at various times throughout these phone sessions, so it would be helpful to show you what it's all about.

6. Imagery Psychoeducation

- Have you ever noticed that when you think about something you've done in the past, you recreate the event in your imagination?
- Do you also do that when you are thinking about something you are going to do in the future?
    - (If no:) Some people use images more than others. Let's try an image now, to see what it's like.
    - (If yes:) We've found that it can sometimes be more than just a picture or a movie. It often involves several senses. Let's try an image now, to see what it's like.
- Keeping your eyes open, focus your eyes on the wall, as you create the image in your mind

(Ask to keep eyes open for practice but in future can have eyes open or closed. If they describe imagery as you are speaking, ask them to just imagine it now and describe it to me later)

- **Read the Lemon Exercise**

If outside noise or distractions occur during imagery practice, acknowledge this and guide the client to accept their presence and to return their awareness to their image:

"stay with your image...
There is some noise happening outside and that's ok. Distractions will happen when you're doing this in your normal life.
Acknowledge the noise and let it pass through your awareness into the distant background.
Come back to the image you are creating...
Focus on all your sensations...
Make your image as vivid as possible, like a movie playing in your mind...."

Lemon Exercise – Imagery Practice

"This exercise is to help you understand more about what mental imagery is. Sometimes we think in words, sometimes we think more in mental pictures or other sensations. By a mental image I mean when you 'see in your minds eye', 'hear with your minds ear' and so on. You can have an image in any sense—for example, some people say they can imagine the taste and smell of a beer, or how it would feel as they swallowed it." *(check for understanding).*

"I am now going to ask you to imagine a situation. Please imagine it happening to yourself, as if you were there, and it was happening right now. Imagine as vividly as possible".

(In the script, pause for about 3s at each "…")

"OK, Let's start.

I want you to look towards the wall, and imagine holding a lemon…

Picture it as vividly as you can, what it looks like, the texture of the skin, whether there is any stem…

Whether the colour is the same across the whole lemon…

Whether there is any light or shade on it…

Imagine holding it close up, so you can see every feature…

Now I want you also to imagine what it feels like to hold it…

Imagine what the texture of the lemon would feel like…

The weight of the lemon in your hand…

Its shape…

What it would feel like if you threw it upwards and caught it…

Keep the picture of the lemon there in your imagination….

Imagine holding the lemon next to your nose. That fresh, tangy smell…

Now, imagine cutting it with a knife. Think about how the knife feels, as you grip it and carefully cut the lemon in two. You hear a slight rasping sound as you do that…

Small drops of juice come out as you cut it…maybe your hand feels a little wet…

Imagine what the halves look like—the segments, the texture of the inside of the lemon, white pith…

You hold half of the lemon to your nose. Smell the juice…

Imagine wiping your finger across the surface, and putting a drop on your tongue. A fresh, acid taste. Imagine swallowing it, and feeling it going down your throat. A cool, refreshing sensation.

Now, imagine taking one of the halves in your hand. You have a glass in your other hand, and you are going to squeeze the juice into the glass…Squeezing it now, and the juice is trickling out…You can hear it going into the glass…Take a sip of the juice, and swallow that…

- How did that feel for you?
- I'd like to hear how vividly you experienced that imagery, so if I can get you to think about a scale where 0 indicates that you couldn't really picture it at all, and 10 indicates that the experience was extremely vivid, I'll ask you a few questions about the story
- When the picture was most vivid for you, what would you rate it out of 10?
- When the picture was most vivid, what was its rating? _____
- When you imagined holding or cutting the lemon—how vividly did you imagine what the lemon or the knife would feel like? _____
- When you smelt the lemon, how vivid was that? _____
- The taste? _____
- Imagining swallowing it? _____
- The sounds of cutting it, or the juice in the glass? _____
- Everyone has some senses that are more vivid than others when they do this. This is the sort of thing I mean, when I am asking you about your imagery. Not just what pictures you see, but also any imagined taste, or smell, or feeling you have when you think about a situation.
- **Rationale for current treatment**
- Research that my colleagues have been doing has found that imagery drives how we feel about doing certain things. There are 3 main things that have been found

(a) The more vivid an image, the stronger a desire for something is and the harder it is to resist

(b) Imagery can be interrupted which reduces desire for that thing

(c) On the other hand, desire for that thing can increase when the imagery of it is made more vivid.

- So basically we can use imagery to help us make positive changes to lifestyle (like increasing exercise).
- Imagery can also help us to plan and make decisions about how we can go about getting the things we want.
- In these phone calls, I'm using the things we've learned about imagery to support people to make lifestyle changes that might help with the management of their diabetes

- Is it ok with you if we continue to use imagery, to help you work out how you feel about your current management of diabetes and what you would like for the future?

7. Imagery with Diabetes Goal

- Imagine the goal in action:

"Let's make your goal to …. more concrete, by playing it out in your imagination. Let's look at what would happen if you did it."

"Think about a particular time and imagine you have reached your goal on that occasion."

"Play it out, like a mini-movie or a TV ad. (Pause for 3 seconds)

Imagine what happens, in the situation and after it. (Pause for 3 seconds)

Imagine where you are, (Pause for 3 seconds)

- *who is there,* (Pause for 3 seconds)
- *what you can see,* (Pause for 3 seconds)
- *what you hear,* (Pause for 3 seconds)
- *what you feel like."* (Pause for 3 seconds)

"Make it as real as you can. Put yourself in the movie." (Pause for 5 seconds)

- Elicit a description and their emotional response

"Tell me what that was like."

- *"How vivid was the image, on a scale from 0 to 10, with 0 being no image at all and 10 being extremely vivid, as if it were really happening?"*

"How did it make you feel, when you thought about that?"

- Check if the goal would help them get the changes they want.

"How were things different in your image of the future from how they are now?"

- Relate back to the not so good things and draw their attention to any that had improved in their image.

"Would that goal get you the changes you want in your life?"

- Take client through each change they want and check that the goal achieves them.

"How was your …[downside/reason for change] in the image?"

"Did [reason for change] happen in the image that you imagined?"

- If goal did not achieve changes wanted:
- Raise this discrepancy with them.
- Assist them to identify and consider another goal that will.
- Invite them to engage in further imagery with the new goal, as per the steps above, checking afterwards if the new goal achieved their desired changes.

(If goal still did not achieve the desired outcome, see if they want to consider another goal and repeat steps above until a goal that achieves their desired outcomes is identified.)

