



POWER2DM

“Predictive model-based decision support for diabetes patient empowerment”

Research and Innovation Project

PHC 28 – 2015: Self-management of health and disease and decision support systems based on predictive computer modelling used by the patient him or herself

POWER2DM D3.1

D3.1.1a Dynamic Behaviour Change Intervention Models for Self-Management

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LUMC	Leiden University Medical Center	Netherlands
SAS	SAS Servicio Andaluz de Salud	Spain
SRFG	Salzburg Research Forschungs Gesellschaft	Austria
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EXECUTIVE SUMMARY

In the scope of Task 3.1 “Dynamic Behaviour Change Intervention Models for Self-Management” behaviour changes techniques (BCTs) relevant for POWER2DM were analysed. This deliverable describes BCT interventions meaningful for diabetes self-management. The document comprises the following sections:

Chapter 2 refers to target groups in POWER2DM

Chapter 3 gives an overview of the theoretical background of behaviour change models and concepts for interventions used in POWER2DM. The focus of Behavior Change Techniques (BCTs) in POWER2DM will be on initiating and maintaining the behaviour change. A detailed overview of BCTs relevant for POWER2DM is given in Appendix 1 and Appendix 2. A further psychological concept POWER2DM will take into consideration is the approach of the Acceptance and Commitment Therapy (ACT) dealing with values and barriers for fostering the patient’s long-term motivation.

Chapter 4 describes how barrier identification and interventions will be included in the self-management components of the POWER2DM platform. The basis for coping with barriers and recommending interventions will be behaviour change models and concepts described in the previous section and listed in the appendixes. For addressing dynamically changing needs of individuals POWER2DM will include the concept of just-in-time adaptive interventions (JITIA) for providing interventions at the right time and only when needed.

Goals, activities and observations are core concepts for self-management. The ontology for goals and activities described in chapter 5 illustrates these core concepts and their relations to each other.

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1 INTRODUCTION

1.1 Purpose and Scope

The purpose of deliverable D3.1.1 is to describe behaviour change intervention models for diabetes self-management. This includes the identification of patient profiles based on specific behavioural problems in diabetes self-management and an analysis of relevant intervention models. The next section describes how POWER2DM components will include behaviour change models and concepts for interventions. The final chapter illustrates the metamodel (ontology) for goals and activities..

1.2 References

- POWER2DM Description of Work
- D1.1 User Requirements and Use Case Scenarios
- The use cases specified in D1.2 Requirements Specification of the POWER2DM Architecture

1.3 Definitions and Acronyms

ACT	Acceptance and Commitment Therapy
BCT	Behavior Change Technique
DM	Disease Management
DSS	Decision Support System
JITAI	Just In Time Adaptive Intervention.
ODL	Observations of Daily Life

2 TARGET GROUPS

The types of users are already described in D1.1 “User Requirements and Use Case Scenarios”. In Chapter 3 “Persona’s” we described the layers of DM Self-management goals and psycho-social barriers. If a problem arises in self-management we need to asses in which area (e.g., glucose monitoring), which specific problem (e.g., too little monitoring) and the underlying reason (e.g., fear of disclosure of being a person with diabetes). Based on this framework we described 7 persona’s that constitute 7 types of users.

3 BEHAVIOUR CHANGE INTERVENTION MODELS AND CONCEPTS

This section gives an overview of the theoretical background of behaviour change models and concepts for interventions used in POWER2DM.

3.1 Behaviour Change Techniques and Stadia of Change

Most theories and determinants explain behavior, but do not describe how to change behavior. This distinction between explaining behavior and changing behavior is essential for methods that design interventions, like Intervention Mapping (Bartholomew et al., 2016). Also for designing the POWER2DM SMSS it is a crucial distinction. Figure 1 displays the relation between behavior (change) theory and technique. Theories may explain behavior by describing determinants (e.g., self-

efficacy from the Theory of Planned Behavior), or how to change behavior (e.g. modeling from Social Cognitive Theory), and provide limitations under which a determinant or technique is more or less effective (i.e., boundaries). For instance, modeling is more effective when the model is similar to the targeted person.

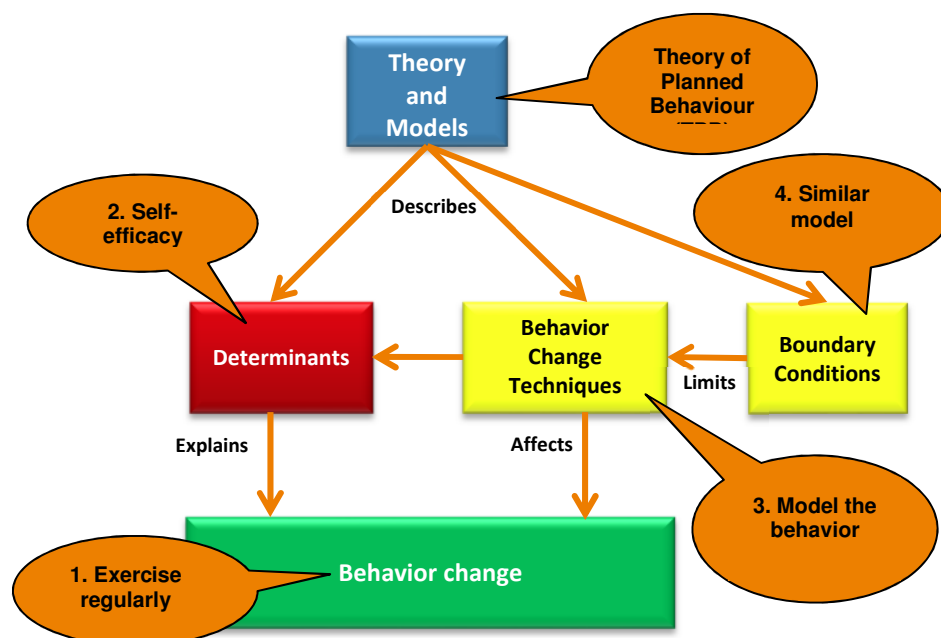


Figure 1 - Relation between theory, technique and behaviour, illustrated by promoting regular exercise.

Abraham and Michie (2008) defined 26 Behavior Change Techniques (BCTs) based on 195 descriptions of interventions to change a person's lifestyle behavior. A BCT is an “observable, replicable, and irreducible component of an intervention designed to alter or redirect causal processes that regulate behaviour”. They can be used alone or in combination with other BCTs. These 26 BCTs consisted of 22 single techniques, and 4 more encompassing techniques; relapse prevention, stress management, motivational interviewing, and time management. Dusseldorp et al. (2014) grouped these 26 BCTs into three phases of behavior change:

- ◆ Motivation phase,
- ◆ Planning phase, and
- ◆ Action/Continuation phase (see Appendix 1).

Nowadays the focus in behavior change is more on behavior maintenance, as compared to behavior initiation (e.g., Kwasnicka et al., 2016). Several other classifications of BCTs exist. Currently, there are 93 unique BCTs that can be hierarchically-clustered into 16 groups (Michie et al., 2013, see also <http://www.bcts.23.co.uk/>).

In developing the POWER2DM SMSS we will use the CALO-RE taxonomy, which is a refined taxonomy of behaviour change techniques to help people change their physical activity and healthy eating behaviours (Michie et al., 2011). These two lifestyle behaviors are especially relevant for managing diabetes. In Appendix 2 the 40 BCTs from CALO-RE are described.

Relevant for POWER2DM

- The BCT taxonomy CALO-RE will be used because of its focus on changing physical activity and healthy eating behaviours.
- The focus will be on initiating and maintaining the behaviour change.

3.2 Values and Barriers based on Acceptance and Commitment Therapy (ACT)

Acceptance and Commitment Therapy (ACT) is a comprehensive theory of language and cognition that is an offshoot of behavior analysis. ACT differs from traditional cognitive behavioral therapy (CBT) in that rather than trying to teach people to better change their thoughts, feelings, sensations, memories and other private events, ACT teaches them to "just notice," accept, and embrace their private events, especially previously unwanted ones. ACT commonly employs six core principles to help clients develop psychological flexibility¹:

- ◆ Cognitive defusion – Learning methods to reduce the tendency to reify thoughts, images, emotions, and memories.
- ◆ Acceptance – Allowing thoughts to come and go without struggling with them.
- ◆ Contact with the present moment – Awareness of the here and now, experienced with openness, interest, and receptiveness.
- ◆ Observing the self – Accessing a transcendent sense of self, a continuity of consciousness which is unchanging.
- ◆ Values – Discovering what is most important to one's true self. They are those elements that give life meaning in a person's life.
- ◆ Committed action – Setting goals according to values and carrying them out responsibly.

The objective of ACT is not elimination of difficult feelings; rather, it is to be present with what life brings us and to "move toward valued behavior" (Hayes et al, 2012a). Acceptance and commitment therapy invited people to open up to unpleasant feelings, and learn not to overreact to them and not avoiding situations where they are invoked. From a psychological perspective the perspective is always one of empowerment: that a rich, meaningful, values-based human life is available to all (Hayes et al, 2012b).

3.2.1 ACT & diabetes

Diabetes is a chronic illness entailing a high risk of disability and death, when life styles are not adjusted and the adherence to medical treatments is low or not regular. Interventions aiming at managing diabetes-related distress may help people in dealing with its emotional challenges and to improve self-management skills. Many individuals with diabetes wish that they did not have diabetes. In addition, individuals who are diagnosed with diabetes have many things they need to do, to keep track of and worry about that they never had to address previously, e.g. watching one's diet, monitoring blood glucose levels, exercising regularly.

Literature demonstrates positive outcomes for diabetes patients treated with ACT interventions. By example, Gregg and colleagues (Gregg et al, 2007) randomly assigned 81 Type 2 diabetes patients to a 7 hours education group and to a group where education was associated with a mindfulness and acceptance training on difficult thoughts and feelings about diabetes, an exploration of personal values related to diabetes, and a focus on the ability to act in a valued direction while contacting difficult experiences. At three months follow up, in the group where 3 of the 7 hours diabetes workshop were focused on ACT processes, patients reported diabetes self-management improved significantly more and were more likely to show HbA_{1c} levels in the target range than in the control. Moreover, analysis have shown that changes in HbA_{1c} were mediated both by changes in self-management and diabetes-related acceptance.

A low diabetes acceptance can be associated with impaired self-care and glycaemic control. This was demonstrated by a study based on the *Acceptance and Actions Diabetes Questionnaire* (AADQ) which measures acceptance of diabetes-related thoughts and feelings and the degree to which they

¹ https://en.wikipedia.org/wiki/Acceptance_and_commitment_therapy

interfere with valued action (Schmitt et al, 2014). As diabetes is a lifelong disease accepting diabetes is a prerequisite for a successful diabetes self-management. Accepting diabetes means (Stenzel, 2012)

- ◆ accepting the diagnosed type of diabetes
- ◆ to be confident to be able to cope with diabetes and the therapy as part of my daily life
- ◆ to act in a way that the diabetes will not be a handicap to reach important goals in the future

Even more, fostering motivation and sustainable acceptance of diabetes is a main goal of ACT for diabetes.

3.2.2 Values

Personal values describe what is most important in the patient's life. They are those elements that give life meaning in a person's life. Personal values can refer to different areas in a person's life and can serve as a compass, guiding the person in the direction that he most wants to go in his life. ACT uses exercises to help dig down to values in important domains representing the deepest desires for the way a patient want to interacts with and relate to the world, other people and himself.

Values are not the same as goals. Values are directions we keep moving in, whereas goals are what we want to achieve along the way. A value is like a compass heading north. Goals can be achieved or 'crossed off', whereas values are an ongoing process. Not everyone has the same values, but there are four basic categories for areas of life that are typically valued by people (Harris, 2013):

- ◆ Work/Education – includes workplace, career, education, skills development, etc.
- ◆ Relationships – includes your partner, children, parents, relatives, friends, co-workers, and other social contacts.
- ◆ Personal Growth/Health – may include religion, spirituality, creativity, life skills, meditation, yoga, nature; exercise, nutrition, and/or addressing health risk factors like smoking, alcohol, drugs or overeating etc.
- ◆ Leisure – how you play, relax, stimulate, or enjoy yourself; activities for rest, recreation, fun and creativity

For example, clients may be asked to write about what they most deeply care about and how that has touched their lives or to write themselves a letter from a wiser future about what to hold dear in the present.

There are different approaches to work with values. The value identification process can be started with an imagination, e.g. with a funeral exercise as suggested by the authors of "The Diabetes Lifestyle Book" (Gregg et al, 2007) and the categories life area can be more detailed, e.g.

- ◆ Family relations, marriage/couples/intimate relations, parenting, friendships/social life, career/employment, education/personal growth and development, recreation/fun/leisure, spirituality, citizenship/ environment/ community life, health/physical well-being (Harris, 2013)

3.2.3 Barriers

Taking the time to sit down and think about what you most value in a given area are the important first step in mapping out a direction for creating a meaningful life. However, this leaves out the barrier to getting there. A big obstacle for many people in meeting realistic goals and activities for diabetes self-management and hence, in attempting to move towards their values, are barriers (Gregg et al, 2007), such as

- ◆ Time barriers – the process of finding time to live the personal values might be difficult at the beginning. It will require being choosy about which goals the patient focuses on to begin with and learning to set limits on things that are not consistent with his values.
- ◆ Energy barriers – refers to the energy to engage in a whole new set of behaviour and activities. If this is a problem patients should start with health-related values first (e.g. changes to your diet, exercise) to become energetic.

- ◆ Feeling barriers and thought barriers – dealing with e.g. feelings like sadness, loneliness, anxiety or maybe thinking about the disease is overwhelming and the patient can't stop it.

