DAFNE*plus*: Glucollector Logic Model

Within the DAFNE*plus* intervention (Coates et al., 2021), the Glucollector component comprised an Accu-Chek Aviva Expert blood glucose meter linked via a router (Withcare+ box) to a web-based portal. It was designed to:

1. Create a convenient way of enabling monitoring, recording and reviewing of blood glucose, carbohydrate and insulin data.
2. Incentivise the collection of blood glucose, carbohydrate and insulin data to increase the quality of data available to participants and facilitators.
3. Provide visualisations of blood glucose, carbohydrate and insulin data in ways that support participants and facilitators to identify patterns and trends in data.
4. Support timely and effective communication between health professionals and participants about blood glucose, carbohydrate and insulin data.
5. Provide a source of reliable and valid information about aspects of type 1 diabetes and its management using Flexible Intensive Insulin Therapy (FIIT).

The Glucollector Logic Model **(Table 1)** describes the:

- features of Glucollector:
    - resources (objects or forms of technology),
    - functionality (a way that the platform processes information), or
    - content (information hosted or displayed on the platform).
- influencers on glycaemic management that each feature addresses.
- expected outputs (changes in capability, opportunity, motivation) that Glucollector is designed to bring about to improve engagement in the behaviours associated with optimal behavioural self-management using FIIT principles.

Table 2 summarises the Outputs column of the DAFNE*plus* Programme Theory. Outputs are the desired and hypothesised changes that the DAFNE*plus* intervention will bring about to deliver the programme's Outcomes (i.e., sustained enactment of behaviours involved in FIIT; see Hamilton et al (2021) for a description of the desired outcomes). Outputs are described using the COM-B model of behaviour, which outlines the necessary conditions for the performance of three behavioural cycles identified as leading to long-term maintenance of glycaemic outcomes and quality of life. These include:

- capability (the knowledge and skills to perform the behaviours),
- opportunity (the ways in which the physical and social environment enable performance of the behaviours) and,
- motivation (the learned and hardwired emotional, belief and attitudinal enablers of the behaviours).

Table 3 summarises the Influencers column of the DAFNE*plus* Programme Theory. Influencers are those features of the internal and external environment identified as contributing to the sustained enactment of FIIT principles. They may be specific behavioural patterns (e.g., overtreatment of hypoglycaemia), or influences on enactment of behaviours involved in FIIT (e.g. perception of burdens of FIIT behaviours).

Table 1: Glucollector Logic Model

Feature	Description	Influencer on Glycaemic Management Targeted	Type	Outputs delivered
Expert Meter	A blood glucose meter that records level of blood glucose, amount of insulin administered and carbohydrate intake. Linked to a Withcare+ box which syncs data to the Glucollector platform.	I2, I14	Resource	O5, M3
Withcare+ Box	An internet enabled router which syncs with the Expert meter to transmit data directly to the DAFNE*plus* website.	I2, I14	Resource	O5, M3
Glucollector Stars System	A virtual star chart to reward and reinforce behaviours associated with good quality data being uploaded to the Glucollector portal. Stars are awarded for checking blood glucose four times a day, logging carbohydrate three times a day, logging quick-acting insulin three times a day, logging basal insulin daily, and uploading data from the Expert meter at least once a week.	I2, I6, I12, I14	Functionality	C3, O5, M4
Glucollector Messaging System	A virtual messaging system in the Glucollector platform that allows DAFNE*plus* facilitators and participants to send messages to each other using asynchronous communication.	I8, I5	Functionality	O1
Blood Glucose Data Visualisation	Data visualisations created to give feedback on blood glucose readings to support interpretation and decision making about what self-management actions to take. All blood glucose readings are colour coded according to the level of action required. For instance, <3mmol/L is presented as red, indicating immediate action, whereas readings between 3.9 to 10.0 mmol/L that require no action are highlighted as green.	I2	Functionality	C3, O5, M1
Hypoglycaemia Management System	A visual display illustrating the consequences of administering hypoglycaemia treatment (15g carbohydrate) on blood glucose levels. Designed to provide feedback and reinforcement of successful management of hypoglycaemia and reduce over-treatment.	I2, I6	Content	C7