When the goal achieves the changes the client wants, review the outcomes of the imagery exercise, highlighting that this goal seemed to achieve the positive changes they desired.

So, it sounds like ….[final goal] will get you some of the important things you would like to see change."

- Check the client's readiness for change.

"So, is that goal one you'd like to think about some more next session?"

If they are still expressing ambivalence and are reluctant to discuss goals, roll with that resistance and spend 5-10 minutes repeating the motivational interviewing, focusing on the reasons for and against change. If the client remains ambivalent, continue discussing change as hypothetical. See if they want to return to the issue at a FUTURE session, and negotiate when that will be.

8. Summary & Homework

- Briefly summarise the session:
- It's been great getting to know you a bit better, and from what you've told me it sounds like … and … are things that you value or find important in your life

- We spoke about what stood out to you when completing the survey and specifically, some of the good and not so good things about your current lifestyle
- We learnt about imagery and how it can be used to make positive changes (increasing vividness increases desire)
- Finally we looked at developing a hypothetical goal for your diabetes management and imagined the changes that result if that goal were achieve
- **Introduce the use of OnTrack Diabetes and asked if they've had a chance to login yet. See if they would like to while I'm on the phone with them**
- Explain how at the beginning of each module they can generate ideas for change and then practice imagining implementing those changes and how it would feel – the program guides them through this and it would be a helpful activity to reinforce everything we've covered in Session One today

Complete treatment expectancy question:
"Now that you know a bit more about what's involved in the treatment, I'd like to ask you: If you do everything in this treatment, what do you think the chance is that the treatment will work for you, from 0 for 'the treatment will not work for you at all' to 100 for 'the treatment will definitely work for you'? What would you rate it?"

- Book next session ideally in 2-3 days

SESSION TWO – 45 min call, week 1

1. Session Overview
2. Revise Session 1
3. Review Days b/w Calls
4. Revise homework
5. Building Self-efficacy
6. Building Strategies
7. Making a Commitment
8. Pictures & Reminders
9. Summary & Homework

1. Session Overview

- Review: last session, management progress, homework, goals
- Finally we can look at using photos and reminders to help you practice imagery

2. Revise Session One

- Ask participant to summarise what they can remember from session one
- If struggling, remind them of hypothetical goal - ask if any more thoughts on it?
- Ask if need to make any other changes to improve the management of their diabetes – has the goal changed since last time?
- How do they feel about committing to that goal?

(If the client is not ready to commit or is reluctant to discuss goals, review the motivational interviewing from session 1. Ask what may be needed before they would feel ready to set a goal or get started. Ask if they would like to continue with the remainder of this session, using their hypothetical goal. If so, reframe the following sections as hypothetical—e.g. "when would you get started, if you did decide to...?" See if they want to return to the issue at a future session, and negotiate when that will be.)

3. Review Days Between Session 1 and Now

- Participant's experience of diabetes management and progress with goal
- Acknowledge disappointment; Reinforce achievements

4. Homework

- Discuss how they went using OnTrack Diabetes and specifically the imagery section of modules

- If didn't, identify barriers and assist in planning to use the program in coming week

5. Self-efficacy (Past Successes using Imagery)

- Do a baseline self-efficacy rating, record the response

"How confident are you that you can reach your goal, if you tried it now? 0-10

- Elicit relevant past successes, record responses

"Have you ever tried this goal before?"

- **IF YES:** *Emphasise aspects of success*
- If success was partial: "I can see that you feel like it was very challenging, but"
- "Later in the session, we'll look more closely at how you could address some of those challenges you faced. But for now, let's focus on the times it worked well."
- **IF NO:**
- "Have you tried anything similar, like stopping smoking, limiting alcohol intake?"
- "What about other things that involve discipline, like studying, sports training, learning a musical instrument?"

- **Elicit success imagery**

"Let's recreate that memory in your imagination. Take yourself back to a particular time when you successfully [achieved goal]. Remember how it felt when you did that. Play the memory out as if you were living it again. Remember to use all your senses."

- **Elicit a description and their emotional response**

"Tell me what that was like" ; "How did it make you feel?"

- **Rate imagery**

"How vivid was the image?"

6. Building Strategies

(A) Identify PAST STRATEGIES that could be used for current goal

"Think back to that time when you ... *[achieved past goal]*. What did you do to achieve that?"

- Focus client on practical strategies (e.g., I joined a gym, I worked out with a friend, I didn't buy sweet food). *(record)*

"Could any of those strategies be used to *[current goal]*?"

- **Elicit imagery of using strategies from past success with the current goal**

"Close your eyes and imagine yourself _____ *[strategy]*.
Imagine yourself doing each step as vividly as possible, using all of your senses. Let the events unfold in your imagination.
Focus on all sensations—what you see, hear, feel, taste, smell.
How are you feeling emotionally?
Play it through like a mini-movie in your mind. Make it as vivid as possible."

- **Elicit a description and their emotional response**

"Tell me what that was like" ; "How did it make you feel?"

- **Rate imagery**

"How vivid was the image?"

"So do you think *(strategy)* is something that might help you to achieve *[goal]*?"
(If strategy did not work with goal, repeat exercise with another)

(B) Ask about OTHER IDEAS they have for how to achieve their goal

What other things do you think you could do to achieve *(goal)*?"

- If they cannot think of any, refer to strategies from past success.

"What else did you do to achieve that when you ... [achieved past goal]?"

- **Elicit imagery of using new strategy with the current goal**

"Let's choose one of those ideas and imagine using it next week. Close your eyes now and imagine yourself doing each step as vividly as possible. Focus on all your senses—what you see, hear, feel, taste, smell. Play it through like a movie."

- **Elicit a description and their emotional response**

"Tell me what that was like" ; "How did it make you feel?"

- **Rate imagery**

"How vivid was the image?"

"So do you think *(strategy)* is something that might help you to achieve *[goal]*?"
(If strategy did not work with goal, repeat exercise with another)

(C) Identify POTENTIAL BARRIERS to implementation of the strategy

"As you were imagining that situation, did anything come to mind that might stop you from using that strategy or reaching your goal?"

(If they can't think of any potential barriers, ***suggest an example*** *based on what they just described. For example, if their strategy is to visit the gym after work, ask if they might forget to pack their gym clothes. What if they had a late meeting, or things were busy at work?)*

- Once barrier identified:

"How might you prevent that from happening, or handle it if it did?"