Barriers can be identified by assessing life areas and related values for importance and contentment. However, diabetes patients often have disease related problems. POWER2DM identified the following diabetes-specific problem areas with their particular problems:

- ◆ Insulin/Medication – low dose, high dose, low frequency, high frequency
- ◆ Diet – too few carbohydrates, too much carbohydrates, too few calories, too much calories, poor nutritional value
- ◆ Glucose monitoring – too little, too much
- ◆ Exercise – too little, too much
- ◆ Stress – stress too high

A detailed overview of typical problems and psycho-social barriers can be found in the appendix, in section 9.

Scores of values for high importance and low contentment presents gaps indicating barriers. For coping with barriers the user will be guided by a workflow based on decision trees. The “leaves” of a decision tree will be interventions as described in section 3.1.

Relevant for POWER2DM

- ◆ POWER2DM will provide a workflow guiding the user for identifying his/her personal values.
- ◆ Specifying goals for diabetes self-management in accordance to personal values increases the patient's compliance to treatment goals. In POWER2DM, personal values will be an additional basis for the patient's self-management goals and activities.
- ◆ If a patient is not able to live according to his/her values or has problems to meet his/her goals the patient is prompted by POWER2DM to identify barriers. POWER2DM will in particular provide decision trees for coping with typical diabetes related barriers.

3.3 Just-in-Time Adaptive Interventions (JITAs)

Unfortunately, it is observed that many of the self-management applications are not very effective when applied longer periods of time. Among many reasons, the most important ones are the false assumptions that individuals adhere to every step in their care plan, perform these actions on time and the same fixed intervention is effective for whole population. These assumptions do not take the behavioral and emotional state of the person into account. Recently, adaptive interventions have emerged as a new perspective on research-based prevention and treatment. The problem with fixed interventions is that the varying intervention needs of individuals may not be met optimally by using a single uniform composition, dosage, frequency, or content of the intervention. For this reason, an adaptive intervention assigns different parameters (dosage, etc.) of certain program components across individuals, and/or within individuals across time. All these parameters vary in response to the intervention needs of individuals, and they are assigned based on decision rules linking characteristics and behavioral context of the individual with specific levels and types of intervention components. Existing health behavior change theories provide the scientific knowledge and background for the design of adaptive interventions as they define the behavioral concepts and describing the factors and relationships among them that affect the health behavior.

With the advance in mobile phone technologies, the concept is mainly used for mobile phone intervention design as a special case of adaptive intervention, and called the **Just-in-time adaptive**

intervention (JITAI) (Spruijt-Metz & Nilsen et al., 2014). This concept holds enormous potential for adapting mobile phone delivered interventions to the dynamics of an individual's emotional, social, physical and contextual state, so as to prevent negative health outcomes and promote the adoption and maintenance of healthy behaviors. A JITAI is an intervention designed to address the dynamically changing needs of individuals via the provision of the type/amount of support needed, at the right time, and only when needed (Nahum-Shani, Inbal, et al, 2014). Recently, many studies focus on JITAIs and design and use them to support health behavior change in physical activity, eating disorders, alcohol use, mental illness, smoking cessation, obesity/weight management and other chronic disorders.

The main components of JITAIs are as follows;

- **Decision points** are points in time at which treatment decisions must be made. These decision points are specified by the designer of the intervention; at every given time interval (e.g. every week check medication adherence performance of patient), specified time points during a day (e.g. every night check the blood glucose management performance of a patient), following the collection of data (e.g. after every blood glucose measurement).
- **Intervention options** in JITAIs include types of support, sources and timing of support; and modes of support delivery.
- **Tailoring variables** are the parameters that influence timely personalization of intervention options to a patient's momentary needs. For example, the location of patient or mood of patient can be tailoring variable to determine the best intervention options. Tailoring variables can be obtained by self-reported or passively collected data about the patients behavioural, emotional, environmental, health status context.
- **Decision rules** are the algorithms that individualize the intervention by specifying which intervention option to offer, when, and by which means based on the tailoring variables. There is a decision rule for each decision point.

3.3.1 Computation Modeling of Behavioral Models and JITAI delivery

With the advances in computer science in anticipatory computing and sensing technologies, the development of computational models of behavioural change becomes popular (Velico Pejovic et al, 2014, 2015). The ultimate goal is to have testable models of behaviour with interoperable subcomponents that capture the complexity of behaviour in the real world and deliver JITAIs based on the reasoning and anticipation done over these models (Spruijt-Metz D et al, 2015). Such models would be developed incrementally, with initial models only responding to small amounts of input capturing only certain aspects of behaviour and interactions. In the current state-of-the-art, there are numerous modelling methodologies used, ranging from system identification complemented with model-predictive control, to agent-based modelling, and dynamic Bayesian network analysis, such as Markov modelling or related machine-learning approaches like reinforcement learning. One of these is the research, carried by Rivera with his research group² which advanced the research for adaptive health interventions and demonstrated how control systems engineering approaches can be used to model and improve an adaptive intervention process. In general, control systems are used to model complex dynamical systems and optimizing outcomes by applying control design algorithms and computer simulations. In fact, the same approach is used for adaptive interventions for behavior change. Experimenting the model and interventions in a randomized experiment and running further simulations on the collected data then allow researchers to modify the model parameters accordingly to increase the confidence and reliability of the model. In these early studies, some dynamic models are proposed and experimented for some specific manual interventions like smoking cessation, gestational weight gain with the Theory of Planned Behavior and self-regulation theories as the basis.

² Arizona State University, Control System Engineering Laboratory, Adaptive Interventions in Behavioral Health, <http://cse1.asu.edu/node/13>

Figure 2 illustrates the modelling of Social Cognitive Theory by using control system engineering methodology with a fluid system analogy. As shown, the concepts in the theory like Self-efficacy, or Outcome Expectancy are modeled as differential equations on inputs like observed behavior, perceived barriers, etc and there are feedback loops (outputs of these states are input to the others).

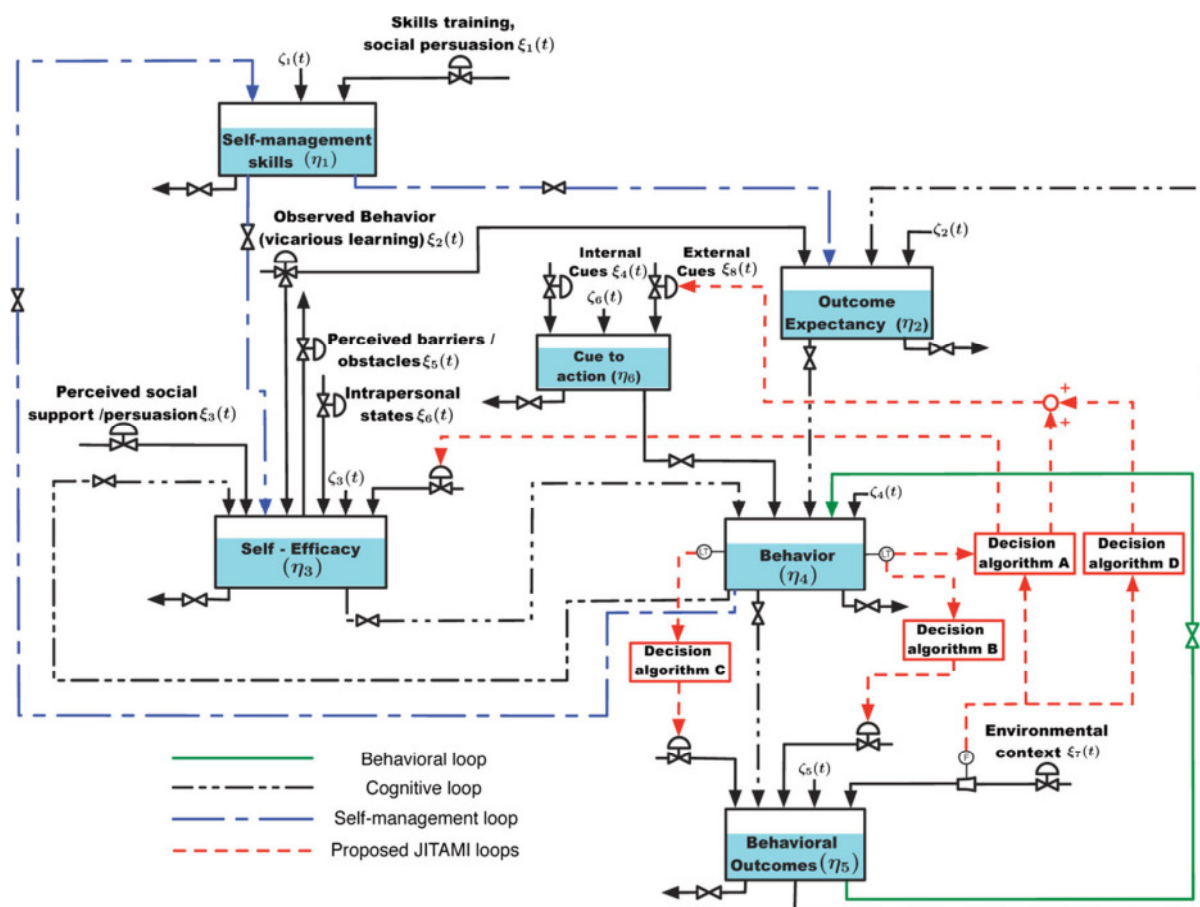


Figure 2 – Modelling of Social Cognitive Theory by Control System Engineering with Fluid system analogy

Relevant for POWER2DM

- POWER2DM will deliver JITAI's over POWER2DM SMSS Mobile Application to support the diabetes self-management process for expected health behaviour changes in certain areas; adherence to medications and dietary, physical activity and other self-management plans.
- POWER2DM will focus on the personalization of interventions in terms of support type with behavioural change techniques (e.g. different motivation methodologies; motivation by outcome expectancy evaluation, or motivation by showing another patient's performance as an example), and timing of interventions.
- POWER2DM use reinforcement learning technologies to determine the type of intervention and best time to show the interventions

4 DIABETES SELF-MANAGEMENT, PSYCHO-SOCIAL BARRIERS AND INTERVENTIONS IN POWER2DM

This section describes how POWER2DM will include behaviour change models and concepts for coping with barriers and recommending interventions.

4.1 Action Plan Workflow

The Action Plan Engine offers a guided workflow for diabetes self-management including personalized adaptive computer-aided health behaviour change interventions to support the patient to obtain and maintain healthy behaviour change. The Action Plan Engine

- ◆ supports the patient for becoming aware and planning personal values
- ◆ supports the patient for planning and executing self-management activities based on personalised goals and values and
- ◆ provides periodical feedback and interventions for improvements based on the patient's status and progress for fostering motivation.
- ◆ provides historical analysis to detect patterns for determining or emphasizing feedback and interventions e.g. assess progress over time, determine barriers or temporary setbacks, etc.

The starting point is the treatment plan including long-term and short-term goals. The Action Plan cycle is an iterative cycle, typically on a weekly basis. If a patient specifies activities on a weekly basis the likelihood that these activities are realistic is higher than planning activities for a longer period. However, the Action Plan cycle can also be bi-weekly, monthly or of another duration.

The steps of the Action Plan cycle are described as follows:

- (1) **Specify & update self-management goals** – based on the treatment plan and optional on the personal values the patient defines his self-management goals. In case, there already exists some self-management goals the patient will update them accordingly.
 - If the patient has no changes on the treatment goals he adopts them in his list of self-management goals.
 - Although the patient can specify self-management goals for each value it would be meaningful to specify at least goals for those values where gaps (=barriers) were identified and actions are needed to cope with the barriers.
 - Example: patient is used on a very active life, likes parties and is a very sportive person. Recently, Type 1 diabetes was diagnosed and since then he is quite often suffering from hypos. He decides to check again the information material about hypos, to be observant about upcoming hypo events, to record them and to talk to his doctor at the next appointment about his problem. Hence, the patient specifies 3 self-management goals – check Info material, record hypo symptoms and talk to the doctor.
- (2) **Check feasibility of self-management goals** - if all self-management goals are specified the Action Plan Engine asks the patient whether all these goals are feasible to him and accord with his values. If not, the patient is requested to check what might be possible barriers
 - e.g. if a goal is too excessive or just too big and the patient got overwhelmed he should break it down one or more realistic sub goals. Another option is to set graded task. i.e. starting with an easy task and to increase the difficulty or scope gradually.
 - Example: the physician recommended 3 times the week some physical exercise. But now looking at all my goals and at my other obligations I realise that will not be feasible for me. But 2 times a week 30 minutes Nordic Walking is still challenging but possible. I will do that and if I'm successful I will try to increase it.
- (3) **Specify & update activities** – in the next step the patients plans and updated the activities for the upcoming week. If desired, reminders can be activated.
 - Example: Nordic walking on Monday and Friday at 18:00, duration 30 min, reminder 15 min before
 - Example: measuring my blood glucose level all days at 7:00, 12:00, 19:00 and 22:00, reminder 5 min before

