Implementation and the Science of Behaviour Change

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Gaps in translation

- **Basic science to promising application**
  - “can it work?”: efficacy
  - 1st gap

- **Promising to clinical application**
  - “does it work in practice?”: effectiveness
  - 2nd gap

- **Research trials to clinical practice**
  - “is it routinely delivered?”: implementation
  - 3rd gap

- **Patient/public engagement**
  - “does it work in practice?”: uptake
  - 4th gap
Research trials to clinical practice

- Quality improvement
- Implementation of evidence-based healthcare recommendations
- Knowledge translation

... All depend on people changing their **behaviour**
- Health professionals, managers, ancillary staff
Health psychology

• Applies the **science of behaviour** to health
  – Prevention of illness and promotion of health and well-being
    • Adherence to medication/health advice; “lifestyle” behaviours
  – Coping with illness
    • As above plus self-management of symptoms
  – Health care delivery/uptake
    • Evidence-based practice; patient engagement
Closing the Implementation Gap

1. Start with understanding the target behaviour in context to establish the nature of the problem
2. Consider the range of possible evidence-based interventions and policies
3. Generate and improve evidence about
   - “what works”
     • specify content
   - “how intervention works”
     • specify theoretical mechanism of action
1. Understand the nature of the target behaviour

- Unless we understand the nature of the behaviours that need to change, unlikely our interventions will be maximally effective
- Start with a model (or theory) of behaviour
1. Understand the target behaviour in context

- Identify key specific behaviours (often several)
  - Who needs to do what differently, when, where, how?
- Why are behaviours as they are?
  - Initiating and maintaining factors
    - E.g. individual motivation, habit, social environment, systems and procedures, physical environment, skills
- What needs to change for the desired behaviour/s to occur?
The COM-B system: Behaviour occurs as an interaction between three necessary conditions...

- **Capability**: Psychological or physical ability to enact the behaviour
- **Motivation**: Reflective and automatic mechanisms that activate or inhibit behaviour
- **Opportunity**: Physical and social environment that enables the behaviour
Motivation: reflective and automatic

Beliefs about what is good and bad, conscious intentions and decisions as per e.g. Theory of Planned Behaviour

Emotional responses, desires and habits resulting from associative learning and physiological states

Reflective-Impulsive Model, Strack & Deutsch, 2004
PRIME Theory of Motivation, West, 2006
2. Consider the range of possible evidence-based interventions and policies

- Starting point is COM-B
- What intervention functions likely to be effective?
- Need a framework for designing interventions with the following criteria:
  1. Comprehensive coverage
  2. Coherence
  3. Clear link to a model of behaviour

Usable by, and useful to, researchers, policy makers, service planners, intervention designers...
Do we have such a framework?

- Systematic literature review identified 19 existing frameworks
  - none met all these criteria
- Development of new framework
  - Model of behaviour at the hub of a wheel
  - Synthesis of existing frameworkS
    - 9 intervention functions
    - 7 policy categories
      - that could enable or support these interventions to occur

Results

- The Behaviour Change Wheel – A system for choosing interventions and policies

Sources of behaviour

Behaviour at the hub .... COM-B
Behaviour at the hub .... COM-B

- Sources of behaviour
- Intervention functions
- Policy categories
Interventions:
activities designed to change behaviours
Policies: decisions made by authorities concerning interventions
## Intervention functions