- Suggest that they integrate this into their plan imagery.

"Let's try the image again, but this time with you ... *[the identified method]*"

- **Elicit imagery of overcoming barrier**

"Imagine you are going to do [goal] but you realise [barrier], can you imagine what it would be like to [method for overcoming barrier]. What would you do/say, what would this feel liken etc.

- **Elicit a description and their emotional response**

"Tell me what that was like" ; "How did it make you feel?"

- **Rate imagery**

"How vivid was the image?"

"So did … [the identified method] help your plan work more effectively?"

(D) Review from Session 1 what they would miss

- Identify strategies that will address the thing they will miss *(e.g. if they eat unhealthily for relaxation, what other ways can they relax that don't involve food?)*

"What will help you get through *[thing they would miss e.g. boredom]* without eating unhealthily?"

- **Elicit imagery for overcoming things they would miss**

"Let's create an image of that. Imagine yourself [thing would miss e.g. eating when bored] and then imagine yourself [strategy e.g. reading instead]. Imagine the things you will do leading up to it, and then what you will do in the situation. Make it as vivid as possible, using all of your senses."

- Give client 10 seconds to imagine implementing the strategy

"Now play that image through to later that day or night. You've managed to get through ... [thing would miss] without [engaging in dysfunction behaviour].
Focus on how you are feeling and any physical sensations."

- Give client 10 seconds to imagine the success

"Now play that image through to the next morning. Imagine how you feel the next day. Remember to use all of your senses. Make it as vivid as possible"

- Give client 10 seconds to imagine positive effects the next day.
- **Elicit a description and their emotional response**

"Tell me what that was like" ; "How did it make you feel?"

- **Rate imagery**

"How vivid was the image?"

"Did ... [strategy] help you to handle ... [thing would miss]?"
"Did you notice any positive effects because you got through that situation without [dysfunctional lifestyle]?"

"After these exercises, how confident are you that you can reach your goal?" 0-10

- Draw attention to a high level of confidence, and to any rises that occurred during this session.
- If confidence remained the same or increased by only a small amount:

"Some people feel more confident after they experience success. You may find your confidence increases even more over time as you start to achieve your goal."

7. Making a Commitment

"We've talked today about what your goal is and some ideas for how you can achieve it. Do you feel ready to make a commitment to that goal now?"
(If client is not ready to commit to goal, continue the discussions as hypothetical and do not ask them to complete the commitment script. See if they want to return to the issue at a future session, and negotiate when that will be.)

"Setting a goal is an important step in your commitment to making a change. Writing a script of your commitment is a way for you to record and refer back to your goal"

- Invite the client to write down their goal, why they are doing it, a key strategy they will use and a past success

a. I am going to ... (my goal)

b. "If I do this, ... (why—the good outcome/s)

c. "I'll do it by... (how—a strategy)

d. "I know I can do it because... (a past win).

- Encourage the client to make their commitment out loud

"Goal commitments are even more powerful when you make the commitment out loud. What do you think about perhaps videoing or audio recording what you've just written? *(Identify preferred method)*

- Ask the client to read their script out loud to you now, as a first step and as a practice for their later recording.
- Ask client if they are willing to share their commitment with someone.

"People can also find that sharing their goal with someone else increase the likelihood of them reaching that goal"

Does anyone come to mind who would support you with this goal and with your diabetes management? How would you feel about sharing your commitment with them?"

- You may also wish to outline specifically how they can help (i.e. supportive msgs)

8. Pictures & Reminders

- Finally I'd like to discuss using pictures and reminders to help you with your management.

"Before our next session, I'd like you to collect some pictures that represent the things that would get better if you achieved your diabetes management goal. For example, if your goal was to lose weight, you may like to take a photo of some old clothes that don't quite fit anymore, but you'd like to wear again one day.

"What pictures do you think you could take or collect and how would you go about this?

- It will also be important for you to practice the imagery we did today.
- Ask the client to identify what time each day would be a good time for them to practise their imagery.

- Assist them to work out how to set a reminder for this time (e.g., a calendar entry with a reminder on their smartphone, an alarm clock).
- Imagery can be brief (10secs) and want to be practising frequently so becomes habit. You can use the imagery anytime – including when feeling challenged

9. Summary & Homework

- Ask participant briefly summarise the session and their action plan
- If having difficulty, describe: goal, past success, strategies, things will miss and overcoming these, commitment script, pictures & reminders
- So for homework between now and our next conversation (in 2 weeks), I'm wondering how you feel about trying the following:
- Recording your commitment and sharing with a friend
- Practicing the imagery about your goal (like what we did today)
- Gathering pictures and setting reminders to practice this imagery
- Book Session 3 (in fortnight)

SESSION THREE – 15 min call, week 2

1. Session Overview
2. Review & Homework
3. Combining Images & Risky Situations
4. Using Imagery with Daily Task

1. Session Overview

- In our last session you decided on a goal and we spoke about how you know you can do this because of your past success with ……. You decided on some strategies to help achieve [goal], these were … and we used imagery to rehearse these. You made a commitment to your goal and we talked about how pictures and reminders can help you get the most out of using imagery
- Today we'll talk about how imaergy can be used to help you with risky times

2. Review & Homework

- Diabetes management; progress with goal; use of OnTrack and imagery
- Acknowledge disappointment; Reinforce achievements; Discuss barriers

3. Combining Images & Risk Situations

- Guide the client through combining their strategies, reasons and success into a single image

The imagery we've been doing in the last two sessions has been around how things will be better after you make a change, how you are going to make this change, and other successes you have had in the past with similar goals. These are the things you put in your commitment script.

*Images about **what will be better** will be really useful if you want to boost your **motivation**. Images about **how** you will make this change will be great when faced with a **difficult situation**. Images about **successes in the past** will boost your **confidence**.*

Sometimes, especially when you are faced with a challenge, it can be helpful to combine these images and imagine **how** you will deal with that challenge, AND the **positive** things that will come from succeeding.

Let's try that now:

Think of a situation that you find especially challenging, and pretend it is coming up soon.

Close your eyes and create in your mind an image of what you will do leading up to the situation, what you will do in it, what positive affects you will notice because you stuck to your goal, and how good you will feel afterwards.

Spend a few moments playing out that image.
If your mind wanders, that's ok, just bring it back to the image and keep playing it through."

- Allow client 15 seconds for imagery
- Discuss the client's experience + vividness of image

Identify any other upcoming risk situations:
"Are there any other risky situations coming up that might be challenging for sticking to your goal?"

