ProACT: Interventional Strategies to Support Individuals Self-Managing Multiple Chronic Health Conditions Using a Digital Behavioural Change Intervention (DBCI).

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Acknowledgements

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$\textbf{Age} = \textbf{Risk of Multimorbidity}$

- Reduce QoL + functional decline
- More likely to die prematurely and be admitted to hospital, and have longer hospital stays.
- Correlated with socioeconomic deprivation
- 50m patients in EU – €700b cost per annum

Rijken et al. (2013) - Eurohealth Incorporating Euro Observer

- US by 2030 171 million people with chronic disease – 50% with Multimorbidity. 65% of Medicare beneficiaries have multimorbidity

Wolff JL et al. (2002) - Arch Intern Med
We do not deal with Multimorbidity

Empower the PwM and their care network to play an active role in managing multimorbidity

**Inefficient** Different clinicians, conflicting advice

**Inconvenient** Hospital appointments on many different days

**Repetitive** Multiple appointments; Repeating medical history

**Burdensome** Hospital appointments on many different days

**Confusing** Hospital appointments on many different days

**Potentially Unsafe** Medication interactions and negative polypharmacy
**AIMS:**

1- Challenge the EU focus on supporting a single disease framework of care to create a patient centric integrated care (IC) ecosystem to understand and manage multimorbidity.

2 - ProACT aims to develop and evaluate a cloud based open API to integrate a variety of new and existing technologies to advance ‘home based’ integrated care (IC) for multimorbidity self-management.

Key emerging trends to be incorporated into the ProACT integrated care include; the consumerism of healthcare, the use of big data, developing patient centric ICT-AT approaches and open innovation models.
Project Outline (2016-2019)

- Phase 1: User Needs Research and Scoping *(M1-9 complete)*
- Phase 2: System Design, Development and Testing *(M9 – M40)*
- Phase 3: Pilot Trials and further co-design and development *(M14 to M26)*

- Phase 4: Main Proof of Concept Trial *(2018: M26/27 to M37/38)*
  - Ireland: 60 PwM and support actors
  - Belgium: 60 PwM and support actors
  - Conditions: Diabetes, COPD, CHF/CHD (associated conditions e.g. Hypertension)
  - Longitudinal Action Research Design (12 months)

- Phase 5: Transfer Feasibility Study *(2018: M30 to M36)*
  - Italy: 15 PwM and support actors
Meet Sarah

Sarah is 85

**Conditions:** Diabetes and Heart Failure

Everyday for the last 5 years she has measured her:
- Weight
- Blood Pressure
- Blood sugar

She writes readings in notebooks and brings them with her to her GP and specialist clinics that she attends for her conditions.

Sarah is finding it hard to remember when to take measurements and to write down the different readings into separate notebooks every day.
How Can ProACT Help Sarah

Monitoring Symptoms

• Sarah’s GP recommended that she try a new technology to help her monitor her symptoms automatically
• ProACT also help Sarah to keep track of other important parameters such as sleep, activity, mood and breathlessness.

Viewing Symptoms

• Her new devices now send her readings automatically to a tablet where she can view her symptoms over the last day, week or month
Knowledge and Education:

- The system also provides Sarah with tips that might be useful for her to manage her conditions and stay as healthy as possible.

- ProACT gives Sarah trustworthy and clear information on managing diabetes and heart failure but also on general topics such as exercise and how to get off the floor safely after a fall.

Health and Care Network:

- Person driven modular ability to personalise care network

- Sarah’s daughter Mary can view the health readings that she chooses to share with her from her phone.
Developing Interventional Strategies

Psychology/Behavioural Science

Co-Design and Development

Systematic Incorporation of BC methods

User Evaluation

Human Computer Interaction

User Needs and Requirements
User Requirements

• Qualitative study
• Interviews and focus groups – semi-structured; 45-120 minutes
• Demographic questionnaires (PwM and informal carer)
• 124 participants across Ireland and Belgium
• Thematic analysis
• Diabetes + CHF/CHD most prevalent
• 57% women
• 21% MCI