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>Increasing knowledge or understanding</td>
</tr>
<tr>
<td>Persuasion</td>
<td>Using communication to induce positive or negative feelings or stimulate action</td>
</tr>
<tr>
<td>Incentivisation</td>
<td>Creating expectation of reward</td>
</tr>
<tr>
<td>Coercion</td>
<td>Creating expectation of punishment or cost</td>
</tr>
<tr>
<td>Training</td>
<td>Imparting skills</td>
</tr>
<tr>
<td>Restriction</td>
<td>Using rules to reduce the opportunity to engage in the target behaviour</td>
</tr>
<tr>
<td>Environmental restructuring</td>
<td>Changing the physical or social environmental promoters or barriers</td>
</tr>
<tr>
<td>Modelling</td>
<td>Providing an example for people to aspire to or imitate</td>
</tr>
<tr>
<td>Enablement</td>
<td>Increasing means/reducing barriers to increase capability beyond education and training</td>
</tr>
<tr>
<td>Policy categories</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Communication/ marketing</td>
<td>Using print, electronic, telephonic or broadcast media</td>
</tr>
<tr>
<td>Guidelines</td>
<td>Creating documents that recommend or mandate practice</td>
</tr>
<tr>
<td>Fiscal</td>
<td>Using the tax system</td>
</tr>
<tr>
<td>Regulation</td>
<td>Establishing rules or principles of behaviour or practice</td>
</tr>
<tr>
<td>Legislation</td>
<td>Making or changing laws</td>
</tr>
<tr>
<td>Environmental/ social planning</td>
<td>Designing and/or controlling the physical or social environment</td>
</tr>
<tr>
<td>Service provision</td>
<td>Delivering a service</td>
</tr>
</tbody>
</table>
Closing the Implementation Gap

1. Start with understanding the target behaviour in context to establish the nature of the problem

2. Consider the range of possible evidence-based interventions and policies

3. Generate and improve evidence about
   - “what works”
     • specify content
   - “how intervention works”
     • specify theoretical mechanism of action
Specifying interventions more precisely

- Interventions often “complex”
  - several, potentially interacting, techniques
- Poorly described
  - Interventions often described vaguely e.g. “behavioural counselling”
  - Where protocols with more detail are available, terminology is variable
- Impedes replication, implementation, evidence synthesis
Guidelines for specifying interventions

- CONSORT guidelines for reporting RCTs
  - Evaluators should report “precise details of interventions [as] actually administered”  
    Moher et al, 2001

- Which precise details?
  - the content or elements of the intervention
  - characteristics of those delivering the intervention
  - characteristics of the recipients,
  - characteristics of the setting (e.g., worksite)
  - the mode of delivery (e.g., face-to-face)
  - the intensity (e.g., contact time)
  - the duration (e.g., number sessions over a given period)
  - adherence to delivery protocols

Example of the problem: Descriptions of “behavioural counselling” in two interventions

<table>
<thead>
<tr>
<th>Title of journal article</th>
<th>Description of “behavioural counseling”</th>
</tr>
</thead>
<tbody>
<tr>
<td>The impact of <em>behavioral counseling</em> on stage of change fat intake, physical activity, and cigarette smoking in adults at increased risk of coronary heart disease</td>
<td>“educating patients about the benefits of lifestyle change, encouraging them, and suggesting what changes could be made” (Steptoe et al. AJPH 2001)</td>
</tr>
<tr>
<td>Effects of internet <em>behavioral counseling</em> on weight loss in adults at risk for Type 2 diabetes</td>
<td>“feedback on self-monitoring record, reinforcement, recommendations for change, answers to questions, and general support” (Tate et al. JAMA 2003)</td>
</tr>
</tbody>
</table>
Biomedicine vs behavioural science … example of smoking cessation effectiveness

Varenicline  *JAMA, 2006*

- **Intervention content**
  - Review smoking history & motivation to quit
  - Help identify high risk situations
  - Generate problem-solving strategies
  - Non-specific support & encouragement

- **Mechanism of action**
  - Activity at a subtype of the nicotinic receptor where its binding produces agonistic activity, while simultaneously preventing binding to a4b2 receptors

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Behavioural counselling  *Cochrane, 2005*

- **Intervention content**
  - None mentioned

- **Mechanism of action**
  - None mentioned
To describe content ....