- Run through imagery
- **Ask them to set a reminder to use their imagery for that risky situation**

Rationale: Helps so don't get carried away in the moment.

4. Using Imagery with Daily Task

"Imagery can be done quickly, and when you are doing other things. To help you remember to use imagery regularly, it may be helpful to pair up practising imagery with another common everyday activity, like washing your hands.

- (1) Ask if have daily task and after (2) what image they would like to practice
- Practice now + assess vividness (if not as vivid – reassure normal b/c it's 2 tasks)

5. Summary & Homework

- Would you like to discuss anything else?
- Would you be able to summarise back to me what we've looked at today?
- Homework: practice imagery with daily task, set daily reminder for a time to think about goal and practice imagery
- Book next appointment (in fortnight)

SESSION FOUR – 15 min call, week 4

1. Session Overview
2. Review & Homework
3. Use of Imagery
4. Practice Imagery for Upcoming Risky Situations
5. Summary & Homework

1. Session Overview

- Today I wanted to see how you've gone the last 2 weeks with your management and goal, and with using the imagery?

2. Review & Homework

- Participant's experience of diabetes management and progress with goal

- Achievements: *"That's great that you…"*

- Barriers: validate disappointment, review achievements (even partial success – e.g. ate less one day)
  "I can see that it has been difficult for you to make changes but I wonder if there are any successes that you have had, even they were temporary or did not go exactly as you planned in the end?"

- "Have you noticed any positive effects from the changes you've made so far?"
- "What strategies have you been finding helpful to achieve this change?"
- "How does it feel to know that you have made these changes/preparations?"

3. Use of Imagery

- Briefly review use of imagery

"How have you been going with using imagery between the sessions?"

If applicable, identify barriers to imagery use, problem solve for how they might be overcome and guide client through imagining implementing plan, including setting

relevant reminders. Highlight features of imagery that may be useful based on information gathered so far.

- Briefly review use of reminders at challenging times
- Review use of imagery with daily task
- Review use of pictures as reminders

4. Practice Imagery for Risky Situations

- Identify upcoming risk situations and set reminders

"Are there any risky situations coming up that might be challenging for sticking to your goal?

Or have there been times you've been feeling more challenged with your goal than other times?"

OR

What barriers have you come across? Has there been anything that has helped overcome this?

Are there still things that you miss about [the previous lifestyle]? What would help at these times?

- Problem solve for risky situations

How can you use imagery to help you overcome this risky situation?

Help client identify some pictures/prompts that will remind them of this imagery

5. Summary & Homework

- Before we finish up, was there anything you would like to raise from today's session or that has been on your mind?
- Would you be able to summarise back to me what we've looked at today?
- If having trouble: we recapped on what you've achieved to date or found difficult and how you're finding imagery, reminders during risk, practice with daily task and use of pictures.
- It would be great if over the next 2 weeks you can continue to practice using the imagery, set yourself reminders (especially in advance for times of risk) and continue to update pictures that will encourage you to think about your goal
- Book next appointment (in fortnight)

SESSION FIVE – 15 min call, week 6

1. Session Overview
2. Review
3. Updating Goals
4. Summary & Homework

1. Session Overview

- Today I wanted to see how you've gone the last 2 weeks with using the imagery?
- I thought we could discuss your progress and any barriers you've come across
- How does sound ok? Is there anything else you would like to add to the agenda?

2. Review

- Participant's experience of diabetes management and progress with goal
- Briefly review use of imagery

"How have you been going with using imagery between the sessions?"

- Briefly review use of reminders at challenging times
- Review use of imagery with daily task
- Review use of pictures as reminders

3. Updating Goals

- Thoughts about goal and if they would like to set one in a different area of diabetes management
- Practice imagery in that area

4. Summary & Homework

- Before we finish up, was there anything you would like to raise from today's session or that has been on your mind?
- Would you be able to summarise back to me what we've looked at today?
- Encourage practice of imagery, reminders, pictures and pairing with daily task and use of OnTrack Diabetes.
- Book next appointment (in fortnight)

SESSION SIX – 15 min call, week 8

1. Session Overview
2. Review
3. Updating Goals
4. Summary & Homework

1. Session Overview

- Today I wanted to see how you've gone the last 2 weeks with using the imagery?
- I thought we could discuss your progress and any barriers you've come across
- How does sound ok? Is there anything else you would like to add to the agenda?

2. Review

- Participant's experience of diabetes management and progress with goal
- Briefly review use of imagery

"How have you been going with using imagery between the sessions?"

- Briefly review use of reminders at challenging times
- Review use of imagery with daily task
- Review use of pictures as reminders

3. Updating Goals

- Thoughts about goal and if they would like to set one in a different area of diabetes management
- Practice imagery in that area

4. Summary & Homework

- Before we finish up, was there anything you would like to raise from today's session or that has been on your mind?
- Would you be able to summarise back to me what we've looked at today?
- Encourage practice of imagery, reminders, pictures and pairing with daily task and use of OnTrack Diabetes.
- Book next appointment (in fortnight)

SESSION SEVEN – 15 min call, week 10

1. Session Overview
2. Review
3. Updating Goals
4. Summary

1. Session Overview

- Today I wanted to see how you've gone the last 2 weeks with using the imagery?
- I thought we could discuss your progress and any barriers you've come across
- How does sound ok? Is there anything else you would like to add to the agenda?

2. Review

- Participant's experience of diabetes management and progress with goal
- Briefly review use of imagery

"How have you been going with using imagery between the sessions?"

- Briefly review use of reminders at challenging times
- Review use of imagery with daily task
- Review use of pictures as reminders

3. Updating Goals

- Thoughts about goal and if they would like to set one in a different area of diabetes management
- Practice imagery in that area

4. Summary

- Before we finish up, was there anything you would like to raise from today's session or that has been on your mind?
- Would you be able to summarise back to me what we've looked at today?
- Encourage practice of imagery, reminders, pictures and pairing with daily task and use of OnTrack Diabetes. Inform that this is the last session, feedback?
- Thank participant for involvement and inform follow-up survey due in 2 week

Appendix E

Functional Imagery Training Session Checklists

To maintain consistency across calls, the session checklists were developed. Items not covered during the correct session were followed up the following call. Client notes were stored in a locked filing cabinet and used as needed to inform the focus of follow-up sessions and promote fidelity of the protocol.

