How state of the art technology can help people maintain weight loss

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BUT >60% of the adult population are already collectively overweight or obese

Projected health care costs are unsustainable

No one organisation, approach or sector can solve the obesity problem.

Evidence-based interventions and commercial programmes for weight loss are widely available and effective in the short-term.

~40% of adults report at least one weight loss attempt in the last 12 months- 80% re-gain their lost weight.

Obesity is a chronic relapsing condition- no simple cure: management, disease prevention.

Physiological and psychological predictors/correlates of weight loss, maintenance or relapse
Weight loss is a predictor of weight regain

No simple cure: prevention and management.

Physiological responses to weight loss can affect energy balance behaviours

Negative Energy balance

Weight loss

Body composition

Fat mass

Fat free mass

Physiology

Circulating appetite signals

Food-based reward systems

Reduced BMR, thermogenesis

Efficiency and level of activity

Behaviour

Increased food intake

Decreased physical activity and energy expenditure

Physiological responses to weight loss define the the behavioural challenge for weight loss maintenance.

**Weight loss**
- Intake < expenditure
- Hunger
- Satiety
- Preference for palatable foods

**Weight loss maintenance**
- Intake = expenditure
- Reduced EE
- Motivation
- Cognitive control (self-regulation)
- Pharmacotherapy

**Weight regain**
- Intake > expenditure
- Metabolic mass
- Metabolic efficiency
- Thermic effect of food
- Volitional physical activity

Difficult reducing EI

Long-term reduction of EI

Long-term engagement in high levels of physical activity

Can we design digital behaviour change interventions that overcome physiological resistance to weight loss?
Numerous weight-loss apps available to citizens.

The 30 commonly available weight loss mobile apps only use a minority of the 20 behavioural strategies shown to be effective in evidence-based interventions.

Behavioural strategies that help *improve motivation, reduce stress and improve problem solving* were generally missing from such apps (Pagoto S *et al.* 2013).

Of 204 smartphone apps coded for adherence to 13 evidence-informed practices for weight control - only 15% had ≥5 of those 13 practices (Breton ER *et al.* 2011).

Most weight management apps miss key evidence-based approaches for longer-term behaviour change.

**Broken Market:** most popular digital approaches to weight management are not evidence based
Prospective behavioural and psychological predictors of longer-term weight loss

<table>
<thead>
<tr>
<th>Psychosocial Factors</th>
<th>Relationship to longer-term weight loss</th>
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<tr>
<td>Self-regulation of eating/activity</td>
<td>+</td>
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<tr>
<td>Exercise self-efficacy</td>
<td>+</td>
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<tr>
<td>Autonomous motivation</td>
<td>+</td>
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<tr>
<td>Perceived stress</td>
<td>-</td>
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<td>Decreased health-related QOL</td>
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<tr>
<td>Depression</td>
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<td>Hunger</td>
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<td>Disinhibition</td>
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Developing evidence-based behavioural strategies for weight loss maintenance in the general population: The NohoW project

• 5 year, €5 million EC-funded project.
• Evidence-based, digital behaviour change tools for weight loss maintenance.
Using digital solutions to navigate to a healthier weight

- Weight loss programmes
  - Decreased motivation, physical and emotional well-being
  - Obesogenic environment
  - Initial weight loss
  - Hostile environment, frustration, sporadic adherence to behaviours/ high risk situations
  - Behavioural lapses
  - Relapse and weight regain
  - Discontinued behaviours

- Adaptive behaviour change
  - Weight loss programmes
  - Well-being and weight maintenance
  - Self regulation
  - Emotion regulation
  - Generic content
  - Self regulation and emotion
  - Individual feedback, stress management, coping
  - Supportive environment, personalised navigation tools
  - Initial weight loss
  - Relapse prevention
  - Adaptive behaviour change
Digital toolkit for weight maintenance

Data Hub

- Individualised prediction
- RCT evaluation

WLM business model and developing ecosystem

Co-designed

Evidence-based

Personalised

Self regulation
Emotion regulation
Self regulation and emotion
Generic content

Self regulation
Emotion regulation

quantified

validated

commercialised
Personalisation

Profiling

Choice
Tracking technologies
**Trial design**

**CID = Clinical investigation day**

- **CID 1**
- **CID 2**
- **CID 3**
- **CID 4**

**Screening**
- **Active intervention**
- **Follow-up**

- **0 months**
- **6 months**
- **12 months**
- **18 months**

**Baseline**

**Primary outcomes**

- **3 European countries (UK, DK, Pt)**
- **1600 participants: BMI >25 and lost ≥5% in last 12 months**

**2 x 2 RCT**

- **Yes**
  - Self weighing
  - Self-regulation/Motivation
  - Emotion/stress regulation

- **No**
  - Self weighing
  - Emotion/stress regulation
  - Baseline

**CID 1**

**CID 2**

**CID 3**

**CID 4**

**Baseline**

**Primary outcomes**

**3 European countries (UK, DK, Pt)**

**1600 participants: BMI >25 and lost ≥5% in last 12 months**
Digital measures and outcomes

- **Screening.**
- **Baseline profiling** - moderators.
- **Primary outcomes** - weight.
- **Secondary outcomes** - health markers, psychological mediators of diet/activity, stress and emotion. Moderators of intervention effects.
- **Process evaluation** - intervention reach, dose, fidelity.
- **Wireless tracking** - weight, patterns, intensity of activity and sleep.
- **Dietary behaviors** - profile of food, energy and nutrient intake.
Digital architecture

Trial management software

Meta-data

Data Hub

Trial Administration portal

API calls to Qualtrics

Eligibility Screening (Qualtrics)

Psychological Questionnaires (Qualtrics)

Biomarkers, Body composition

API calls to Fitbit

Digital dietary records

Activity monitors

Scales

Self regulation

Emotion regulation

Self regulation and emotion

Generic content
Psychological and behavioural predictors of WLM in NoHoW

Moderators
- Weight loss practices, history, demographics, health behaviours.
- Self determination traits, relapse prevention skills.
- Responsivity to hunger satiety cues.

Mediators
- Action planning, control goals, Autonomy, motivation.
- Behavioural regulation of eating.
- Stress management, Emotion regulation, Acceptance & commitment.
- Self-evaluation, Adherence.

Dietary intake
- Control and loss of control of eating.
- Hunger, restraint, disinhibition, binge eating.

Costs/rewards of engagement

Patterns and intensity of activity
- Sleep.
- Sedentary activities.
- Activity choice.

Weight loss Intake < expenditure

Weight regain Intake > expenditure

Weight loss maintenance Intake = expenditure

Long-term engagement in
High levels of physical activity.

Difficulty reducing EI

Reduced EI
Weight loss induces physiological and behavioural changes that predispose us to weight regain.

WLM interventions need to facilitate adjustment of individual energy balance behaviours to navigate around physiological resistance to weight loss.

Digital technologies: routes to personalised navigation of energy balance behaviours.


Behavioural energy balance: personalized solutions to long-term weight management through advanced tracking of EB behaviours and psychometric markers of likely change in such behaviours.
# Acknowledgements

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