Behaviour change techniques and a framework for increasing physical activity

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Acknowledgements

• Key collaborators in this work
  – Prof Robert West, University College London
  – Prof Marie Johnston, University of Aberdeen
  – Health Psychology Research Group

• Funders
This talk

• Understanding behaviour
• Complex interventions and behaviour change techniques
• What works?
• A framework for designing interventions
Understanding behaviour

- Behaviour is in the moment and influenced by its context
- Understanding behaviour is key to changing it
- Understand before you intervene!
Changing behaviour

• Intervene at many levels
• simultaneously & consistently

NICE Guidance for Behaviour change at population, community and individual levels (2007)

Obesity and the Economics of Prevention, OECD (2010)

Source: Dahlgren and Whitehead, 1991
Behaviours are different and contexts are different

• If we are to develop effective interventions to change behaviour
  – need to understand the particular behaviour in its particular context

• For example .... the two categories of behaviour that need to change to combat the obesity epidemic ....
Understanding behaviour in context is key to effective interventions

• Physical activity
  – requires **energisation**, “push”
  – begin doing things
  – create impulses
  – respond to cues

• Healthy eating
  – requires **self-control**, “pull”
  – avoid/stop doing things
  – resist impulses
  – **not** respond to cues
Understand the behaviour in context

• Why are behaviours as they are?
• What needs to change for the desired behaviour/s to occur?
A thought experiment

For behaviour to change, what three conditions need to exist?
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.

Michie et al. (2011) *Implementation Science*
This talk

• Understanding behaviour
• Complex interventions and behaviour change techniques
• What works?
• A framework for designing interventions
Interventions are complex

• Several, potentially interacting, techniques
  – content or elements of the intervention
  – delivery of the intervention
    • 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)
    • characteristics of those delivering the intervention
    • characteristics of the recipients,
    • characteristics of the setting (e.g., worksite)
  – adherence to delivery protocols

Effective principles of individual behaviour change

- **Maximise Capability** to regulate own behaviour
  - Develop relevant skills (e.g. goal setting, monitoring, feedback)
  - Develop specific plans to change
- **Maximise Opportunity** to support self-regulation
  - Elicit social support
  - Avoid social and other cues for current behaviour
  - Change routines and environment
- **Increase Motivation** to engage in the desired behaviour
  - Reward change
  - Develop appropriate beliefs
    - E.g. benefits of changing, others’ approval, personal relevance, confidence to change
  - Develop positive feelings about changing
- **Reduce Motivation** to continue with the undesired behaviour

*Abraham, Kelly, West & Michie, 2008, Psychology, Health and Medicine*
Content of the intervention: behaviour change techniques

• “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
Interventions are made up of specific behaviour change techniques (BCTs)

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. General encouragement
16. Contingent rewards
17. Teach to use cues
18. Follow up prompts
19. Social comparison
20. Social support/ change
21. Role model
22. Prompt self talk
23. Relapse prevention
24. Stress management
25. Motivational interviewing
26. Time management

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.

Gives us an agreed, standard method of describing interventions to

- Report interventions as accurately as possible
  - Replicate interventions in research to build evidence
  - Implement effective interventions
- Synthesise published reports in systematic reviewing
Example of the problem: Descriptions of “behavioural counselling” in two interventions

<table>
<thead>
<tr>
<th>Title of journal article</th>
<th>Description of “behavioural counselling”</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>“<em>educating</em> patients about the benefits of lifestyle change, encouraging them, and suggesting what changes could be made” (Steptoe et al. <em>AJPH</em> 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>“<em>feedback</em> on self-monitoring record, <em>reinforcement</em>, recommendations for change, answers to questions, and general support” (Tate et al. <em>JAMA</em> 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