CHECKLIST

Session One

OnTrack ID: _____ Date: _____ Session length: _____	
Task	Completed
Negotiated agenda	☐
Discussed survey/thoughts on health/management	☐
Collaboratively decided on focus	☐
Discussed good/bad things about current lifestyle	☐
Developed hypothetical goal	☐
Lemon exercise	☐
Imagery rationale	☐
Practiced imagery with diabetes goal	☐
Summary	☐
Homework [Imagery + OnTrack Diabetes]	☐
Booked Next Appointment	☐

CLIENT NOTES

Session One

Call/Email Log	Notes
	Set Agenda: Y/N
	Survey/health/management reflections:
	Good/bad things about current lifestyle: What would miss:
	Hypothetical goal:
	Lemon exercise: Sense:
	Imagery with diabetes goal:
	Next Session:

CHECKLIST

Session Two

OnTrack ID: _____ Date: _____ Session length: _____	
Task	Completed
Negotiated agenda	☐
Reviewed week/homework/session one	☐
Imagery of **past successes**	☐
Imagery of **strategies** used in past successes	☐
Imagery of **alternative strategies**	☐
Explore **barriers** and imagery of **response** to barriers	☐
Imagery of strategies for managing **what they would miss**	☐
Commitment Script	☐
Pictures and Reminders	☐
Summary	☐
Homework [Imagery + OnTrack Diabetes + Script]	☐
Booked Next Appointment	☐

CLIENT NOTES

Session Two

<table>
<tr><th>Call/Email Log</th><th colspan="2">Notes</th></tr>
<tr><td rowspan="10"></td><td colspan="2">Set Agenda: Y/N</td></tr>
<tr><td colspan="2">Review of week/homework:</td></tr>
<tr><td>Baseline SE (0-10):</td><td>Post SE (0-10):</td></tr>
<tr><td colspan="2">Past successes:</td></tr>
<tr><td colspan="2">Past success strategies:</td></tr>
<tr><td colspan="2">Alternative strategies:</td></tr>
<tr><td colspan="2">Barriers + solutions:</td></tr>
<tr><td colspan="2">Strategies - what they would miss:</td></tr>
<tr><td colspan="2">Commitment script:</td></tr>
<tr><td colspan="2">Pictures + reminders:</td></tr>
<tr><td colspan="2">Next Session:</td></tr>
</table>

CHECKLIST

Session Three

OnTrack ID: _____ Date: _____ Session length: _____	
Task	Completed
Negotiated agenda	☐
Reviewed session two	☐
Explained combined imagery	☐
Imagery of **challenging situation**	☐
Imagery of **upcoming** risky situation	☐
Paired imagery with **daily task**	☐
Summary	☐
Homework [Imagery + OnTrack Diabetes + Update Pictures]	☐
Booked Next Appointment	☐

CLIENT NOTES

Session Three

Call/Email Log	Notes
	Set Agenda: Y/N
	Review of week/homework:
	Combined imagery:
	Challenging situation:
	Upcoming risky situation:
	Daily task:
	Next Session:

CHECKLIST

Session Four

OnTrack ID: _____ Date: _____ Session length: _____	
Task	Completed
Negotiated agenda	☐
Reviewed **homework** + **management** from fortnight	☐
Reviewed use of **imagery**	☐
Reviewed use of **reminders in risky situations**	☐
Reviewed use of imagery with **daily task**	☐
Reviewed use of **pictures** as goal reminder	☐
Summary	☐
Homework [Risk Imagery + OnTrack Diabetes + Update Pictures]	☐
Booked Next Appointment	☐

CLIENT NOTES

Session Four

Call/Email Log	Notes
	Set Agenda: Y/N
	Review of fortnight/homework: Achievements/barriers:
	Experience of imagery:
	Reminders of imagery for risk:
	Daily task:
	Picture update:
	Next Session:

CHECKLIST

Session Five

OnTrack ID: _____ Date: _____ Session length: _____	
Task	Completed
Negotiated agenda	☐
Reviewed **homework** + **management** from fortnight	☐
Reviewed use of **imagery**	☐
Reviewed use of **reminders in risky situations**	☐
Reviewed use of imagery with **daily task**	☐
Reviewed use of **pictures** as goal reminder	☐
Addressed updating goals	☐
Summary	☐
Homework [Risk Imagery + OnTrack Diabetes + Update Pictures]	☐
Booked Next Appointment	☐

CLIENT NOTES

Session Five

Call/Email Log	Notes
	Set Agenda: Y/N
	Review of fortnight/homework: Achievements/barriers:
	Experience of imagery:
	Reminders of imagery for risk:
	Daily task:
	Picture update:
	Goals:
	Next Session:

CHECKLIST

Session Six

OnTrack ID: _____ Date: _____ Session length: _____	
Task	Completed
Negotiated agenda	☐
Reviewed **homework** + **management** from fortnight	☐
Reviewed use of **imagery**	☐
Reviewed use of **reminders in risky situations**	☐
Reviewed use of imagery with **daily task**	☐
Reviewed use of **pictures** as goal reminder	☐
Addressed updating goals	☐
Summary	☐
Homework [Risk Imagery + OnTrack Diabetes + Update Pictures]	☐
Booked Next Appointment	☐

CLIENT NOTES

Session Six

Call/Email Log	Notes
	Set Agenda: Y/N
	Review of fortnight/homework: Achievements/barriers:
	Experience of imagery:
	Reminders of imagery for risk:
	Daily task:
	Picture update:
	Goals:
	Next Session:

CHECKLIST

Session Seven

OnTrack ID: _____ Date: _____ Session length: _____	
Task	Completed
Negotiated agenda	☐
Reviewed **homework** + **management** from fortnight	☐
Reviewed use of **imagery**	☐
Reviewed use of **reminders in risky situations**	☐
Reviewed use of imagery with **daily task**	☐
Reviewed use of **pictures** as goal reminder	☐
Addressed updating goals	☐
Summary + Homework [Imagery + OnTrack]	☐
FIT Feedback	☐
Reminder of 3-month FUP data	☐

CLIENT NOTES

Session Seven

Call/Email Log	Notes
	Set Agenda: Y/N
	Review of fortnight/homework: Achievements/barriers:
	Experience of imagery:
	Reminders of imagery for risk:
	Daily task:
	Picture update:
	Goals:
	FIT Feedback:

Appendix F

Randomised Controlled Trial Baseline and 3-month Survey

1. INFORMATION LETTER

OnTrack Diabetes Survey

RESEARCH TEAM

Ms Sophie Parham

Prof David Kavanagh

DESCRIPTION

This project is undertaken as research that will lead to the distribution of data via a PhD thesis, publications, and conference proceedings. All data will be kept strictly confidential, and participants will remain anonymous. The purpose of this project is to test the effectiveness of the OnTrack Diabetes program. This is an online program aimed to support people with Type 2 diabetes to improve their self-care and day-to-day stress/emotional coping. The project team is interested in finding out if people with Type 2 diabetes find the program useful, and whether it can help them with their diabetes management and mood. You don't need to have problems with your mood to take part. It's about seeing if the program helps anyone with Type 2 diabetes enjoy life to the full and have improved diabetes outcomes.