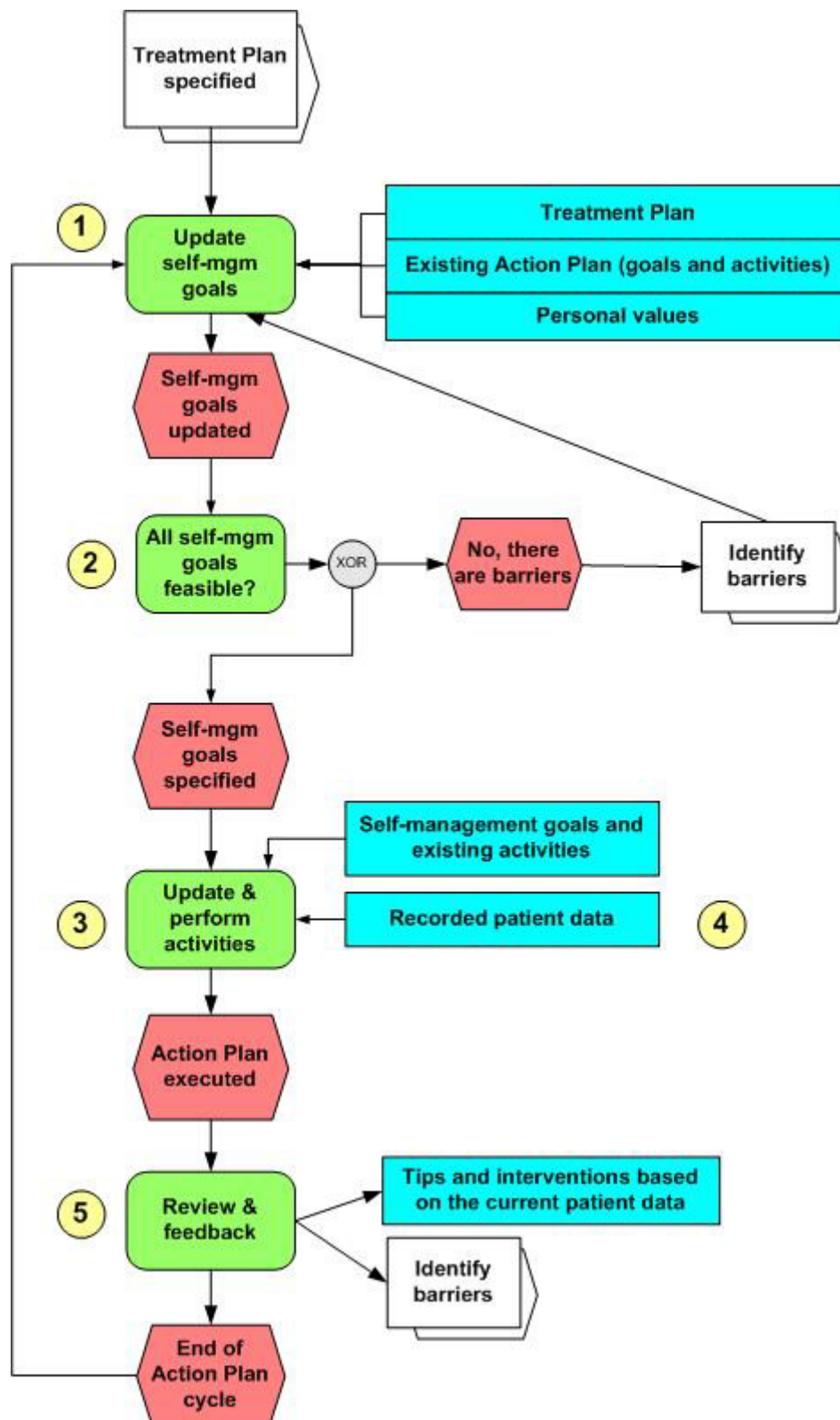


Figure 3 - Action Plan cycle

- (4) **Update & perform activity (self-monitoring)** – during the week, patient data will be recorded by devices but also manually. This phase supports the self-monitoring of vital data and behaviour

- Example (device): values for blood sugar, blood pressure, weight
- Example (manually by e.g. Web forms): restless legs (category: sleeping problem), dizziness (category: symptoms), high stress (journal), bad mood

Motivational messages, reminders and BCT-based advices and interventions (see also sections 3.1 and 4.4.1) aim at fostering the patient's compliance and self-management activities.

- (5) **Review & Feedback** – at the end of the week (or when the patient wants to ask for feedback) the Action Plan Engine evaluates and gives feedback how successfully the patient has fulfilled his planned self-management goals and activities. The patient might also review a wider time period beyond a week. If some results for planned activities are missing the Action Plan Engine requests for those patient data. Next, the Action Plan Engine gives feedback about the overall performance and of the performance of all concerned self-management goals and activates. Additionally, The Action Plan Engine provides hints and advices (=interventions for self-management) for all activities and goals.

- These interventions for self-management are based on BCTs and can be of different types, e.g.
 - Information about behaviour patterns and the consequences
 - Identifying barriers in case of low performance of an activity or critical journal entries (see section 4.3)
 - Including e.g. slide-shows for demonstrating alternative behaviours
 - Reminding the patient on rewards (specified as part of a goal) and on his/her personal values
 - Refer to links providing social support
 - Including advices for relaxation in case of increased stress
- Additionally, the review can analyse historical patterns e.g. evaluating progress over several weeks and provide the patient with a “bigger picture” to help the patient plan better and even identify potential barriers, even those that are temporal e.g. seasonal. There might be patterns of interest supports motivational strategies and even help the patient realize his/her own barriers over time. The action plan might be aware of holidays or other events that can be correlated with performance or compliance.
- Example (overall performance): *Perfect! You have improved from 85% to 90%! Keep it up!*
- Example (low performance regarding glucose monitoring): *What are the barriers to measure your blood sugar level continuously? What would you need that it works next week? Be also aware of your personal overall health goal to live your life to the fullest (including travelling, snowboarding and biking tours and playing soccer with friends) despite diabetes.*
- Example (motivation for more physical activity): *Invite a friend or family member to join you the next time you go. Or see if you can find any local group that you could join. Doing sports together is more fun and a great opportunity to meet new people!*
- Example (in case of bad sleeping quality): *Keep your bedroom cool and well ventilated. Slide-show with more tips*
- Example (patient didn't meet a self-management goal for several weeks): *Could it be that your goal is currently unrealistic? In that case, try to make the goal simpler and achievable and continue towards your goal!*
- Example (bad mood): *Maybe you would like to have a look into the tutorial <about coping with feeling and/or thought barriers>. There you will find some ideas how you can cope with your bad mood.*

4.2 Value Compass

As known from ACT, the Acceptance and Commitment Therapy (Gregg et al, 2007), specifying (self-management) goals in accordance to personal values increases the patient's compliance to treatment

goals. Values describe what is most important in the patient's life. They are those elements that give life meaning in a person's life.

Personal values can refer to different areas in a person's life and can serve as a compass guiding the person in the direction that he most wants to go in his life. Specified personal values are a basis for all self-management goals and activities. An integrated function of the Action Plan Engine will be the **Value Compass** guiding the patient through a workflow for identifying and updating personal values. This workflow comprises the following main steps and is based on the ACT approach (see section 3.2):

- (1) imaging an event where people speak friendly about the patient
 - e.g. 90th anniversary, the own funeral, farewell party, miracle question
- (2) specifying personal values for life areas by questions. To keep it simple and clear POWER2DM will focus on the following four life areas (see Figure 4):
 - *Personal Growth/Health*: may include religion, spirituality, creativity, life skills, meditation, yoga, nature; exercise, nutrition, and/or addressing health risk factors like smoking, alcohol, drugs or overeating etc.
 - *Work/Education*: includes workplace, career, education, skills development, etc.
 - *Relationships*: includes your partner, children, parents, relatives, friends, co-workers, and other social contacts.
 - *Leisure*: how you play, relax, stimulate, or enjoy yourself; activities for rest, recreation, fun and creativity.

A list of possible values will help to identify personal values. At the end of this step, the user will be requested to summarize the key messages what is important to him/her (= value) in 1 sentence.

Life Areas

Take a look at the different life areas for a first impression which life aspects belong to them.

Health/Wellbeing	Relationships	Work / Education	Leisure
includes exercise, nutrition, health risk factors and areas of personal growth (e.g. spirituality, creativity)	includes your partner, children, parents, relatives, friends, co-workers, and other social contacts	includes workplace, career, education, skills development, homemaking, care-giving, volunteering, etc.	includes activities for rest, recreation, fun and creativity how you play, relax, stimulate, or enjoy yourself

Ask yourself the question:
What do I want the person representing the life should say about me?
What should s/he say how I lived my life, what was important to me?
 Select one area to start with.

Back Next

Figure 4 - Value Compass: Life Areas

- (3) The user is requested to assess all values by scores for importance and contentment for identifying gaps (=hints for barriers). See also Figure 5.
- (4) The gap between (high) importance and (low) contentment is typically a hint that there is a barrier for this value. In this case, the user is prompted to be guided by a workflow for identifying barriers and proposing interventions will start (see section 4.3)

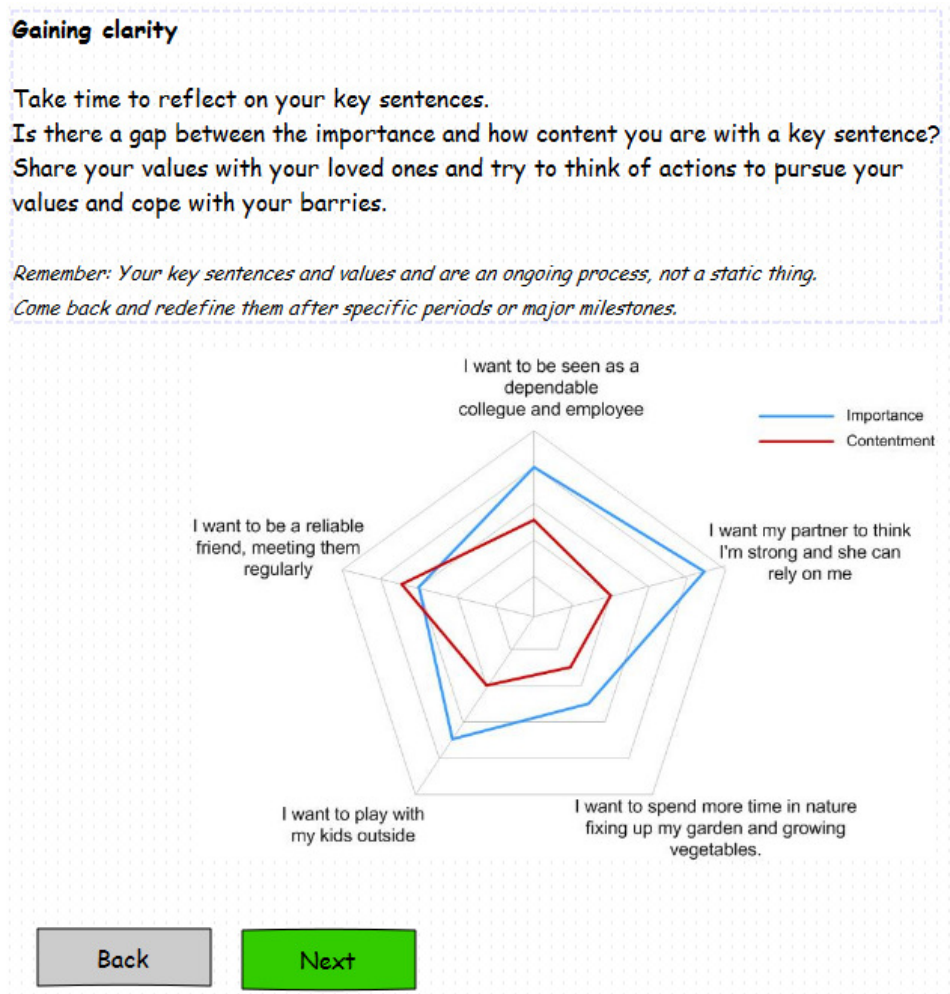


Figure 5 – Value Compass: importance and contentment of key sentences

Example: Anna wants to have children within the next few years, but currently her HbA1c is too high. It should be below 53 mmol/mol before she is “allowed” to try to get pregnant. She specifies importance = 10 and contentment = 2. The Action Plan requests her to specify what she needs (in particular from a not-medical point of view) to increase her HbA1c below 53 mmol/mol, to define a goal for that and to discuss this topic with her doctor.

The result will be personal values important for the patient in his life. Depending on the patient this might be a private section and it has to be the patient’s decision whether he wants to share his value compass or parts of it with e.g. his physician or not. However, it aims at fostering long-term motivation for self-management activities.

The patient can utilise this function as an additional input for specifying self-management goals in accordance with not only the treatment goals but also with his/her personal values, but also as input in case of an appointment with a physician or a psychologist when specifying the treatment plan.

4.3 Decision Trees for coping with Barrier

Appointments with physicians might be quarterly or once a year. Between these appointments at home the patient may realise that s/he will have some troubles to fulfil the treatment plan in accordance with his personal values. This function about coping with barriers aims to be a support for self-management when using the Action Plan Engine:

- ◆ for increasing awareness how coping with barriers can facilitate the patient to manage his diabetes properly,
- ◆ for specifying realistic self-management goals and activities with a high degree of fulfilment and
- ◆ in case there is no physician or psychologist available for discussing problems, the patient can actively seek information how to cope with barriers.

Within the POWER2DM project it will not be possible to cover all barriers diabetes patients are confronted with. However, the most frequent barriers are summarized in the table presented in the Appendix 3 – Self-management Problems and psycho-social barriers. This table will be a starting point for designing decision trees for coping with barriers and recommending appropriate interventions. The following three figures describe a decision tree guiding patients through a workflow for identifying their problems with glucose monitoring. In the first step (see Figure 6) patients are asked to check whether they have any problem with their current goals. This can be e.g. a weekly request. If the patient says yes then they are asked which goal. In this case the patient chooses “Glucose monitoring” as the problem.