**Behavioural counselling** *Cochrane, 2005*

- **Intervention content**
  - None mentioned

- **Mechanism of action**
  - *None mentioned*
“Taxonomies” of BCTs

- Physical activity/healthy eating/mixed: 26 BCTs
  Abraham & Michie, 2008
- Physical activity & healthy eating: 40 BCTs
  Michie et al, Psychology & Health, 2011
- Smoking cessation: 53 BCTs
  Michie et al, Annals of Behavioural Medicine, 2010
- Reducing excessive alcohol use: 42 BCTs
  Michie et al, Addiction, 2012
- Condom use: 47 BCTs
  Abraham et al, 2012
- General behaviour change: 137 BCTs
- Competence framework: 89 BCTs
  Dixon & Johnston, 2011

93 item BCT Taxonomy v1, in press, Annals of Behavioral Medicine
This talk

• Understanding behaviour
• Complex interventions and behaviour change techniques
• What works?
• A framework for designing interventions
Applications of taxonomy approach

1. Identifying active ingredients in interventions
   – Meta-regression in evidence synthesis
     • Physical activity & healthy eating
2. Investigating mechanisms of action
   – The intervention “ProActive”
3. Designing interventions
   – The Behaviour Change Wheel
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

• 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

SELF-MONITORING/FEEDBACK

GOAL

Compare behaviour with standard

Discrepancy noted

No discrepancy – goal reached

Disengage from goal – give up

GOAL-SETTING

Act to reduce discrepancy

Environmental influences

ACTION-PLANNING
Theoretical combination of techniques

- **self-monitoring** of behaviour
- Other core self regulatory processes:
  - setting **goals**
  - reviewing goals
  - specifying **action plans**
  - **feedback** on performance
Findings

• Interventions comprising self-monitoring with at least one other “self-regulatory” techniques (n=28) compared with the other interventions (n=56)
  • were twice as effective
  • d=0.60 vs d=0.26
Used BCT taxonomy approach to

- Assess fidelity of delivery
- Evaluate mechanism of action
  - By linking intervention content to theory

Collaboration with Wendy Hardeman, Ann Louise Kinmonth and Steve Sutton, University of Cambridge
Example: intervention to increase physical activity of those at risk of Type 2 diabetes

- “ProActive”: 14 behaviour change techniques
- Delivered by trained professionals in 5 sessions over 12 months
- Specified in detailed protocols/manuals
- An RCT of 365 people, family history & sedentary
  - Increased activity by equivalent of 20 minutes per day
  - No difference between intervention and “control” groups

• What worked?
  • Assess implementation/ fidelity


• How did it work?
  • Link component techniques to theory

Intervention techniques

1. Give information
2. Elicit questions
3. Summarise message
4. Set goals
5. Self-monitor
6. Build motivation
7. Action plans
8. Use prompts
9. Use rewards
10. Build support
11. Review goals
12. Build habits
13. Relapse prevention
14. Generalise skills

Theories

1. Theory of Planned Behaviour
2. Relapse Prevention Theory
3. Self-regulation Theory
4. Operant Learning Theory
The implementation process

Theories of behaviour change

Techniques in manual

Delivery of techniques by professional

Participant response to intervention

Physical activity
Question: How did the intervention work?

• 27 participants selected to study in depth

• Tape recorded and transcribed sessions

• All discussion in sessions relevant to behaviour change was reliably coded into techniques and theories
  – Both of professionals and of participants
Percentage of techniques delivered by professionals

45%
Variation in implementation

Sessions: $p<0.001$ (Page test)

Facilitators: $p<0.001$ (Kruskal-Wallis test)
How were techniques distributed over the theories? (a) in protocol (b) delivered

- Theory of Planned Behaviour
- Self-regulation Theory
- Operant Learning Theory
- Relapse Prevention Theory
Process linking theory and behaviour change

Theories of behaviour change

- Techniques in manual

- Delivery of techniques by professional

- Participant response to intervention

- Physical activity
How was (a) professional (b) participant talk about behaviour distributed over the theories?
Which theories best accounted for change?