You are invited to participate in this project if you: have had Type 2 diabetes for at least 3 months, are aged 18 years and over, live in Australia, have regular access to a computer with the internet, are contactable by telephone, and have at least grade 5-level written English.

PARTICIPATION

Participation in this project is entirely voluntary. If you do agree to participate, you can withdraw from the project without comment or penalty. Your decision to participate or not participate will in no way affect your current or future relationship with the Queensland University of Technology or the Wesley Research Institute. Participation involves receiving access to the OnTrack Diabetes program. As we are testing which parts of the program

improve specific areas of diabetes and emotional outcomes, some participants may not receive access to the program for the first 3 months. Participants are given a secure username and password with which they can access the program from any computer or smart phone with the internet. Some participants will receive regular phone calls by a Lead Investigator to reinforce some of the program tools. Participants are asked to complete an online survey about Type 2 diabetes self-care and mood at baseline and 3 months. This may take between 30mins - 1hour to complete and includes participants' most recent glycosylated haemoglobin (HbA1c) result (if it was taken less than 4 weeks ago), weight, height and waist measurements. With their consent, we can get the HbA1c level from their doctor if this is easier. If it has been longer than 4 weeks since an HbA1c test was done, we ask that another test is taken so that the result is recent. Following completion of the baseline survey, the participant is given a secure username and password to access the OnTrack Diabetes program.

EXPECTED BENEFITS

It is expected that this project will benefit you by providing information and support for your Type 2 diabetes management and mood. The research team expects that you will enjoy taking part in the OnTrack Diabetes program and that it may be of benefit to your mood and assist you with your diabetes management. However, your participation in this project is part of testing the program, so we cannot be certain of these benefits.

RISKS

There are minimal risks associated with your participation in this project. These include the possibility that disclosing sensitive information about your Type 2 diabetes control/ mood may be uncomfortable for you. However, as most measures are undertaken online anonymously, we expect that there would be minimal, if any, impact. Participation remains anonymous throughout and following the trial, so participants can be assured that their privacy is maintained. Should you wish to access additional support services for any discomfort or distress experienced during the trial, there will be information about relevant support services on the OnTrack Diabetes program site. You are also encouraged to contact the researcher to enquire about additional support services, if required. QUT provides for limited free counselling for research participants of QUT projects who may experience discomfort or distress as a result of their participation in the research. Should you wish to access this service please contact the Clinic Receptionist of the QUT Psychology

Clinic on (07) 3138 0999. Please indicate to the receptionist that you are a research participant.

PRIVACY AND CONFIDENTIALITY

All comments and responses will be treated confidentially. Your information will be coded anonymously in the study's database so that there is no risk of your personal details being revealed to any person outside the research team. This database is only accessible by secure username and password by authorised research personnel. There is extremely minimal risk that privately disclosed information which you provide during the study could be accessed by unauthorised personnel. The project is funded by the Wesley Research Institute (WRI). The WRI will not have access to the data obtained during the project. Please note that non-identifiable data collected in this project may be used as comparative data in future projects.

CONSENT TO PARTICIPATE

We would like to ask you to confirm your agreement to participate by continuing with this survey, following online eligibility screening over the phone.

QUESTIONS / FURTHER INFORMATION ABOUT THE PROJECT

If have any questions or require any further information about the project please contact one of the research team members below.

Sophie Parham – Lead Investigator
Wesley Research Institute
The Wesley Hospital, Brisbane
Email Sophie: sparham@wesleyresearch.com.au

Prof David Kavanagh – Principal Investigator
School of Psychology & Counselling, Faculty of Health
Institute of Biomedical Health and Innovation, QUT
Phone (07) 3138 6143
Email david.kavanagh@qut.edu.au

CONCERNS / COMPLAINTS REGARDING THE CONDUCT OF THE PROJECT

UnitingCare Queensland and QUT are committed to research integrity and the ethical conduct of research projects. This research has received ethics approval from the UnitingCare Health Human Research Ethics Committee. However, in the case of any concerns that you have about your participation in this research or its conduct, please contact the UCQ HREC Coordinator, Ms Pat Patterson, on (07) 3025-2000 or email uc.ucare@ucareqld.com.au. Alternatively you may contact the QUT Research Ethics Unit on (07) 3138 5123 or email ethicscontact@qut.edu.au. Uniting Care Queensland and QUT Research Ethics Unit are not connected with the research project and can facilitate a resolution to your concern in an i
I have read this document

2. CONSENT FORM

OnTrack Diabetes Survey

Yes

By submitting the completed questionnaire, you are indicating that you:

• have read and understood the information document regarding this project

• have had any questions answered to your satisfaction

• understand that if you have any additional questions you can contact the research team

• understand that you are free to withdraw at any time, without comment or penalty

• understand that you can contact either UCQ HREC Coordinator, Ms Pat Patterson, on (07) 3025- 2000 or email uc.ucare@ucareqld.com.au or the Research Ethics Unit on (07) 3138 5123 or email ethicscontact@qut.edu.au if you have concerns about the ethical conduct of the project

• understand that non-identifiable data collected in this project may be used as comparative data in future projects

• agree to participate in the project

3. Personal Information

OnTrack Diabetes Survey

Todays Date:

Date of Birth:

Gender:

Male

Female

4. Clinical Information

OnTrack Diabetes Survey

Date of last HbA1c level

HbA1c Level:

Your HbA1c obtained in the last 4 weeks (please record % reading - e.g. 6.8)

Please enter your WEIGHT (in kg):

5. Demographic Information (please note these were only asked at baseline)

OnTrack Diabetes Survey

What is the highest level of education you completed?

Never attended school

Primary school

Some high school

Completed high school

University, TAFE, etc

Other (please specify)

What is your current relationship status?