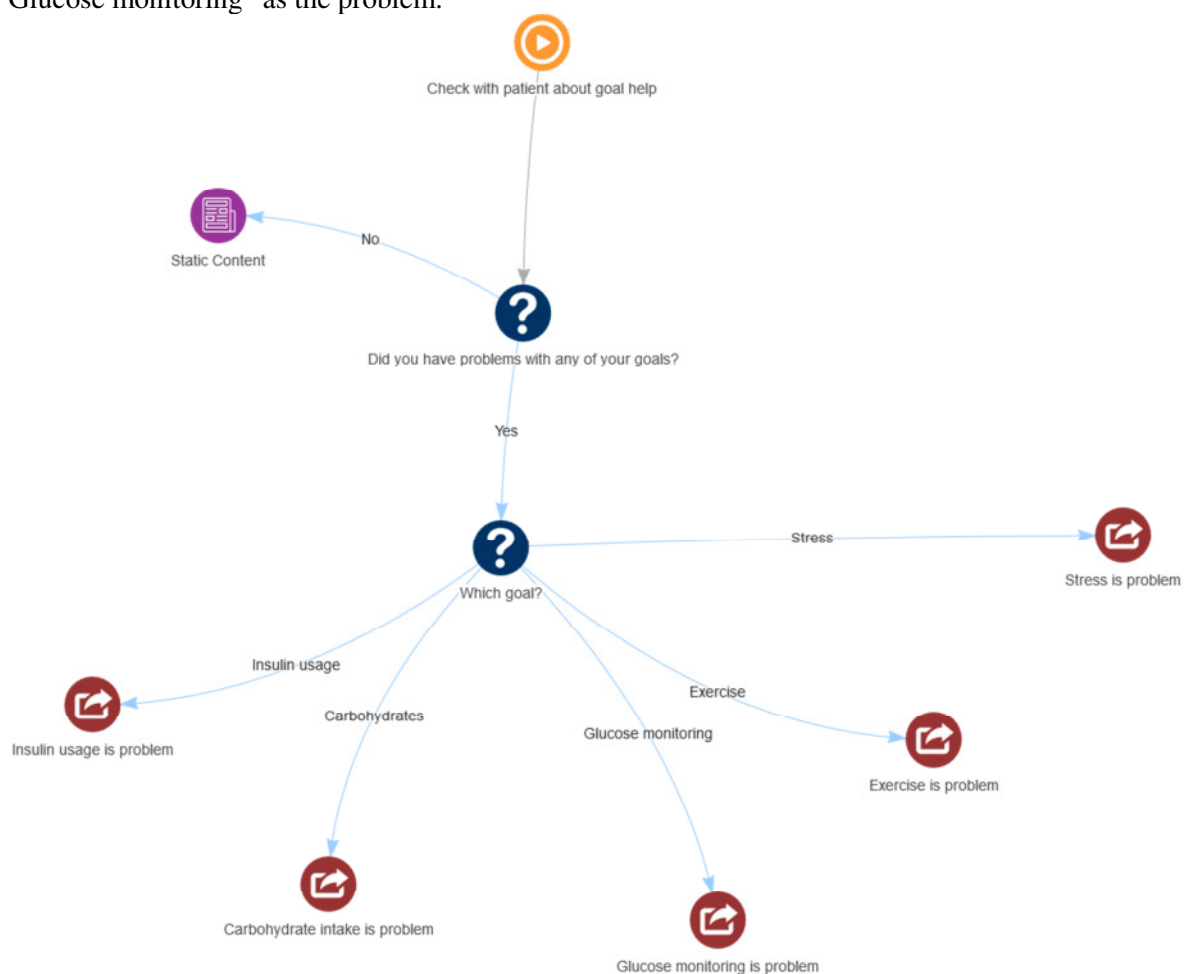


Figure 6 - Decision Tree for identifying goal problems

Red nodes can trigger new decision trees. The next step (see Figure 7) aims at finding out where and why the patient is having a problem with glucose monitoring. This patient indicates that he monitors too little. Next, POWER2DM asks for common problems regarding glucose monitoring barriers, e.g. dislike of needles, forgetting to monitor. If the patient cannot identify any specific barriers they are then asked about general barriers, e.g. not important, patient doesn't care. In our example, the patient indicates that he just don't like monitoring his blood glucose.

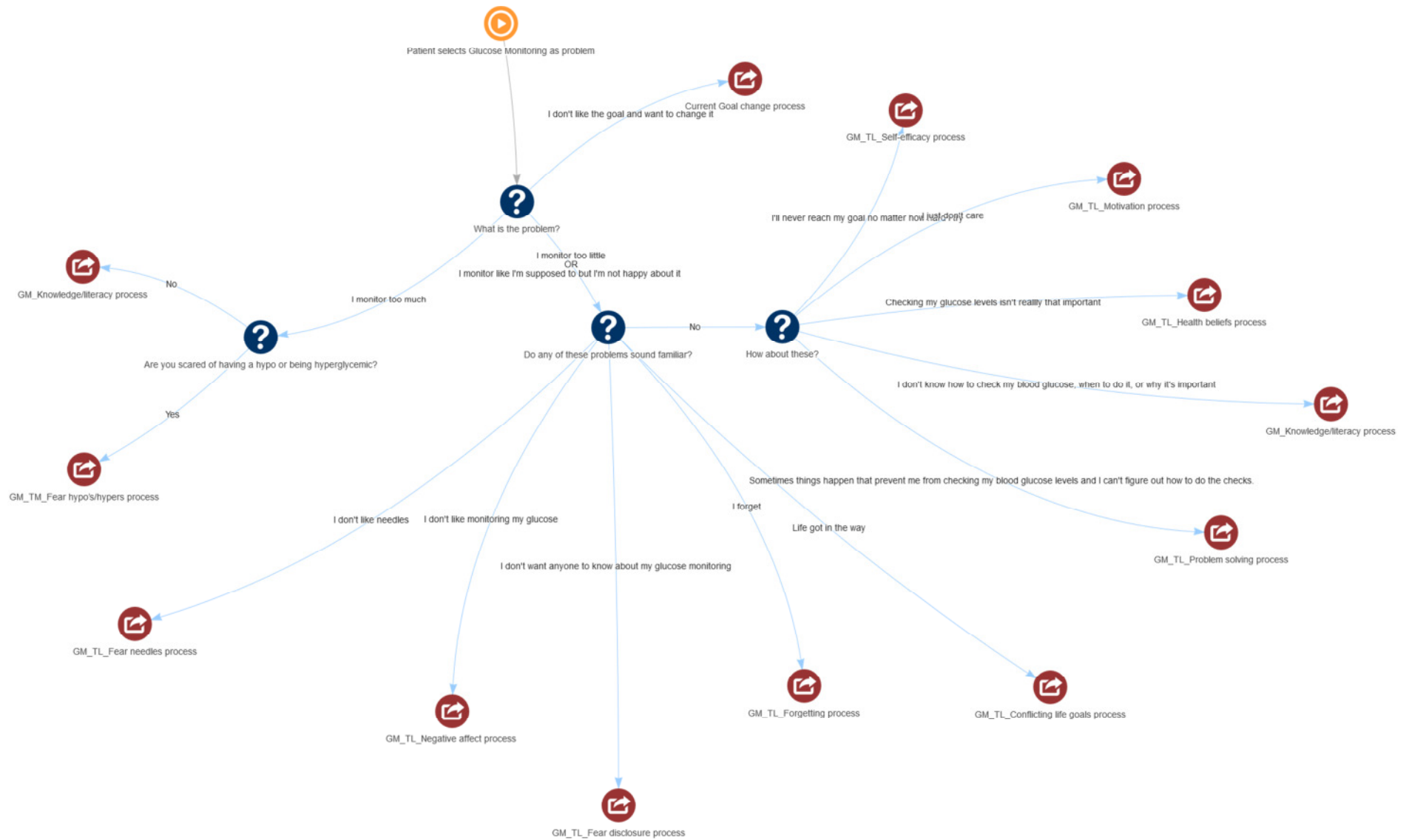


Figure 7 - Decision Tree for identifying glucose monitoring problems

The answer triggers the next step (see Figure 8) suggesting interventions for coping with the user's problem. For this barrier the patient is given the following options

- ◆ receiving more information about glucose monitoring and not feeling good about it
- ◆ reading/hearing/seeing stories from other patients about this
- ◆ choosing from exercises to try to cope with the barrier
- ◆ changing the related goal.

This is the leaf of the tree. Depending on the selected option POWER2DM leads to the next step, e.g. presenting the required information or to the goal menu for changing the related goal.

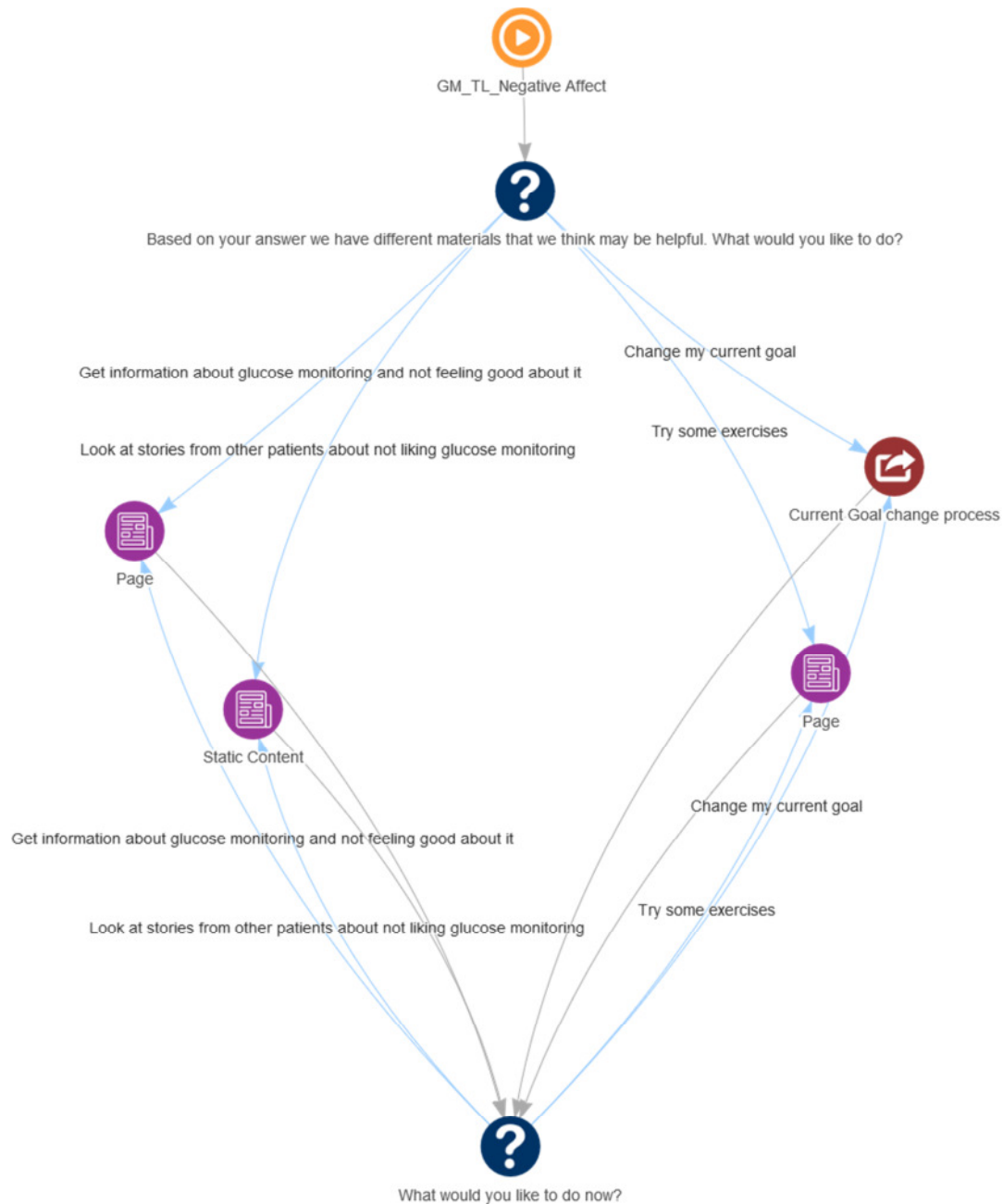


Figure 8 - Decision Tree for coping with negative effects

The following three figures give an idea how a decision for exercise barriers can be presented to the user and can be an integrated part of the Action Plan workflow:

- ◆ Step 1 (Figure 9) – asking the patient about the type of exercise problem. The patient selects “too little exercise”

- ♦ Step 2 (Figure 10) – asking the patient about the specific barrier of his problem. Additionally, further general advices are presented
- ♦ Step 3 (Figure 11) – in the last step interventions are presented, in this case a. link to multi-media information material (psychoeducation) and a context-related advice (a step-counter in this case). Decision trees will be an integrated part of the Action Plan Engine and interventions can be adopted as additional goals or activities

[Barrier](#) > [Exercise](#)

What is the specific problem?

☒ Too little exercise
☐ Too much exercise
☐ Another problem

Figure 9 - Exercise decision tree, step 1

[Barrier](#) > [Exercise](#) > too little

Specify the problem in detail:

☐ Are you scared of having a hypoglycaemic episode and therefore, reduce exercising?
☒ Do you feel discouraged due to previous lack of success to be physically active?
☐ Do you sometimes forget to exercise?
☐ Are you not able to find enough time to exercise?

In general, you have to increase exercise either in frequency, duration or intensity (e.g. steps/stairs, distance)
 If you are unsure, please contact your doctor.

Figure 10 - Exercise decision tree, step 2

Barrier > Exercise > too little > Tip

Recommendation:
 A slide show with tips for increasing exercise
 Do you want to do it now?