Feature	Description	Influencer on Glycaemic Management Targeted	Type	Outputs delivered
Time Blood Glucose in Target Range (Time in Range; TIR)	Time in Range (TIR) presents the percentage of time a participant's uploaded blood glucose reading were within their prescribed range. For example, a Time in Range of 70% indicates that 70% of uploaded readings are between 4 and 10 mmol/L. Participants can view TIR for a given week, month or quarterly (3 month) period.	I12, I14	Functionality	C3, M1, M2, M4
Time Blood Glucose Below Target Range (TBR)	Time Below Range (TBR) presents the percentage of time a participant's uploaded blood glucose readings were below their target range. For example, a TBR of 3% indicates that 3% of readings are below 3.9mmol/L. Participants can view TBR for a given week, month or quarterly (3 month) period.	I12, I14	Functionality	C3, M1, M2, M4,
Trends in Blood Glucose Patterns	Visual representation of whether a participant's consecutive uploaded blood glucose readings represented a trend towards increasing or decreasing blood glucose levels.	I2, I12	Functionality	C3,C5, C6, M1, M2, M4
Estimated A1c	An estimate of glycosylated haemoglobin based on a minimum of available blood glucose readings on the Glucollector platform.	I14, I15	Functionality	C3, M1, M2, M4
Amber Flag Alerts	A system of automated messages which alert the participant and DAFNE*plus* facilitator to problematic patterns of blood glucose data based on automated analysis of uploaded readings. Level One alerts are generated after a week of problematic readings. They go to the participant only, explain the issue detected and signpost to e-learning material relevant to the issue. Level Two alerts are generated after two weeks of problematic readings and are sent to participant and DAFNE*plus* facilitator, prompting the facilitator to contact the participant to offer support. Automated messages are also generated to prompt participants to upload blood glucose, insulin, and carbohydrate data if this has not been done recently.	I2, I14	Functionality	O1, O3, O5, M1
E-learning portal	Online reference material hosted on the DAFNE*plus* website. Topics include: pathophysiology of type 1 diabetes, carbohydrate counting and FIIT principles. Information can be accessed at any time to reinforce course content	I1, I2, I10	Content	C1, C2, 05

Table 2: Expected Outputs of DAFNE*plus,* i.e. Changes in Elements of Capability, Opportunity or Motivation to Enact Behaviours Associated with Flexible Intensive Insulin Therapy

Output Identifier	Output (Changes in Elements of Capability, Opportunity or Motivation to Enact Behaviours Associated with Flexible Intensive Insulin Therapy)
C1_HealthLit	Increased knowledge of type 1 diabetes
C2_SkillFIIT	Increased knowledge of Flexible Intensive Insulin Therapy (FIIT)
C3_ForgetTarget	Increased skills in applying FIIT
C4_SkillCBSM	Increased knowledge and skills in applying principles of cognitive and behavioural self-management skills for type 1 diabetes
C5_SkillCong	Increased ability to achieve congruence between FIIT principles and life demands
C6_AttHyper	Reduction in over-reliance on corrective insulin dosing to manage hyperglycaemia
C7_AttHypo	Reduction in over-treatment of hyperglycaemia using carbohydrate
O1_TimeHCP	Increased access to timely and appropriate health professional support over a year
O2_PracEmSupp	Increased access to practical and emotional non-professional social support for self-management
O3_HCPAuton	Exposure to health professional interactions that support autonomy in self-management and avoid stigma
O4_T1DModel	Exposure to other models of people with type 1 diabetes learning how to implement FIIT and self-management strategies
O5_TechAccess	Access to technology that supports capability and motivation to enact FIIT and other diabetes self-management strategies
M1_ConfAdjust	Increases in confidence to independently adjust insulin and ratios to accommodate changes in the condition, life events and transitions
M2_ValueFIIT	Increased perception of the value of enacting FIIT principles
M3_Burden	Reduction in perception of burdens associated with enacting FIIT principles and other diabetes self-management behaviours
M4_EmpwrFIIT	Increases in feelings of success and empowerment in relation to enacting FIIT principles
M5_RegNegEmo	Reduction in emotional states associated with enacting FIIT principles
M6_Hope	Reduced feelings of hopelessness and increased optimism about positive long-term health consequences of type 1 diabetes
M7_SelfCompass	Increases in self-compassion in situations where self-management feels difficult or does not result in expected outcomes
M8_Think	Decrease in thinking patterns associated with procrastination or avoidance in relation to self-management behaviours (e.g. perfectionism, all-or-nothing, catastrophising)

Att=Attitudes, Know=Knowledge, Intent=Intention, Norm=Normative Behaviours, Skill=Behavioural Skills

Table 3: Behavioural Influencers

Behavioural Influencer	Influencer
I1_HealthLit	Low health literacy
I2_SkillFIIT	Lack of knowledge and skills to enact Flexible Insulin Intensive Therapy (FIIT)
I3_ForgetTarget	Forgetting blood glucose targets
I4_AdjTarget	Intentional upward adjustment of blood glucose targets
I5_AdaptFIIT	Inability to adapt FIIT principles in response to life events or transitions
I6_OverTxHypo	Over-treatment of hypoglycaemia using carbohydrate
I7_ShortInsHyper	Over-reliance on short acting insulin doses to manage hyperglycaemia
I8_AccHcpFIIT	Lack of access to Health Professionals trained in FIIT principles
I9_NonAutonHCP	Health Professional interactions that do not support autonomous motivation
I10_LackInfoFIIT	Lack of access to reliable information about type 1 diabetes and its management using FIIT principles
I11_LackSupport	Lack of support from friends and family on diabetes-related issues
I12_LowConfFIIT	Low confidence in decision making about use of FIIT principles
I13_ProcAvoid	Thinking patterns associated with procrastination or avoidance in relation to self-management
I14_EffortReward	Low effort/reward trade-off for engaging in FIIT
I15_Hopelessness	Hopelessness about long-term consequences of type 1 diabetes
I16_LackSelfCompass	Lack of self-compassion in situations where self-management feels difficult or does not result in expected outcomes
I17_HighBurden	Perceived burden associated with enacting FIIT principles and other diabetes self-management behaviours
I18_NegEmoState	Negative emotional states associated with enacting FIIT principles

References

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