Married

De facto

Separated

Divorced

Widowed

Never married

Other (please specify)

Which of the following describes your current employment status? Choose as many as apply to you.

Working full-time

Working part-time

Not working (but not retired)

Home duties

Full-time student

Part-time student

Retired

Permanently unable to work, or ill

The following items are about your motivation to control your diabetes, by eating healthily, keeping physically active, and monitoring your blood sugar regularly.

6. Motivation Thought Frequency Scale

OnTrack Diabetes Survey

Over the last week, how often did you feel you wanted to...

...eat healthily

...keep active

...test blood sugar regularly

Never 0 1 2 3 4 5 6 7 8 9 10 Constantly

Over the last week, how often did you feel you needed to...

...eat healthily

...keep active

...test blood sugar regularly

Never 0 1 2 3 4 5 6 7 8 9 10 Constantly

Over the last week, how strong was your urge to...

...eat healthily

...keep active

...test blood sugar regularly

Never 0 1 2 3 4 5 6 7 8 9 10 Constantly

Over the last week, how often did you imagine yourself...

...eat healthily

...keep active

...test blood sugar regularly

Never 0 1 2 3 4 5 6 7 8 9 10 Constantly

Over the last week, how often did you imagine how you would...

...eat healthily

...keep active

...test blood sugar regularly

Never 0 1 2 3 4 5 6 7 8 9 10 Constantly

Over the last week, how often did you imagine how good it would be to...

...eat healthily

...keep active

...test blood sugar regularly

Never 0 1 2 3 4 5 6 7 8 9 10 Constantly

Over the last week, how often did you imagine succeeding at...

...eat healthily

...keep active

...test blood sugar regularly

Never 0 1 2 3 4 5 6 7 8 9 10 Constantly

Over the last week, how often did you imagine how much worse you'd feel if you didn't...

...eat healthily

...keep active

...test blood sugar regularly

Never 0 1 2 3 4 5 6 7 8 9 10 Constantly

Over the last week, how often did you picture times you did something like these in the past?

...eat healthily

...keep active

...test blood sugar regularly

Never 0 1 2 3 4 5 6 7 8 9 10 Constantly

Over the last week, how often did thoughts about the following things come to mind?

...eat healthily

...keep active

...test blood sugar regularly

Never 0 1 2 3 4 5 6 7 8 9 10 Constantly

Over the last week, how often did other things remind you about...
...eat healthily
...keep active
...test blood sugar regularly
Never 0 1 2 3 4 5 6 7 8 9 10 Constantly

Over the last week, how often did thoughts about the following things grab your attention?
...eat healthily
...keep active
...test blood sugar regularly
Never 0 1 2 3 4 5 6 7 8 9 10 Constantly

7. Self-Efficacy for Diabetes Scale
OnTrack Diabetes Survey

How confident do you feel that you can eat your meals every 4 to 5 hours every day, including breakfast every day?
Not at all confident 1 2 3 4 5 6 7 8 9 Totally confident 10

How confident do you feel that you can follow your diet when you have to prepare or share food with other people who do not have diabetes?
Not at all confident 1 2 3 4 5 6 7 8 9 Totally confident 10

How confident do you feel that you can choose the appropriate foods to eat when you are hungry (for example, snacks)?
Not at all confident 1 2 3 4 5 6 7 8 9 Totally confident 10

How confident do you feel that you can exercise 15 to 30 minutes, 4 to 5 times a week?
Not at all confident 1 2 3 4 5 6 7 8 9 Totally confident 10

How confident do you feel that you can do something to prevent your blood sugar level from
Not at all confident 1 2 3 4 5 6 7 8 9 Totally confident 10

How confident do you feel that you know what to do when your blood sugar level goes higher or lower than it should be?
Not at all confident 1 2 3 4 5 6 7 8 9 Totally confident 10
How confident do you feel that you can judge when changes in your illness mean you should visit the doctor?
Not at all confident 1 2 3 4 5 6 7 8 9 Totally confident 10

How confident do you feel that you can control your diabetes so that it does not interfere with things you want to do?
Not at all confident 1 2 3 4 5 6 7 8 9 Totally confident 10

8. Short Fat Questionnaire
OnTrack Diabetes Survey

How often do you eat fried food with a batter or breadcrumb coating?
Never
Less than once a week
Once or twice a week
3 to 5 times per week
6 or more times a week

How often do you eat cream sauces or cheese sauces?
Never
Less than once a week
Once or twice a week
3 to 5 times per week
6 or more times a week

How often do you add butter, margarine, oil or sour cream to vegetables, cooked rice or spaghetti?
Never
Less than once a week
Once or twice a week

3 to 5 times per week
6 or more times a week

How often do you eat vegetables that are fried or roasted with fat or oil?
Never
Less than once a week
Once or twice a week
3 to 5 times per week
6 or more times a week

How is your meat usually cooked?
Eat meat occasionally or never
Grilled or roasted without added oil or fat
Grilled or roasted with added oil or fat
Stewed or goulash
Fried

How many times a week do you eat sausages, devon, salamis, meat pies, hamburgers or bacon?
Never
Less than once a week
Once or twice a week
3 to 5 times per week
6 or more times a week

How much butter/margarine do you use on your bread?
Don't use butter or margarine
Thinly
Medium
Thickly

How many times a week do you eat chips or French fries?

Never

Less than once a week

Once or twice a week

3 to 5 times per week

6 or more times a week

How often do you eat pastries, cakes, sweet biscuits or croissants?

Never

Less than once a week

Once or twice a week

3 to 5 times per week

6 or more times a week

How many times a week do you eat chocolate, chocolate biscuits or sweet snack bars?

Never

Less than once a week

Once or twice a week

3 to 5 times per week

6 or more times a week

How many times a week do you eat potato crisps, corn chips or nuts?

Never

Less than once a week

Once or twice a week

3 to 5 times per week

6 or more times a week

How often do you eat cream?