Yes Later (Plan activity) No

Recommendation:

Use a step-counter and try to achieve 3000 steps per day

Adopt as goal

Figure 11 - Exercise decision tree, step 3 (interventions)

4.4 Relation of JITAI with POWER2DM Concepts

Figure 12 illustrates the relationships between the JITAI and the main POWER2DM concepts to describe the patient situation in terms of diabetes care. Insulin/medication adherence, carbohydrate intake, physical activity, stress are major problem areas that POWER2DM will focus on for self-management. For each of these areas, patient may have a list of possible problems that influence his/her health. The barriers are the major reasons for these problems. Goals either set as treatment goal by physician or self-management goal by patient thyself, addresses the identified problems and set a target for the patient to overcome the problem. They also help to reach the personal values set by patient himself as described in Section 4.2. Action plans are the plans (recommendations) for the patient that aims to overcome a barrier or problem directly and help to reach a Goal.

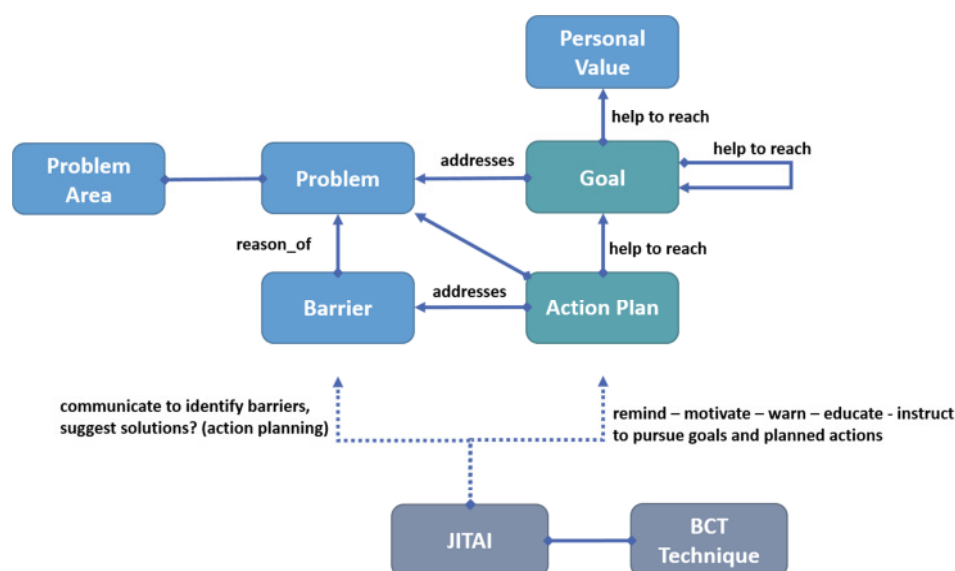


Figure 12 – Relation of JITAI with other POWER2DM Concepts

JITAI in POWER2DM are used for two different purposes; i) to interact with patient at the right time to get information to support the barrier and problem identification process in self-management, and

ii) to support the pursue of goals and adherence to planned actions by timely reminders, motivations, warnings, educational contents, and instructions. Each JITAI is trying to implement a BCT technique.

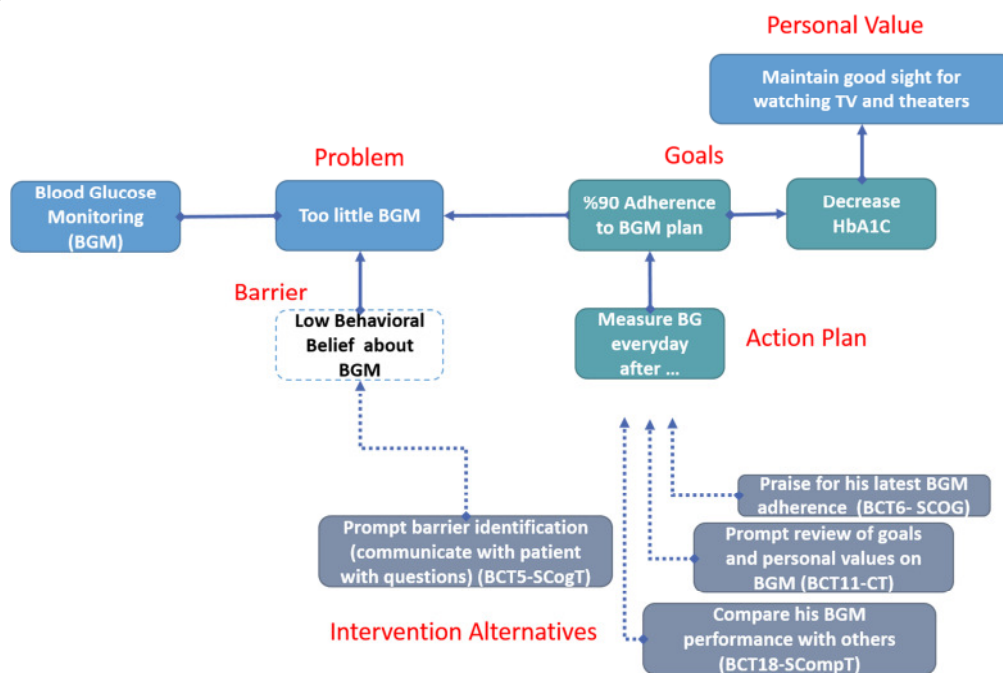


Figure 13 – An example for the relations

Figure 13 shows an example case for all the concepts and some possible interventions for the same case. Patient has a problem that he is not monitoring his blood glucose enough and he has a goal of 90% adherence to blood glucose monitoring plan set by his physician which is the sub-goal to decrease HbA1c. This main goal is addressing the personal value of patient; maintaining good sight for watching TV and theatres. In relation with blood glucose monitoring goal, an action is planned to measure his blood glucose every day at specific times. In order to identify the barrier that results the “too little blood glucose monitoring” problem, system asked questions which as a result the barrier is identified; “patient has a low behavioural belief about monitoring of blood glucose monitoring”. In order to support patient to adhere to his action plans, different JITAI with different BCT techniques can be delivered to patient; “BCT-6 Provide General Encouragement”, “BCT-11 Prompt review of behavioural goals” or “BCT-19 Social comparison with others”.

As **intervention options** POWER2DM focuses on the followings;

- Type of support (BCT Technique) suitable for patient for that time
- Timing of JITAI within the day by considering the interruptibility, expected effect for the intervention and intervention burden on the patient

From the research perspective, POWER2DM will search answers for following research questions;

Q1: Do habit gain for a daily self-management activity based on reminders differ at the beginning of self-management process and later in the process? (Lally, P et. al, 2010)

- **Hypothesis:** Yes. Patients would have a slower rate of habit gain at the beginning and comparatively faster rates at the later phases

Q2: Does the total number of interventions in a day making a patient uncomfortable differ over time?

- **Hypothesis:** Yes. Patients would tend to see less interventions as they would learn how to behave or they get bored of seeing interventions

Q3: Does interruptibility of patients affect the timely utilization of interventions (See Amelia Scenario) (Veljko Pejovic et. Al, 2014)

- **Hypothesis:** Yes. The view rate of interventions would increase if they are delivered at the moments when patients are more likely to be interrupted
 - e.g. When the phone screen is open or after they use a social application
 - e.g. When they do not drive
 - e.g. When they are at home

Q4: Does frequency of interventions affect the view rate/success?

- **Hypothesis:** Yes. Patients would less likely to view interventions if the temporal gap between subsequent interventions is small

Q5: Does timing of the intervention during the day affect the view rate/success?

- **Hypothesis:** Yes. Based on the personal preferences and daily routines patient might or might now want to see interventions during certain periods during the day

Q6: Does type of BCT technique in intervention delivery affect the view rate/success?

- **Hypothesis:** Yes, each patient may different characteristics and their responses may differ for different types of BCT techniques.
 - e.g. Motivating patient by showing a behavioural link (As you paid attention to your calorie intakes, you lost 500 gr last week)
 - e.g. Motivating patient by showing outcome expectancies (If you will adhere to your dietary plan, you may lose weight in next month)
 - e.g. Motivating patient by giving positive health behaviour examples in people's reference groups (Your friend adhere to his dietary plan, and lose 1 kg in last month.)

Focusing on these questions, Communication Engine may use the following parameters as the **tailoring variables** for the JITAIs and to model the learning system in this direction.

- Contextual parameters
 - Location (home, office, etc)
 - Phone usage
 - Time
 - Current Activity
- Psychological parameters
 - Mood
 - Stress levels
 - Evaluations for Health Behavior Models (e.g. Theory of Planned Behavior) concepts (e.g. Attitude towards behaviour, Subjective norms, Perceived behaviour control, etc)
 - ...
- History of applied interventions
 - Applied interventions and reaction to interventions
 - The rate of success for the applied interventions

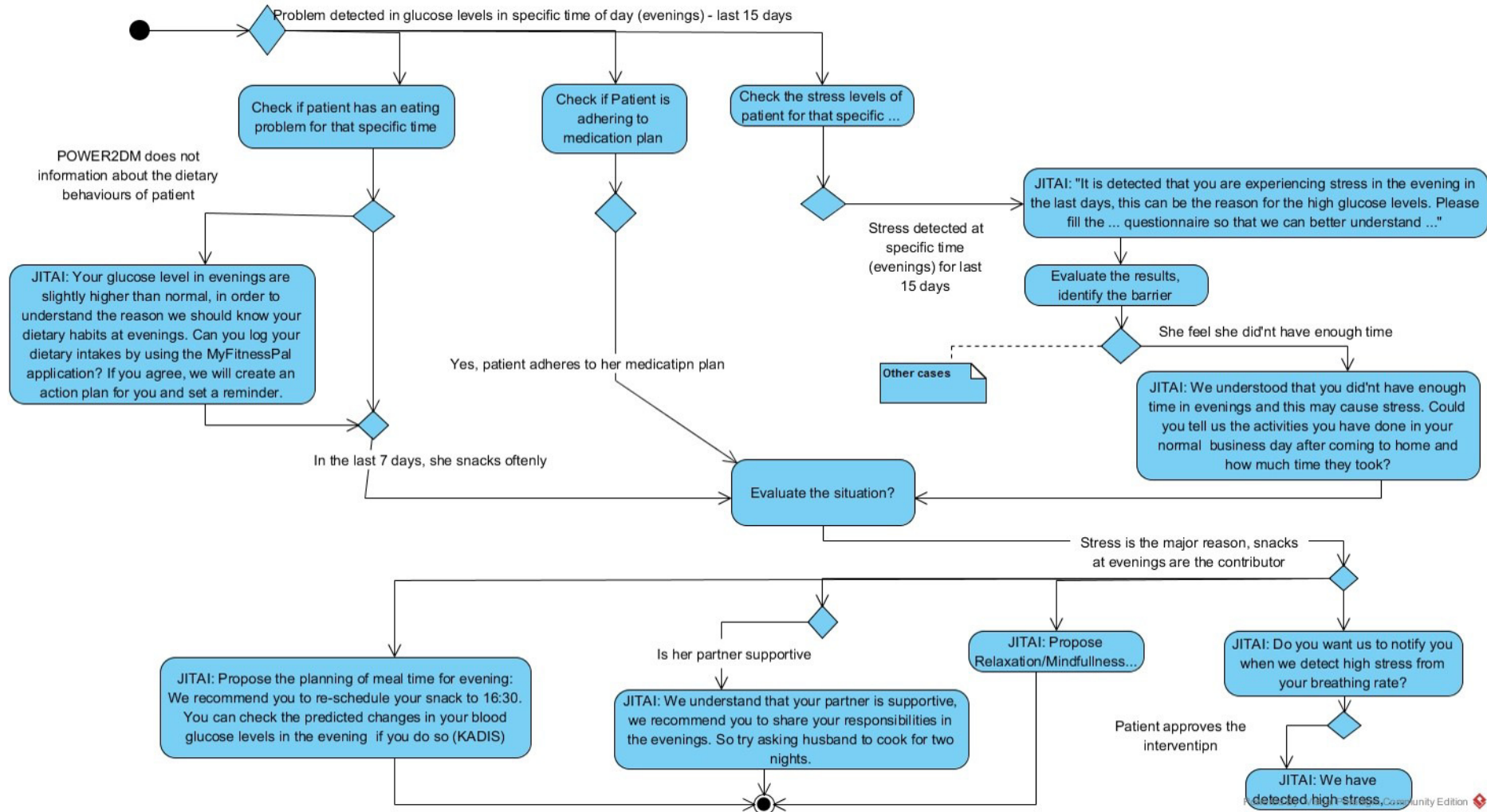
4.4.1 Methodology for JITAI design and implementation

In order to design an effective JITAI conceptually and implement it within the POWER2DM system, a trans-disciplinary study is needed where clinicians, psychologists and patients themselves work on the conceptual design (what will be beneficiary for the patient, in what cases, what BCT techniques can be used, the process, etc.) and software engineers work on the how this can be implemented and bound to the data collected and functionalities provided by the systems. Also it is very important to narrow down the scope to the most important JITAIs to be realistic about the implementation and evaluation of effectiveness of the designed JITAIs.

Figure 14 illustrates a fictional decision flow including several decision points and JITAI delivery based on several tailoring variables and rules. We do not intend implement such a complex workflow, we present it just to give an insight how we should design the JITAIs. Furthermore, it is not realistic to cover all possible cases that may occur during diabetes self-management care, it will help if such functionality can be provided for common problems experienced by patient groups.

In the light of this, we have designed the following methodology for the conceptual design of JITAIs that will be the reference point during the implementation (implementation of algorithms, UI interfaces, rules, flows, etc).