- Need a reliable method
  - distinct BCTs
  - standardised and precise language

- Taxonomies of BCTs
  - “Active ingredients” within the intervention designed to change behaviour. They are observable, replicable and irreducible components of an intervention. Can be used alone or in combination with other BCTs.
Example: reliable taxonomy of BCTs to change physical activity and healthy eating behaviours

1. General information
2. Information on consequences
3. Information about approval
4. Prompt intention formation
5. Specific goal setting
6. Graded tasks
7. Barrier identification
8. Behavioral contract
9. Review goals
10. Provide instruction
11. Model/ demonstrate
12. Prompt practice
13. Prompt monitoring
14. Provide feedback
15. Social comparison
16. Social support/ change
17. Role model
18. Prompt self talk
19. Relapse prevention

Involves detailed planning of what the person will do including, at least, a very specific definition of the behaviour e.g., frequency (such as how many times a day/week), intensity (e.g., speed) or duration (e.g., for how long for). In addition, at least one of the following contexts i.e., where, when, how or with whom must be specified. This could include identification of sub-goals or preparatory behaviours and/or specific contexts in which the behaviour will be performed.

The person is asked to keep a record of specified behaviour/s. This could e.g. take the form of a diary or completing a questionnaire about their behaviour.

Further development

• Smoking cessation: 71 BCTs

• Physical activity & healthy eating: 40 BCTs

• Reducing excessive alcohol use: 42 BCTs
  *Submitted*

• General behaviour change: 137 BCTs
Current study:
Strengthening evaluation and implementation by specifying components of behaviour change interventions (2010-2013)

International Advisory Board

Email: BCTTaxonomy@ucl.ac.uk

Website: Google ‘BCT taxonomy
Identifying “active ingredients” …

• Can use BCT analysis in systematic reviews to identify effective components within interventions
  – Use meta-regression

• Example
  – 84 interventions (n=28,838) of interventions to increase physical activity &/or Healthy eating
  – Interventions ave. 6 techniques (range 1-14)
    • Many different combinations
  – Effect d=0.37, 95% CI 0.29-0.54
  – Very heterogeneous effects ($I^2=79\%$)
    • not explained by 10 moderators examined e.g.
    • Setting, population, intervention characteristics, target behaviour
Results

• Only one technique, self-monitoring, had a significant effect for both behaviours across interventions
  – $d=0.57$, 14.6% variance

• Next step
  – Use psychological theory to predict combinations of techniques that might be more effective
  – Control Theory suggests how feedback may interact with other techniques to change behaviour

Carver & Scheier, 1982
A Self-regulation (control) Theory: Carver & Scheier, 82

GOAL

Compare behaviour with standard

GOAL-SETTING

Act to reduce discrepancy

SELF-MONITORING/FEEDBACK

Environmental influences

No discrepancy – goal reached

Disengage from goal – give up

Discrepancy noted
Theoretical combination of techniques

• self-monitoring of behaviour

• Other core self regulatory processes:
  – setting goals, reviewing goals, specifying action plans, feedback on performance

• Comparison of interventions of self-monitoring with at least one other “self-regulatory” technique (n=28) vs all others (n=56)

• Theoretical combination twice as effective
  – d=0.60 vs d=0.26

Audit & Feedback Cochrane review (Jamtvedt et al, 2006): An example of a “theory-lite” synthesis

• Audit & feedback (A&F)
  – ‘Any summary of clinical performance of health care over a specified period of time’

• Cochrane review of 118 A&F trials
  – A&F is typically effective
  – Effects vary
    • 16% decrease to 70% increase in compliance
  – What explains variability?
Moderator analysis

• Categories
  – “intensive”, “moderate” or “non-intensive”
  – What do these terms mean?
Re-analysis of Cochrane Review: Theory-based hypotheses

- Feedback more effective when goal/target is set
- Most effective where goal/target and action plan

1. Feedback only

2. Feedback + goal

3. Feedback + goal + action plan

Modes of delivery

- **Non-intensive**
  - ((group feedback) NOT (from a supervisor or senior colleague)) OR ((individual feedback) AND (written format) AND (containing information about costs or numbers of tests without personal incentives))

- **Moderate**
  - (any other combination of characteristics than described in Intensive or Non-intensive group)

- **Intensive A&F**
  - (individual recipients) AND ((verbal format) OR (a supervisor or senior colleague as the source)) AND (moderate or prolonged feedback)

Behaviour change techniques

- **Feedback only**
  - 61 comparisons

- **Feedback + goal**
  - 8 comparisons

- **Feedback + goal + action plan**
  - 3 comparisons

- **Additional BCTs**
  - 73 interventions & 34 control arms
What is theory?