Never

Less than once a week

Once or twice a week

3 to 5 times per week

6 or more times a week

How often do you eat ice cream?
Never
Less than once a week
Once or twice a week
3 to 5 times a week
6 or more times a week

How many times a week do you eat cheddar, Edam or other hard cheese, cream cheese or cheese like Camembert?
Never
Less than once a week
1 or 2 times a week
3 to 5 times per week
6 or more times a week

What type of milk do you drink or use in cooking or tea and coffee?
Skim or none
Reduced fat
Full cream and reduced fat
Full cream
Condensed

How much of the skin on your chicken do you eat?
None of the skin or I'm a vegetarian
Some of the skin
Most or all of the skin

How much of the fat on your meat do you eat?
None of the fat or I'm a vegetarian
Some of the fat
Most or all of the fat

9. Diabetes Self-Care
OnTrack Diabetes Survey

These questions are designed to find out about how you have managed your diabetes over the last 7 days. If you were sick during the last 7 days, please think back to the last 7 days you were not sick.

On how many of the last 7 days did you eat 5 or more servings of fruit and vegetables?
0 1 2 3 4 5 6 7
How many days during the past week did you participate in at least 30 minutes total (one session, or several smaller sessions) of physical activity?
0 1 2 3 4 5 6 7

On how many of the last 7 days did you test your blood sugar?
0 1 2 3 4 5 6 7

10. Depression Anxiety Stress Scale
OnTrack Diabetes Survey

Please read each statement and click on the circle beside the response which indicates how much the statement applied to you OVER THE PAST WEEK. There are no right or wrong answers. Do not spend too much time on any statement.
The meaning of each response is below:

(0) NEVER - Did not apply to me at all
(1) SOMETIMES - Applied to me to some degree, or some of the time
(2) OFTEN - Applied to me to a considerable degree, or a good part of time
(3) ALMOST ALWAYS - Applied to me very much, or most of the time

I found it hard to wind down.

I was aware of dryness of my mouth.

I couldn't seem to experience any positive feelings at all

I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion)

I found it difficult to work up the initiative to do things

I tended to over-react to situations

I experienced trembling (e.g. in the hands)

I felt that I was using a lot of nervous energy

I was worried about situations in which I might panic and make a fool of myself

I felt that I had nothing to look forward to

I found myself getting agitated

I found it difficult to relax

I felt down-hearted and blue

I was intolerant of anything that kept me from getting on with what I was doing

I felt I was close to panic

I was unable to become enthusiastic about anything

I felt I wasn't worth much as a person

I felt that I was rather touchy

I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat)

I felt scared without any good reason

I felt that life was meaningless

11. Medication

OnTrack Diabetes Survey

1) Name of medication

Unit strength

Amount taken each day

2) Name of medication

Unit strength

Amount taken each day

3) Name of medication

Unit strength

Amount taken each day

4) Name of medication

Unit strength

Amount taken each day

5) Name of medication

Unit strength

Amount taken each day

6) Name of medication

Unit strength

Amount taken each day

Please list all the medications you have been on in the PAST 3 MONTHS that were prescribed by your doctor. Please be sure to provide the NAME, UNIT STRENGTH, and AMOUNT of each medication you've taken each day.

Example: Name = lipitor; Unit strength = 5 mg; Amount taken each day = 1 x 2/day

Do you ever forget to take your diabetes medicine?

Yes

No

Are you careless at times about taking your diabetes medicine?

Yes

No

When you feel better, do you sometimes stop taking your diabetes medicine?

Yes

No

Sometimes, if you feel worse when you take the diabetes medicine, do you stop taking it?

Yes

No

Appendix G

Alcohol Craving Experience (ACE) (Kavanagh et al., 2009)

Part A. Think of the last time you had a strong craving or urge for alcohol

How long did it last?

How strong was this craving?

During this craving episode, how often:

Did a picture of a drink come to mind?

Did you imagine tasting the drink?

Did you imagine swallowing alcohol?

Did you imagine the smell of alcohol?

How much did you try to stop thinking about drinking?

Part B. Over the past 24 hours, how often:

Did you try to stop thinking about drinking?

Did thoughts about drinking just pop in and vanish without trying?

Did you think about drinking?

Appendix H

Craving Experience Questionnaire (May et al., 2014)

Factor/Item Strength form, CEQ-S

Intensity Right now . . ./At that time . . .

Want . . . how much do/did you want it?

Need . . . how much do/did you need it?

Urge . . . how strong is/was the urge to have it?

Imagery Right now/At that time, how vividly do/did you

Picture . . . picture it

Taste . . . imagine its taste?

Smell . . . imagine its smell?

Mouth . . . imagine what it would feel like in your mouth or throat?

Intrusiveness Right now . . ./At that time . . .

Not think . . . how hard are/were you trying not to think about it?

Intrusive . . . how intrusive are/were the thoughts?

Think . . . how hard is/was it to think about anything else?

Frequency form, CEQ-F

Over the last [time-frame] how often . . .

Want. . . did you want it?

Need. . . did you need it?

Urge. . . did you have a strong urge for it?

Imagery Over the last [time-frame] how often did you . . .

Picture. . . picture it

Taste. . . imagine its taste?

Smell. . . imagine its smell?

Mouth. . . imagine what it would feel like in your mouth or throat?

Intrusiveness Over the last [time-frame] how often . . .

Not think. . . were you trying not to think about it?

Intrusive. . . were the thoughts intrusive?

Think. . . was it hard to think about anything else?

Appendix I

Motivation Thought Frequency for Physical Activity (MTF-PA)

(Kavanagh et al., under review)

"Thinking about increasing your physical activity, please select a number on each row to answer these questions. "

Over the last week, how often did you…

1. …feel you wanted to do it?
2. …feel you needed to do it?
3. …have a strong urge to do it?

Over the last week, how often did you…

4. …imagine yourself doing it?
5. ...imagine how you would do it?
6. ...imagine how good it would be to do it?
7. ...picture times you did something like this in the past?
8. ...imagine succeeding at it?
9. ...imagine how much worse you'd feel if you didn't do it?

Over the last week, how often…

10. ...did other things remind you about it?
11. ...did thoughts about it grab your attention?
12. ...did thoughts about it come to mind?

Appendix J

Motivation Thought Frequency – Alcohol (MTF-A) (Robinson et al., 2016)

"Thinking about cutting down or stopping drinking…"

Intensity

Over the last week, how often did you…

…feel you wanted to do it?

…feel you needed to do it?

…have a strong urge to do it?

Imagery

Over the last week, how often did you…

…imagine yourself doing it?

… imagine how you would do it?

… imagine how good it would be to do it?

… picture times you did something like this in the past?

…imagine succeeding at it?

…imagine how much worse you'd feel if you didn't do it?

Availability

Over the last week, how often…

…did other things remind you about it?

… did thoughts about it grab your attention?

… did thoughts about it come to mind?