- i) Identify the important cases (decision points) in self-management phase that may need a JITAI.
 - e.g. Danger of hypoglycemia detected (based on latest measurement or insulin injection and KADIS prediction)
 - e.g. Time for a planned exercise is approaching and it is predicted that patient may not perform it as the habit is not performed yet
 - e.g. The problem “too little insulin” is already detected and scheduled time for insulin intake is approaching
- ii) Define the decision flow for each of these cases by further elaborating on the rules, sub decision points, flow
- iii) Identify the possible JITAI based on different BCT techniques for each leaf of the decision flow tree
 - e.g. Motivate patient for the approaching exercise plan by “BCT-2 Provide information on consequences.”
 - e.g. Motivate patient for the approaching exercise plan by “BCT-19 Social Comparison”
- iv) Define the details of the JITAI



The following templates can be used to identify important cases and document them;

Case Identifier	An identifier for the case. Group the cases under the problem areas and use them as prefix for identification (e.g. BGM-1; case 1 for blood glucose monitoring)
Case Description	Short description of the case
Decision Point	The time points that we need to check to detect the case e.g. For each blood glucose measurement, e.g. For each log of insulin intake
Decision Rule	Give the rules and thresholds that triggers the case by mapping them to a data directly collected in POWER2DM or can be inferred in POWER2DM from the data by analytics or learnings e.g. if latest BG measurement < 70 e.g. if patient gets an insulin intake higher than planned and if KADIS prediction shows a possible hypoglycemia
Decision Flow	Provide an UML Activity Diagram (similar to Figure 14) to describe the decision flow including the sub-decision points, rules and actions or JITAI to be performed by system Describe each sub-decision point and action step by step and give identifiers to them.
JITAI List	List the interventions (and the BCT technique they are based on) covered by this flow

Then for each intervention identified for the case, the following template can be used to define the JITAI.

JITAI Identifier:	An identifier for JITAI
BCT Technique:	The BCT Technique it is based on
Description	Short description of JITAI, what is to be shown and how.
JITAI Content	
Notification Message	The notification message to be shown to the patient initially from his mobile phone e.g. “You have injected ... units insulin lately. According to prediction models, your blood glucose level may decrease to hypoglycaemic region in ... hour. Please be careful”
Detailed View	Description of the detailed view that is shown to the patient if he clicks on the notification message. If related, provide the links for educational material, videos, articles to be used to support the intervention. In the second phase of JITAI design, a visual mockup design for the UI will be provided based on the descriptions.

4.5 POWER2DM Interventions

Based on the BCT types (see tables in section 7 and 8) and on the table about problems and barriers (see section 9) interventions are defined and assigned.

Our methodology for identification of the interventions uses the following dimensions for categorization of interventions:

- ♦ **Area** – this is the topic area within a problem occurs. We identify the following groups;
 - Carbohydrate Intake (CARB)
 - Medication/Insulin Adherence (MED)
 - Glucose Monitoring (GMON)
 - Dietary/Weight Management (DIET)
 - Physical Activity/Exercise (EXC)
 - Stress/Sleep (STRESS)
- ♦ **Problem Area** – labels the specific problem, e.g. too little (for GMON), too much (for EXC)
- ♦ **Cause/Barrier** – specifies possible the causes resp. the barriers of the associated problem area, e.g. fear of hypo's, eating problem
- ♦ **Intervention** – proposes interventions for the identified barrier. Intervention will be general for addressing many different causes for different problems. Interventions like this usually consist of several BCTs.

Section 10 shows an example for “too little glucose monitoring” (BGM, too little) with some barrier und intervention. The table additionally includes a column describing the basic intervention types for a Cause/Barrier.

5 ONTOLOGY FOR GOALS AND ACTIVITIES

One of the core features in the Action Plan in POWER2DM is to support the patient in the identification of self-management goals, and the definition of single activities that help to achieve them. In order to build such a system we need to define the properties of goals and activities and their relation to other concepts used in POWER2DM.

Figure 15 provides an overview on the entities goals and activities and their major relations. The final specification of the goals and activity ontology will be included in the “Personal Health Data Model” of POWER2DM.

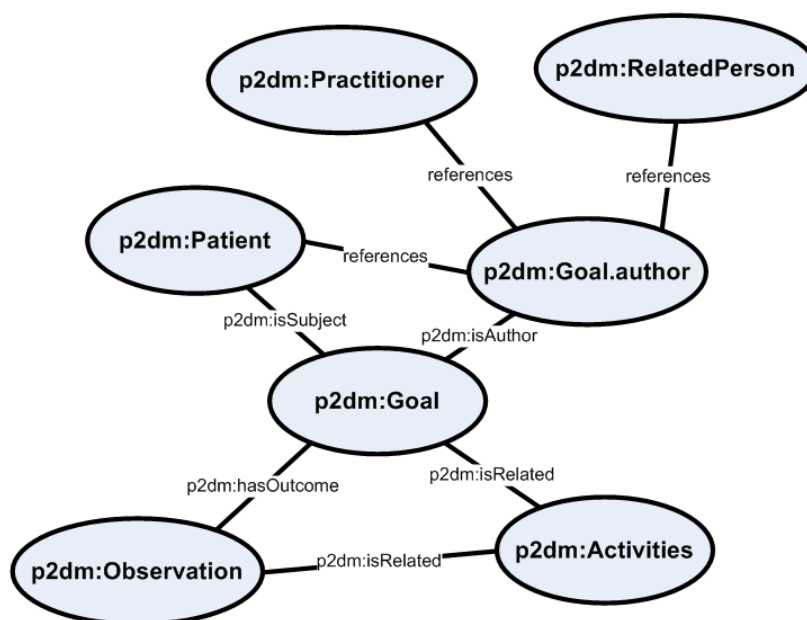


Figure 15 – Goals, Activities and their relation to Observations and Persons

As described in section 5.2, the Action Plan requires the specification of dedicated goals that should be achieved during the therapy process. Goals can be either defined during the shared-decision making phase (treatment goals) or during the self-management phase (self-management goals). The

goals in POWER2DM are modelled according to the FHIR type “Goal”³. It describes the intended objective(s) for a patient such as weight loss, restoring an activity of daily living, meeting a process improvement objective, etc. The properties which describe a goal are shown in the following table.

Concept	Description	FHIR Reference
patient	A Goal is always assigned to a single patient.	Goal.subject
dateTime	A concrete starting date (and time) when working towards this goal is intended to start	Goal.startDate
endDate	A time period until the goal is planned to be reached	Goal.targetQuantity
created	The timestamp, when the goal has been created for the first time.	
lastModified	The timestamp, when the last change on the goal has been applied.	Goal.Meta.lastUpdated
identifier	A UUID to identify the goal	Goal.Identifier.value
status	Status of the goal, such as “proposed”, “in-progress”, “achieved”	Goal.status
title	Name/title of the goal	Goal.text
description	Description of the goal	Goal.description
motivation	Motivational Message, explaining why it is important to work towards this goal.	Goal.motivationalMessage (extension)
relatedRecommendations	One or more related treatment goal(s) that have been recommended and agreed during the shared-decision making process.	Goal.goal-pertainsToGoal
relatedActivities	A list of activities related to the goal.	
reward	A reward that will be given once the goal is achieved.	Goal.reward
targetMeasure	A measurement that is used to measure the achievement of the goal.	Goal.goal-target
addresses	A current situation (Problem, Personal Value, current Observation) describing the current state that should be changed by achieving the goal.	Goal.addresses
tag	On or more tag can be added to the goal in order to support better searching, sorting or filtering of goals.	Goal.meta.tag
category	A category for the goal, e.g. physical activity, blood glucose management (insulin, monitoring), dietary management, sleeping/stress management etc.	Goal.category
author	A reference to the author of the goal. This information is also used to distinguish between self-management goals defined by the patient and treatment goals defined during the shared decision making phase.	Goal.author

Table 1: Goals definition in POWER2DM

Goals are achieved by performing one or more activities. The duration of activities is comparably short, are scheduled to concrete dates and times and they should contribute to the achievement of one or more goals. The following table lists the properties required for defining activities. Activities can be mapped to an extended `ProcedureRequest` class from the FHIR model. Activities will be “acknowledged” by the appearance of an Observation. Therefore whenever a measurement result is recorded by the patient, the Action Plan Component needs to be informed in order to map it to an activity.

Concept	Description	FHIR Reference
Patient	An activity is always assigned to a single patient.	ProcedureRequest.subject

³ Specified by the FHIR Patient Care Work Group: <https://www.hl7.org/fhir/goal.html>

dateTime	A concrete starting date (and time) of the planned activity	ProcedureRequest.scheduled
endDateTime	The end date and time of the activity.	ProcedureRequest.scheduled
created	The timestamp, when the activity has been created for the first time.	ProcedureRequest.orderedOn
lastModified	The timestamp, when the last change on the activity has been applied.	ProcedureRequest.meta.lastUpdated
identifier	A UUID to identify the activity	ProcedureRequest.Identifier.value
title	Name/title of the activity	ProcedureRequest.text
description	Description of the activity	ProcedureRequest.Instruction.valueString
status	Status of the activity, such as “planned”, “finished”.	ProcedureRequest.status
type (category)	A category for the activity, e.g. physical activity, blood glucose measurement. This should match with the related goal category (see below).	ProcedureRequest.category
tag	On or more tag can be added to the activity in order to support better searching, sorting or filtering of activities, e.g. more concrete specification of the activity category, like “walking”.	ProcedureRequest.meta.tag
reminder	Reference to the setting of a reminder for this activity. If active, specify what type of reminder is used (email, sms, push notification, communication engine), and how many minutes before the activity a reminder should be sent.	[to be defined]
schedules	The schedule of the activity. Needs to support multiple repetitions per day (e.g. for insulin intakes)	ProcedureRequest.scheduled[x]
relatedGoals	A list of goals related to this activity.	ProcedureRequest.relatedGoal
relatedProblems	A list of related problems, if any.	ProcedureRequest.relatedProblem
relatedBarriers	A list of related barriers, if any.	ProcedureRequest.relatedBarrier
relatedObservations	The observations related to this activity	[to be defined]
actionDetails	The details for this action, including a numeric value (e.g. the planned distance for a walking activity).	ProcedureRequest.actionDetail

Table 2: Activity definition in POWER2DM

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7 APPENDIX 1 – OVERVIEW OF BCTS

The BCTs are grouped into three phases: Motivation phase, Planning phase, and Action/Continuation phase. Techniques are numbered according to the taxonomy of Abraham and Michie (2008). One technique may be important for several phases. In this case, the technique is classified to the phase it was most important. (Adapted from Dusseldorp et al., 2014)

Motivation phase	
Technique	Definition
1. Provide information about behavior health link	General information about behavior risk, for example, susceptibility to poor health outcomes or mortality risk in relation to the behavior
2. Provide information on consequences	Information about the benefits and costs of action or inaction, focusing on what will happen if the person does or does not perform the behavior
3. Provide information about others' approval	Information about what others think about the person's behavior and whether others will approve or disapprove of any proposed behavior change
4. Prompt intention formation	Encouraging the person to decide to act or set a general goal, for example, to make a behavior resolution such as "I will take more exercise next week"
25. Motivational interviewing	Prompting the person to provide self-motivating statements and evaluations of their own behavior to minimize resistance to change
Planning phase	
5. Prompt barrier identification	Identify barriers to performing the behavior and plan ways of overcoming them
7. Set graded tasks	Set easy tasks, and increase difficulty until target behavior is performed.
8. Provide instruction	Telling the person how to perform a behavior and/or preparatory behaviors
9. Model or demonstrate the behavior	An expert shows the person how to correctly perform a behavior, for example, in class or on video
10. Prompt specific goal setting	Involves detailed planning of what the person will do, including a definition of the behavior specifying frequency, intensity, or duration and specification of at least one context, that is, where, when, how, or with whom
16. Agree on behavior contract	Agreement (e.g., signing) of a contract specifying behavior to be performed so that there is a written record of the person's resolution witnessed by another
19. Provide opportunities for social comparison	Facilitate observation of nonexpert others' performance for example, in a group class or using video or case study
20. Plan social support or social change	Prompting consideration of how others could change their behavior to offer the person help or (instrumental) social support, including "buddy" systems and/or providing social support
21. Prompt identification as a role model	Indicating how the person may be an example to others and influence their behavior or provide an opportunity for the person to set a good example
26. Time management	Helping the person make time for the behavior (e.g., to fit it into a daily schedule)

Action/Continuation phase	
6. Provide general encouragement	Praising or rewarding the person for effort or performance without this being contingent on specified behaviors or standards of performance
13. Provide feedback on performance	Providing data about recorded behavior or evaluating performance in relation to a set standard or others' performance, i.e., the person received feedback on their behavior.
15. Teach to use prompts or cues	Teach the person to identify environmental cues that can be used to remind them to perform a behavior, including times of day or elements of contexts.
17. Prompt practice	Prompt the person to rehearse and repeat the behavior or preparatory behaviors
11. Prompt review of behavior goals	Review and/or reconsideration of previously set goals or intentions
12. Prompt self-monitoring of behavior	The person is asked to keep a record of specified behavior(s) (e.g., in a diary)
14. Provide contingent rewards	Praise, encouragement, or material rewards that are explicitly linked to the achievement of specified behaviors
18. Use follow-up prompts	Contacting the person again after the main part of the intervention is complete
22. Prompt self-talk	Encourage use of self-instruction and self-encouragement (aloud or silently) to support action
23. Relapse prevention (relapse prevention therapy)	Following initial change, help identify situations likely to result in readopting risk behaviors or failure to maintain new behaviors and help the person plan to avoid or manage these situations
24. Stress management (stress theories)	May involve a variety of specific techniques (e.g., progressive relaxation) that do not target the behavior but seek to reduce anxiety and stress

8 APPENDIX 2 – CALO-RE BCT TAXONOMY

(Michie et al., 2011)