<table>
<thead>
<tr>
<th>Role/Services</th>
<th>Ireland</th>
<th>Belgium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person with Multimorbidity</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>Informal carer</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Formal carer</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>GP</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Community based healthcare</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public health nurse; care coordinator</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Hospital based clinician</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geriatrician; Clinical Nurse Specialists; Physio; Occupational Therapist; Dietician; Speech and Language Therapist; Cardiologist; Endocrinologist</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>Formal care provider</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Pharmacist</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>124</strong></td>
<td></td>
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</table>
47 key requirements across a number of categories to help inform the interventional strategies:

1. Reducing impact of multimorbidity (3)
2. Self-management of multimorbidity (14)
3. Medication management (7)
4. Information, knowledge and education (7)
5. Sources of support (3)
6. Communication (2)
7. Technology use (11)

We employed traditional user-centred HCI techniques to help to translate this qualitative data into meaningful requirements for design:
Designing ProACT as a BC intervention

• **What is the aim of the system?**

To improve self management skills and support for PwMs using a digital rather than paper based system

• **What is the behaviour that needs to change to do this?**

PwM - needs to change their behaviour from managing their conditions using memory and paper based strategies to a digital self management tool

• **Systematic approach to address this?**

The Behavioural Change Wheel approach involves an 8-stage process for developing behavioural change diagnoses and targeted interventional strategies.

- Synthesis of 19 frameworks to classify interventions (health, environment, culture change and social marketing)
- **Centre**: COM-B model
- **Inner ring**: Nine intervention functions (what purpose(s) we the intervention serves)
- **Outer ring**: Seven policy categories

(Michie, Atkins and West, 2014)
Why apply the BCW model?

• Enabled us to design ProACT technology as a behaviour change intervention

• Understanding target behaviours within the framework of COM-B provides the first steps in selecting appropriate intervention strategies to bring about the desired change.

• Process allowed us to provide a framework for evaluation

• Behaviour change interventions may fail because the wrong assumptions have been made about what needs to change (Michie, Atkins and West, 2014).
<table>
<thead>
<tr>
<th>COM-B model component (Michie et al., 2014)</th>
<th>ProACT Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical Capability</strong></td>
<td>Have the skill to be able to use the technology (e.g. ability to use an iPad and a BP monitor)</td>
</tr>
<tr>
<td><strong>Psychological Capability</strong></td>
<td>Be able to understand the impact symptom monitoring, knowledge of conditions and recording information could have on self management</td>
</tr>
<tr>
<td><strong>Reflective Motivation</strong></td>
<td>Hold the belief that ProACT will help with management of conditions</td>
</tr>
<tr>
<td><strong>Automatic Motivation</strong></td>
<td>Have established routines and habits for self managing conditions</td>
</tr>
<tr>
<td><strong>Physical Opportunity</strong></td>
<td>Have an Internet connection to be able to use ProACT</td>
</tr>
<tr>
<td><strong>Social Opportunity</strong></td>
<td>Availability of support and recommendations from wider care and health network to use ProACT</td>
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 Behaviour Change Targets

1. Measure and view key symptoms on regular basis using the ProACT system (PwM): This target is designed to evaluate if participants adopted the system into their self management routine.

2. Recognise and record changes in symptoms from baseline readings (PwM): This target is designed to evaluate whether PwMs engaged with their key symptoms over time in order to enhance self management skills for multiple conditions.

3. Confirm viewing of key symptom readings on ProACT (care network participants i.e. informal carer or HCP): This target is designed to evaluate if key support actors have viewed symptom readings for the person that they are caring for.
## Target 1: Measure and view key symptom readings on ProACT (Person with Multimorbidity)