• Mechanisms of action
  – How things are related to each other

• A definition
  – A ‘set of statements that organizes, predicts and explains observations
  – describing how phenomena relate to each other, and
  – what you can expect under still unknown conditions’

(Bem and Looren de Jong, 1997)
Why apply theory?

- **Systematic reviewing**
  - Facilitate accumulation and integration of evidence
    - across context, population and behaviour
    - of effects and of causal mechanisms
  - Informs method for evidence synthesis of complex interventions

- **Intervention design**
  - Informs selection of behaviour change techniques (BCTs) theoretically predicted to be effective
  - Allows refinement and development of theory and, hence, more effective interventions
To develop more effective interventions …

We need to improve our scientific methods in the following areas:

1. **Apply theories of behaviour change** to intervention development and evaluation, and to evidence syntheses
   - allows questions to be answered about not just “what worked” in interventions but “how they worked”.

2. **Specify intervention content** in sufficient detail in trial protocols and published reports to allow accurate replication and evidence syntheses that can identify “active ingredients” within interventions.

3. Develop a **model of behaviour** as a starting point for systematic, theory-based intervention development.
Systematic reviews: Why use theory?

• Can propose pathways and mechanisms that predict and explain change
  Michie & Abraham, 2004

• Can help to identify techniques to bring about change, via theory-linked technique taxonomies

• Builds on, and can further develop, behaviour change evidence base
Evidence syntheses of BC interventions

- Often find **no clear patterns, inconsistent results and small effects**
- Synthesis depends on **categorising** complex, multi-component interventions
- Categories often **ad hoc**
- Specifying content as BCTs allows theoretically based categorisation & analysis
• Intensive A&F
  – (individual recipients) AND ((verbal format) OR (a supervisor or senior colleague as the source)) AND (moderate or prolonged feedback)

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Problems of categorising by “intensity”

- No clear pattern of effect
- Categories conflates content with modes of delivery
- No theoretical rationale
- Therefore, knowledge generated is limited
  - ‘A&F will continue to be an unreliable approach to quality improvement until we learn how and when it works best’ (Foy et al, 2005)
A theory-based approach

1. Conceptual deconstruction of intervention
   1. Identifying component techniques
   2. Identifying underlying theoretical framework

2. Generation of theory-based hypotheses concerning effectiveness

What is Audit and Feedback?

Jamtvedt et al, 2006

• ‘Any summary of clinical performance of health care over a specified period of time’
  – Summary
    • E.g. numbers, words, visual; Given when, to whom?
  – Performance
    • E.g. Self-reported, observed, individual, group, relative to standard/past/others?
  – Time
    • E.g. Continuous/episodic, duration?
On what basis does one select intervention components?

• Need to have a theory about how A & F is working
• Minimum that is needed is
  – A standard for the performance
  – Measure of performance
  – A means of feeding back
  – Is this enough?
    • Theory suggests need a mechanism for reducing discrepancy between standard and performance
Identifying active ingredients in interventions

• Usual meta-analysis
  – overall effect of heterogeneous interventions

• Technique-based meta-regression
  – similar to traditional regression, except data at study rather than individual level
  – classify interventions into component BCTs
  – meta-regression to investigate effects of
    • individual techniques across interventions
    • theoretically based combination of techniques
What BCTs are effective in interventions to increase physical activity and healthy eating?

• Inclusion criteria
  – Interventions using behavioural &/or cognitive techniques
  – in adults
  – designs experimental or quasi-experimental
  – outcome measures objective or validated self-report

• 6 electronic databases, 1990-2007

• Intervention content analysed using
  – a reliable taxonomy of 26 techniques
  – a theoretically derived combination of techniques

• Random effects meta-analysis and meta-regression
  – isolates unique contribution of specific techniques to heterogeneity

The interventions

• 84 interventions \( (n=28,838) \)

• Target behaviour
  – Physical activity &/or Healthy eating

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