	BCT Technique	Description
BCT-1	Provide information on consequences of behaviour in general	Information about the relationship between the behaviour and its possible or likely consequences in the general case, usually based on epidemiological data, and not personalised for the individual (contrast with technique 2).
BCT-2	Provide information on consequences of behaviour to the individual	Information about the benefits and costs of action or inaction to the individual or tailored to a relevant group based on that individual's characteristics (i.e. demographics, clinical, behavioural or psychological information). This can include any costs/ benefits and not necessarily those related to health, e.g. feelings.
BCT-3	Provide information about others' approval	Involves information about what other people think about the target person's behaviour. It clarifies whether others will like, approve or disapprove of what the person is doing or will do. NB Check that any instance does not also involve techniques 1 (Provide information on consequences of behaviour in general) or 2 (Provide information on consequences of behaviour to the individual) or 4 (Provide normative information about others' behaviour).
BCT-4	Provide normative information about others' behaviour	Involves providing information about what other people are doing i.e., indicates that a particular behaviour or sequence of behaviours is common or uncommon amongst the population or amongst a specified group – presentation of case studies of a few others is not normative information. NB this concerns other people's actions and is distinct from the provision of information about others' approval (technique 3 [Provide information about others' approval]).
BCT-5	Goal setting (behaviour)	The person is encouraged to make a behavioural resolution (e.g. take more exercise next week). This is directed towards encouraging people to decide to change or maintain change. NB This is distinguished from technique 6 (Goal setting - outcome) and 7 (Action planning) as it does not involve planning exactly how the behaviour will be done and either when or where the behaviour or action sequence will be performed. Where the text only states that goal setting was used without specifying the detail of action planning involved then this would be an example of this technique (not technique 7 [Action planning]). If the text states that 'goal setting' was used if it is not clear from the report if the goal setting was related to behaviour or to other outcomes, technique 6 should be coded. This includes sub-goals or preparatory behaviours and/or specific contexts in which the behaviour will be performed. The behaviour in this technique will be directly related to or be a necessary condition for the target behaviour (e.g. shopping for healthy eating; buying equipment for physical activity). NB check if techniques applied to preparatory behaviours should also be coded as instances of technique 9 (Set graded tasks).
BCT-6	Goal setting (outcome)	The person is encouraged to set a general goal that can be achieved by behavioural means but is not defined in terms of behaviour (e.g. to reduce blood pressure or lose/maintain weight), as opposed to a goal based on changing behaviour as such. The goal may be an expected consequence of one or more behaviours, but is not a behaviour per se (see also techniques 5 [Goal setting - behaviour] and 7 [Action planning]). This technique may co-occur with technique 5 if goals for both behaviour and other outcomes are set.
BCT-7	Action planning	Involves detailed planning of what the person will do including, as a minimum, when, in which situation and/or where to act. "When" may describe frequency (such as how many times a day/week or duration (e.g., for how long)). The exact content of action plans may or may not be described, in this case code as this technique if it is stated that the behaviour is planned contingent to a specific situation or set of situations even if exact details are not present NB The terms "goal setting" or "action plan" are not enough to ensure inclusion of this technique unless it is clear that plans involve linking behavioural responses

		to specific situational cues, when only described as “goal setting” or “action plan” without the above detail it should be regarded as applications of technique 5 and 6.
BCT-8	Barrier identification/Problem solving	This presumes having formed an initial plan to change behaviour. The person is prompted to think about potential barriers and identify ways of overcoming them. Barriers may include competing goals in specified situations. This may be described as “problem solving”. If it is problem solving in relation to the performance of a behaviour, then it counts as an instance of this technique. Examples of barriers may include behavioural, cognitive, emotional, environmental, social and/ or physical barriers. NB Closely related to techniques 7 (Action planning) and 9 (Set graded task) but involves a focus on specific obstacles to performance. It contrasts with technique 35 (Relapse prevention/ Coping planning) which is about maintaining behaviour that has already been changed.
BCT-9	Set graded tasks	Breaking down the target behaviour into smaller easier to achieve tasks and enabling the person to build on small successes to achieve target behaviour. This may include increments towards a target behaviour, or incremental increases from baseline behaviour. NB The key difference to technique 7 (Action planning) lies in planning to perform a sequence of preparatory actions (e.g. remembering to take gym kit to work), task components or target behaviours which are in a logical sequence or increase in difficulty over time - as opposed to planning “if-then” contingencies when/where to perform behaviours. General references to increasing physical activity as intervention goal are not instances of this technique.
BCT-10	Prompt review of behavioural goals	Involves a review or analysis of the extent to which previously set behavioural goals (e.g. take more exercise next week) were achieved. In most cases this will follow previous goal setting (see technique 5, ‘goal setting-behaviour’) and an attempt to act on those goals, followed by a revision or readjustment of goals, and/ or means to attain them. NB Check if any instance also involves techniques 6 (goal setting - behaviour), 8 (Barrier identification/Problem solving), 9 (Set graded tasks) or 11 (Prompt review of outcome goals).
BCT-11	Prompt review of outcome goals	Involves a review or analysis of the extent to which previously set outcome goals (e.g. to reduce blood pressure or lose/maintain weight) were achieved. In most cases this will follow previous goal setting (see technique 6, goal setting-outcome’) and an attempt to act on those goals, followed by a revision of goals, and/ or means to attain them. NB Check that any instance does not also involve techniques 5 (goal setting - outcome), 8 (Barrier identification/Problem solving), 9 (Set graded tasks) or 10 (Prompt review of behavioural goals).
BCT-12	Prompt rewards contingent on effort or progress towards behaviour	Involves the person using praise or rewards for attempts at achieving a behavioural goal. This might include efforts made towards achieving the behaviour, or progress made in preparatory steps towards the behaviour, but not merely participation in intervention. This can include self-reward. NB This technique is not reinforcement for performing the target behaviour itself, which is an instance of technique 13 (Provide rewards contingent on successful behaviour).
BCT-13	Provide rewards contingent on successful behaviour	Reinforcing successful performance of the specific target behaviour. This can include praise and encouragement as well as material rewards but the reward/ incentive must be explicitly linked to the achievement of the specific target behaviour i.e. the person receives the reward if they perform the specified behaviour but not if they do not perform the behaviour. This can include self-reward. Provision of rewards for completing intervention components or materials are not instances of this technique. References to provision of incentives for being more physically active are not instances of this technique unless information about contingency to the performance of the target behaviour is provided. NB Check the distinction between this and techniques 7 (Action planning) and 17 (Prompt self-monitoring of behavioural outcome) and 19 (Provide feedback on performance).
BCT-14	Shaping	Contingent rewards are first provided for any approximation to the target behaviour e.g., for any increase in physical activity. Then, later, only a more demanding performance, e.g., brisk walking for 10 minutes on three days a

		week would be rewarded. Thus, this is graded use of contingent rewards over time.
BCT-15	Prompting generalization of a target behaviour	Once a behaviour is performed in a particular situation, the person is encouraged or helped to try it in another situation. The idea is to ensure that the behaviour is not tied to one situation but becomes a more integrated part of the person's life that can be performed at a variety of different times and in a variety of contexts.
BCT-16	Prompt self-monitoring of behaviour	The person is asked to keep a record of specified behaviour/s as a method for changing behaviour. This should be an explicitly stated intervention component, as opposed to occurring as part of completing measures for research purposes. This could e.g., take the form of a diary or completing a questionnaire about their behaviour, in terms of type, frequency, duration and/or intensity. Check the distinction between this and techniques 17 (Prompt self-monitoring of behavioural outcome).
BCT-17	Prompt self-monitoring of behavioural outcome	The person is asked to keep a record of specified measures expected to be influenced by the behaviour change, e.g. blood pressure, blood glucose, weight loss, physical fitness. NB It must be reported as part of the intervention, rather than only as an outcome measure. Check the distinction between this and techniques 16 (Prompt self-monitoring of behaviour).
BCT-18	Prompting focus on past success	Involves instructing the person to think about or list previous successes in performing the behaviour (or parts of it). NB This is not just encouragement but a clear focus on the person's past behaviour. It is also not feedback because it refers to behaviour preceded the intervention.
BCT-19	Provide feedback on performance	This involves providing the participant with data about their own recorded behaviour (e.g., following technique 16 [Prompt self-monitoring of behaviour]) or commenting on a person's behavioural performance (e.g., identifying a discrepancy with between behavioural performance and a set goal – see techniques 5 [Goal setting - behaviour] and 7 [Action planning] – or a discrepancy between one's own performance in relation to others' – note this could also involve technique 28 [Facilitate social comparison]).
BCT-20	Provide information on where and when to perform the behaviour	Involves telling the person about when and where they might be able to perform the behaviour this e.g. tips on places and times participants can access local exercise classes. This can be in either verbal or written form. NB Check whether there are also instances of technique 21 (Provide instruction on how to perform the behaviour).
BCT-21	Provide instruction on how to perform the behaviour	Involves telling the person how to perform a behaviour or preparatory behaviours, either verbally or in written form. Examples of instructions include; how to use gym equipment (without getting on and showing the participant), instruction on suitable clothing, and tips on how to take action Showing a person how to perform a behaviour without verbal instruction would be an instance of technique 22 only. NB Check whether there are also instances of techniques 5, 7, 8, 9, 22. Instructions to follow a specific diet or programme of exercise without instructions how to perform the behaviours are not included in this definition. Cooking and exercise classes as well as personal trainers and recipes should always be coded as this technique, but may also be coded as 22 (Model/ Demonstrate the behaviour).
BCT-22	Model/ Demonstrate the behaviour	Involves showing the person how to perform a behaviour e.g., through physical or visual demonstrations of behavioural performance, in person or remotely. NB This is distinct from just providing instruction (technique 21) because in "demonstration" the person is able to observe the behaviour being enacted. This technique and techniques 21 (Provide instruction on how to perform the behaviour) and may be used separately or together. Instructing parents or peers to perform the target behaviour is not an instance of this technique as fidelity would be uncertain.
BCT-23	Teach to use prompts/ cues	The person is taught to identify environmental prompts which can be used to remind them to perform the behaviour (or to perform an alternative, incompatible behaviour in the case of behaviours to be reduced). Cues could include times of day, particular contexts or technologies such as mobile phone alerts which prompt them to perform the target behaviour. NB This technique could be used independently or in conjunction with techniques 5 (goal setting -

		behaviour) and 7 (Action planning) (see also 24 [Environmental restructuring]).
BCT-24	Environmental restructuring	The person is prompted to alter the environment in ways so that it is more supportive of the target behaviour e.g. altering cues or reinforcers. For example they might be asked to lock up or throw away or their high calorie snacks, or take their running shoes to work. Interventions in which the interveners directly modify environmental variables (e.g. the way food is displayed in shops, provision of sports facilities) are not covered by this taxonomy and should be coded independently.
BCT-25	Agree behavioural contract	Must involve written agreement on the performance of an explicitly specified behaviour so that there is a written record of the person's resolution witnessed by another.
BCT-26	Prompt practice	Prompt the person to rehearse and repeat the behaviour or preparatory behaviours numerous times. Note this will also include parts of the behaviour e.g., refusal skills in relation to unhealthy snacks. This could be described as "building habits or routines" but is still practice so long as the person is prompted to try the behaviour (or parts of it) during the intervention or practice between intervention sessions, e.g. as "homework".
BCT-27	Use of follow up prompts	Intervention components are gradually reduced in intensity, duration and frequency over time, e.g. letters or telephone calls instead of face to face and/or provided at longer time intervals.
BCT-28	Facilitate social comparison	Involves explicitly drawing attention to others' performance to elicit comparisons. NB The fact the intervention takes place in a group setting, or have been placed in groups on the basis of shared characteristics, does not necessarily mean social comparison is actually taking place. Social support may also be encouraged in such settings and this would then involve technique 29 (Plan social support/ social change). Group classes may also involve instruction (technique 21 [Provide instruction on how to perform the behaviour]) demonstration (technique 22 [Model/ Demonstrate the behaviour]) and practice (technique 26 [Prompt practice]).
BCT-29	Plan social support/ social change	Involves prompting the person to plan how to elicit social support from other people to help him/ her achieve their target behaviour/ outcome. This will include support during interventions e.g., setting up a "buddy" system or other forms of support and following the intervention including support provided by the individuals delivering the intervention, partner, friends, family.
BCT-30	Prompt identification as role model/ position advocate	Involves focusing on how the person may be an example to others and affect their behaviour e.g., being a good example to children. Also includes providing opportunities for participants to persuade others of the importance of adopting/ changing the behaviour, for example, giving a talk or running a peer-led session.
BCT-31	Prompt anticipated regret	Involves inducing expectations of future regret about the performance or non-performance of a behaviour. This includes focusing on how the person will feel in the future and specifically whether they will feel regret or feel sorry that they did or did not take a different course of action. Do not also code instances of this technique as the more generic providing information on consequences (techniques 1 [Provide information on consequences of behaviour in general] and 2 [Provide information on consequences of behaviour to the individual]).
BCT-32	Fear Arousal	Involves presentation of risk and/or mortality information relevant to the behaviour as emotive images designed to evoke a fearful response (e.g. "smoking kills!" or images of the grim reaper). Do not also code instances of this technique as the more generic providing information on consequences (techniques 1 [Provide information on consequences of behaviour in general] and 2 [Provide information on consequences of behaviour to the individual]).
BCT-33	Prompt Self talk	Encourage the person to use talk to themselves (aloud or silently) before and during planned behaviours to encourage, support and maintain action.
BCT-34	Prompt use of imagery	Teach the person to imagine successfully performing the behaviour or to imagine finding it easy to perform the behaviour, including component or easy versions of the behaviour. Distinct from recalling instances of previous success without imagery (technique 18 [Prompting focus on past success])
BCT-35	Relapse prevention/	This relates to planning how to maintain behaviour that has been changed. The

	Coping planning	person is prompted to identify in advance situations in which the changed behaviour may not be maintained and develop strategies to avoid or manage those situations. Contrast with techniques 7 (Action planning) and 8 (Barrier identification/ Problem solving) which are about initiating behaviour change.
BCT-36	Stress management/Emotional control training	This is a set of specific techniques (e.g., progressive relaxation) which do not target the behaviour directly but seek to reduce anxiety and stress to facilitate the performance of the behaviour. It might also include techniques designed to reduce negative emotions or control mood or feelings that may interfere with performance of the behaviour, and/ or to increase positive emotions that might help with the performance of the behaviour. NB Check whether there are any instances of technique 8 (Barrier identification/ Problem solving), which includes identifying emotional barriers to performance, in contrast to the current technique, which addresses stress and emotions, whether they have been identified as barriers or not.
BCT-37	Motivational interviewing	This is a clinical method including a specific set of techniques involving prompting the person to engage in change talk in order to minimize resistance and resolve ambivalence to change (includes motivational counselling). NB Only rate this technique if explicitly referred to by name, not if one identifies specific elements of it, this may happen if you have prior experience with this technique.
BCT-38	Time management	This includes any technique designed to teach a person how to manage their time in order to make time for the behaviour. These techniques are not directed towards performance of target behaviour but rather seek to facilitate it by freeing up times when it could be performed. NB Only rate this technique if explicitly referred to by name, not if one identifies specific elements of it, this may happen if you have prior experience with this technique.
BCT-39	General communication skills training	This includes any technique directed at general communication skills but not directed towards a particular behaviour change. Often this may include role play and group work focusing on listening skills or assertive skills. NB Practicing a particular behaviour-specific interpersonal negotiation e.g., refusal skills in relation to cigarettes or alcohol would not be an instance of this technique.
BCT-40	Stimulate anticipation of future rewards	Create anticipation of future rewards without necessarily reinforcing behaviour throughout the active period of the intervention. Code this technique when participants are told at the onset that they will be rewarded based on behavioural achievement.