<table>
<thead>
<tr>
<th>Intervention functions</th>
<th>COM-B components served by intervention functions</th>
<th>BCTs to deliver intervention functions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Education</strong></td>
<td>Psychological capability</td>
<td>5.1 Information about health consequences</td>
</tr>
<tr>
<td></td>
<td>Reflective motivation</td>
<td>1.2 Feedback on behaviour</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.7 Feedback on outcome(s) of the behaviour</td>
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<tr>
<td></td>
<td></td>
<td>7.1 Prompts/cues</td>
</tr>
<tr>
<td><strong>Training</strong></td>
<td>Psychological capability</td>
<td>4.1 Instruction on how to perform a behaviour.</td>
</tr>
<tr>
<td></td>
<td>Automatic Motivation</td>
<td>6.1 Demonstration of the behaviour</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8.3 Habit Formation.</td>
</tr>
<tr>
<td><strong>Environmental</strong></td>
<td>Physical opportunity</td>
<td>12.5 Adding objects to the environment</td>
</tr>
<tr>
<td><strong>Restructuring</strong></td>
<td></td>
<td>12.1 Restructuring the physical environment.</td>
</tr>
<tr>
<td><strong>Persuasion</strong></td>
<td>Reflective motivation</td>
<td>9.1 Credible source</td>
</tr>
<tr>
<td><strong>Enablement</strong></td>
<td>Social opportunity</td>
<td><strong>3.1 Social support</strong></td>
</tr>
<tr>
<td><strong>Incentivisation</strong></td>
<td>Reflective motivation</td>
<td><strong>10.4 Social reward</strong></td>
</tr>
</tbody>
</table>
**BCW: Informed the UI Design**

- Through the process of creating intervention strategies for each of the targets, we have translated intervention functions into additional application features.

- It has also helped us to understand the importance of features within the system that we may not have otherwise focused on (such as habit formation, social support etc.)

- Understand and pin-point BC functions and techniques in the system and helping us to define how to evaluate them and the system as a DBCI
BCW: Implications for Analytics

• BCW has highlighted the importance of *User Engagement metrics and analytics* to help us to evaluate ProACT as a BC intervention.

• The BCW has highlighted the need for the *personalisation* of behaviour change techniques and interventions which we have considered in the design of our CareAnalytics (PROACT Artificial Intelligence - IBM).

1. Data cleaner
2. Probabilistic Health and Wellness Profile Builder
3. Goal Recommender
4. Education Recommender
5. User Engagement Analyser
GOAL SETTING

• Presents particular challenges and complexities for multimorbidity. Due to link with age additional conditions impact on ability to achieve goals.

• S.M.A.R.T goals (Doran, 1981) were not common practice for PwM or care network. Goals were general and not measurable.

• Issue: Lack of awareness around types of realistic goals to set, lack of support from care network (time, not wanting to overload PwM, sense PwM should self direct, care network insufficient data to inform goals). Peer rather than clinical support a key motivator.
1. Present PwM Goal Suggestions **taking into account their complete profile** and health and well-being status

2. Education to understanding **how to set realistic goals themselves** based on data feedback

3. System to support **true collaborative goal settings**, initiated by PwM

4. System can **support single disease if necessary** when acute difficulty with one condition is identified.

5. **Flexibility of goal revision** - to account for bad and good health days
Evaluating ProACT as a BC Intervention

Each of the BC targets will be evaluated by:

• **Analysing system usage statistics** – how participants engage with specific features of the system i.e. measuring symptoms, recognising change, view education content

• **Quantitative trial assessment data (assessment measures)**

• **Qualitative interview data** – Thematic Analysis - Understand experiences

23 key metrics including: Session length, dashboard time, reflection screen time, view readings time, view reading screen responses health tips time, my info time, button presses on each screen, daily app opens etc.

19 Assessments including: Usability (T2;T3;T4), Burden (T2;T3;T4), technology proficiency (T1;T4), social connectedness (T1, T4), QoL (T1-T4), self efficacy (T1-T4, illness perceptions (T1-4), self-management (T1-T4), Demo (T1), med lists (T1;T4)

Interview schedules, reflect key assessment areas above.
Conclusions

• Digital health **holds promise** but designing and delivering DBCI’s is **challenging**

• Key to our success is to design interventions based on a **strong theoretical foundation**

• **The BCW provides** a solid, systematic and theoretical framework in which to inform the design of complex intervention for multimorbidity management

• **Technology advances rapidly** - Agile, iterative methodologies are needed to develop strong PoC’s before larger studies

• **Multimorbidity/Comorbidity** – May unlock how we can manage diseases on a single platform
Thank You!

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