9 APPENDIX 3 – SELF-MANAGEMENT PROBLEMS AND PSYCHO-SOCIAL BARRIERS

Ultimate Goal	Optimalisation HbA1c (= lowering risk of complications) and DM-QOL										
	Insulin -/+				Carbohydrates -/+		Glucose monitoring -/+		Exercise -/+		Stress -
Problem area	Dose too low	Frequency too low	Dose too high	Frequency too high	Too little	Too much	Too little	Too much	Too little	Too much	(physical)stress too high
Psychological Barrier (specific)	Fear hypo's	Fear hypo's	Fear hypers	Fear hypers	Fear hypers	Fear hypo's		Fear hypo's/hypers	Fear hypo's	Fear hypers	
	Fear weight	Fear weight			Fear weight	Eating problem				Fear weight	
		Fear injections					Fear 'needles'				
		Negative affect (NA)			Negative affect (NA)	Negative affect (NA)	Negative affect (NA)		Negative affect (NA)		Negative affect (NA)
		Fear Disclosure					Fear Disclosure				
		<i>Forgetting</i>			<i>Forgetting</i>		<i>Forgetting</i>		<i>Forgetting</i>		
		Conflicting life goals			Conflicting life goals	Conflicting life goals	Conflicting life goals		Conflicting life goals		Conflicting life goals
(general)	DM self-efficacy DM health beliefs DM knowledge/literacy/problem solving skills Locus of control <i>Motivation</i>										
Socio-demographic barrier	Lack of social support Comorbidity DSM: Axis IV problems (financial, work, relationship, family issues)										

Table 3 - T1DM: Multiple scenarios optimalisation DM SM (general)

Notes:

- Fear of hypers = fear of complications
- Negative affect (other than fear -> sadness, anger, depression, 'trauma') = avoiding confrontation DM because of negative emotions triggered by DM self-care

- *Coping = emotional and behavioral coping and is DEALING with negative affect (dysfunctional behavioral coping, usually is avoidance)*
- *Excess use of alcohol/drugs/nicotine = either coping or comorbidity....*

Ultimate goal	Optimalisation HbA1c (= lowering risk of complications) and DM-QOL									
DM SM goal	Calories/Carbs/Fat -	Exercise +	Oral anti-diabetics +	Glucose monitoring -/+		Insulin -				Stress -
DM SM problem	Too many/much	Too little	Too little	Too little	Too much	Dose too little	Frequency too little	Dose too high	Frequency too high	Too much
Psychological Barrier (specific)	Fear of hypo's	Fear of hypo's	(Fear of hypo's)		Fear of hypo's / hyper's	Fear hypo's	Fear of hypo's	Fear of hypers	Fear of hypers	
	Eating problem					Fear of weight	Fear of weight			
				Fear 'needles'		Fear injections	Fear injections			
	Negative affect	Negative affect	Negative affect	Negative affect		Negative affect	Negative affect			Negative affect
			Fear disclosure	Fear disclosure		Fear disclosure	Fear disclosure			
		Forgetting	Forgetting	Forgetting			Forgetting			
	Conflicting life goals	Conflicting life goals	Conflicting life goals	Conflicting life goals		Conflicting life goals				Conflicting life goals
general	DM self-efficacy DM health beliefs DM knowledge/literacy/problem solving skills Locus of control <i>Motivation</i>									
Socio Demographic Barrier	Lack of social support Comorbidity DSM: Axis IV problems (financial, work, relationship, family issues)									

Table 4 - T2DM: Multiple scenarios optimalisation DM SM (**general**)

10 APPENDIX 4 – INTERVENTIONS FOR TOO LITTLE GLUCOSE MONITORING

The following table shows an example for “too little glucose monitoring” with some barrier und possible intervention.

Area	Problem Area	Cause/Barrier	Intervention type	Intervention
Glucose Monitoring	Too little	Negative affect-frustration over lack of success	Psycho-education is helpful, <u>normalizes</u> the anxiety, <u>acknowledges</u> negative emotions (and thereby <u>reducing self-blame</u>), and can provide with <u>basic/general behavioural tips</u> regarding behavioural activation Possible formats of psycho-education: -story telling (example/role model) -informational text -avatar explaining (audio/visual) -video (behavioural tips)	Patient is presented with information and normalizing stories about how other people's glucose levels vary. (normalizing): <i>"It's actually pretty common to have variation of blood glucose levels. Most patients experience this at some time in their life."</i>
				Patient is presented with information on how others also feel frustrated by lack of success. (normalizing) <i>"It can be difficult when you try your best to achieve something but you just don't feel like it's working out. Here are what some other people said about being frustrated about lack of success in controlling their blood glucose levels..."</i>
				Patient is presented with information about influence versus control of blood glucose. <i>"We like to think that we can have 100% control over what happens in our life, but sometimes that isn't completely true. Often we can only influence things to go the way that we want them too."</i>
				Patient is presented with information on importance of checking blood glucose even if the levels are frustrating: <i>"You may feel like you're not being successful in your diabetes self-management because your blood glucose levels are too high no matter what you do, but just the act of checking is an important step towards controlling your diabetes. Knowing your daily levels can help you or your healthcare providers adapt your diabetes care so that you are eventually successful."</i>
				Patient is presented on importance of checking blood glucose

				levels in general: <i>"Out of all the research done on diabetes care, one area always shows up as important for helping people in the long term: blood glucose monitoring. It doesn't matter what is found, too high, too low, or right on point, just checking has been found to help people control their diabetes more than anything else."</i>
				Focus on previous successes: <i>"It may not work out all the time, but if we look back at your history you were actually in the healthy range 75% of the time! Let's keep working together to try to make it even better."</i>
			Online Exercise/Assignment List (ticking boxes) Pop-up questions (short) Pictures/text to fill in	<i>"Frustrations are silly little creatures that only want to get in the way of your success. Picture your frustration as a creature in your mind and draw this on your phone or piece of paper. Then slowly draw features that make this creature silly. Don't let frustration get in the way of being the success that you are!"</i>
			Activation	Check blood glucose after exercising (prompting monitoring when glucose levels should be lower can promote successful feelings off of which to build further success)
				Power2DM provides with list of pleasurable activities. Let person choose 5-10 pleasurable activities that help to give positive energy. Do these activities need adjustment/to take into account DM SM ? Is DM hindering these activities? Can you plan to do one of these activities (almost) every day? With whom/where? How do/did you usually feel, while doing this?
			Generating social support	Online forums (give options for online forums for patient to connect to other patients through)
				Give scripted ideas for ways that patient can talk with loved ones about their feelings regarding blood glucose monitoring
Glucose Monitoring	Too little	Negative affect-patient is saddened when they think about having diabetes	Psycho-education is helpful, <u>normalizes</u> the anxiety, <u>acknowledges</u> negative emotions (and thereby <u>reducing self-blame</u>), and can provide with <u>basic/general behavioural tips</u> regarding behavioural activation Possible formats of psycho-education: -story telling (example/role model)	Patient is presented with information and normalizing stories about how other people have had negative feelings when thinking about having diabetes (normalizing): <i>"Feeling sad sometimes about diabetes is pretty common and is nothing to be ashamed about. Diabetes can be hard to manage, but just going to your doctor and using this app shows that you're motivated to get your diabetes under control. Here are some stories from other patients where they talk about difficulties they've had with</i>

			-informational text -avatar explaining (audio/visual) -video (behavioural tips)	<i>accepting their diabetes.”</i>
			Online Exercise/Assignment List (ticking boxes) negative Pop-up questions (short) Pictures/text to fill in List (ticking boxes) Instructions (creating flash cards) Picture/text List (dragging emotions/sensations) List (pleasurable activities tick boxes) Instructions on planning activities	Exercise with ‘traffic light’ metaphor. Green = ‘feeling happy/ok’, Orange = ‘negative change’, Red = ‘feeling bad/horrible’ Provide with list of negative emotions/sensations. Let person drag negative emotions/sensations to the color (green/orange/red) that applies to them. Making their own ‘warning signals’ traffic light. Next is combining list of pleasurable activities and ‘warning signals traffic light’: what do you do when you are aware of the warning signals? What happens if you would do the pleasurable activity? What would happen if you would just ignore them? Planning of activities for specific sensations/emotions
				<i>Motivational Interviewing with Value Compass exercise: Use Value Compass to identify what values are important to the patient? How can good self-management improve these areas?</i>
				<i>ABC Scheme exercise (Snoek et al. 2001): Explain how Activating events lead to negative Beliefs and how these beliefs have Consequences for the patient’s feelings, thoughts, and actions. Then prompt a thought exercise where the patient needs to discuss whether these thoughts were helpful or not, whether they help the patient reach their goals, and how they may be faulty.</i>
				Modifying negative cognitions: Power2DM provides with list of common negative cognitions (around DM SM). Let person choose 1-5 cognitions that he/she thinks apply to him/her. When do they feel this way? What do they do when feeling like this? Provide with list of positive cognitions (around DM SM). Let person choose 1-5 cognitions (or more) that apply to him/her. Activate these thoughts by using ‘flash cards’: when/where/how to use them
				<i>Mindfulness exercise: “Bad thoughts and feelings can</i>

				<i>sometimes make everything seem dark and like it's not going your way. The truth is that these bad thoughts and feelings are only coloring the world around you like dark sunglasses. Think about the last negative thought you had; maybe it was about your diabetes or, like 'I feel like an outsider because of my diabetes', or maybe it was more general. Now think about the impact that this thought had on your thoughts and feelings. Normal things that happened may have seemed bad because you were looking at them through these dark sunglasses. Now let's take these sunglasses off and look at them. Are they helping you in any way? Do you need them for anything? Are they actually hurting you? Did they make you feel bad about something that you shouldn't have felt bad about? Those sunglasses which you just took off, they aren't helping you and they're just sunglasses so let's put them away. The next time that you are feeling bad, check to see if you aren't wearing those sunglasses again. If you think that you may be, then take them off and see how the world can be brighter when you are seeing it clearly.</i>
			Activation	
			Generating social support	Online forums (give options for online forums for patient to connect to other patients through)
				Give scripted ideas for ways that patient can talk with loved ones about their feelings regarding blood glucose monitoring
			Generating professional support	Offer links to therapists professional help
				Offer to set reminder for next visit with doctor to discuss these problems
Glucose Monitoring	Too little	Fear of disclosure	Psycho-education is helpful, <u>normalizes</u> the anxiety, <u>acknowledges</u> negative emotions (and thereby <u>reducing self-blame</u>), and can provide with <u>basic/general behavioural tips</u> regarding behavioural activation Possible formats of psycho-education: -story telling (example/role model) -informational text -avatar explaining (audio/visual) -video (behavioural tips)	Patient is presented with information and normalizing stories about how other people have had negative feelings about disclosing their glucose monitoring to others (normalizing): "Some people with diabetes are worried that other people will judge them or think less of them if they knew what actually had to happen in their diabetes self-management. This couldn't be further from the truth. Those around you want to support you in your diabetes. Here are some stories from other patients who also felt nervous or scared about letting others know about their diabetes care."

				Offer tips on how to talk with others regarding diabetes: <i>“Some people don’t feel like they can talk to those close to them about their diabetes because they don’t know how. The first place to start is letting them know what diabetes is. Here is a short overview of diabetes that you can use to help start a conversation. Once you’ve gone through this list with your partner you can describe what you have to do for your diabetes each day.”</i>
			Online exercise	Exercise (mini-exposure): <i>Pretend that you were sitting across from someone you care about (write their name here). What would you like to tell them about your diabetes care? What do you think they would think about your diabetes care?</i> Follow-up: <i>Would you like us to send these notes to (person whose name was listed)?</i>
			Activation	Action plan: plan a specific time to sit down and discuss diabetes with partner
				Action plan: script a conversation with a person important to you to let them know about your diabetes
			Generating social support	Online forums (give options for online forums for patient to connect to other patients through)
				Give scripted ideas for ways that patient can talk with loved ones about their feelings regarding blood glucose monitoring