Although *Self-regulation theory* is the basis of the most commonly delivered intervention techniques, *Operant learning theory* may be a better explanation for behaviour change among participants.
This talk

- Understanding behaviour
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- What works?
- A framework for designing interventions
Designing effective behaviour change interventions

1. **Identify** the target behaviour/s

2. Understand the **target behaviour/s** in context

3. Consider full range of possible **intervention functions**

4. Identify specific **behaviour change techniques**
Understand the behaviour
Do we have a framework that has ....

1. Comprehensive coverage
2. Coherence
3. Clear link to a model of behaviour

Useable by, and useful to, policy makers, service planners and intervention designers
Systematic literature review

- Identified 19 frameworks to classify behaviour change interventions
- Addressed behaviours relating to health, environment, culture change, social marketing etc.
- Results for 3 criteria:

<table>
<thead>
<tr>
<th>Model of behaviour</th>
<th>Based on a model of behaviour or behaviour change</th>
<th>7/19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coherence</td>
<td>Is structured logically and coherently</td>
<td>3/19</td>
</tr>
<tr>
<td>Comprehensiveness</td>
<td>Covers all types of interventions</td>
<td>0/19</td>
</tr>
</tbody>
</table>
Synthesis into an integrated framework

• Model of behaviour at the hub of a wheel
• Synthesis of existing frameworks
  – 9 intervention functions
    • each include one or more behaviour change techniques
  – 7 policy categories
    • that could enable or support these interventions to occur

Interventions: activities designed to change behaviours.
Policies: decisions made by authorities concerning interventions

Behaviour change techniques and a framework for increasing physical activity

• Start by understanding the problem
  – Specific behaviours in specific contexts
    – COM-B
    – Then identify the intervention strategy

• Consider the full range of effective interventions
  – and supporting policies

• Identify behaviour change techniques
  – and modes of delivery
For more information

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Health Psychology Research Group, 2011
Frameworks included in systematic review

1. **Epicure taxonomy** West (2006) Taxonomy of approaches designed to influence behaviour patterns
2. **Culture capital framework** Knott et al. (2008) Framework of knowledge about culture change, offering practical tools for policymaking
3. **EPOC taxonomy of interventions** Cochrane Effective Practice and Organisation of Care Review Group (EPOC) (2010) Checklist to guide systematic literature reviewers about the types of information to extract from primary studies
4. **RURU: Intervention implementation taxonomy** Walter et al. (2003) Taxonomy covering a wide range of policy, practice and organisational targets aimed at increasing impact of research
5. **MINDSPACE** Institute for Government and Cabinet Office (2010) Checklist for policy-makers aimed at changing or shaping behaviour
6. **Taxonomy of behaviour change techniques** Abraham et al. (2010) Taxonomy of behaviour change techniques grouped by change targets
8. **People and places framework** Maibach et al. (2007) Framework that explains how communication and marketing can be used to advance public health
• **10. Injury control framework** Geller *et al.* (1990) Heuristic framework for categorising and evaluating behaviour change strategies aimed at controlling injuries


• **12. Legal framework** Perdue *et al.* (2005) Conceptual framework for identifying possible legal strategies used for preventing cardiovascular diseases

• **13. PETeR** White (in prep.) Comprehensive and universally applicable model or taxonomy of health

• **14. DEFRA’s 4E model** DEFRA (2008) Process model for policy makers aimed at promoting pro-environmental behaviours in accordance with social marketing principles

• **15. STD/ HIV framework** Cohen and Scribner (2000) Taxonomy to expand the scope of interventions that can be used to prevent STD and HIV transmission

• **16. Framework on public policy in physical activity** Dunton *et al.* (2010) Taxonomy aimed at understanding how and why policies successfully impact on behaviour change

• **17. Intervention framework for retail pharmacies** Goel *et al.* (1996) Framework that presents factors that may affect retail pharmacy describing and strategies for behaviour change to improve appropriateness of prescribing

• **18. Environmental policy framework** Vlek (2000) A taxonomy of major environmental problems, their different levels and global spheres of impact, and conceptual modelling of environmental problem-solving

• **19. Population Services International (PSI) framework** PSI (2004) A conceptual framework to guide and help conduct research on social marketing interventions
## Intervention functions

<table>
<thead>
<tr>
<th>Intervention function</th>
<th>Definition</th>
<th>Health examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>Increasing knowledge or understanding</td>
<td>Providing information to promote healthy eating</td>
</tr>
<tr>
<td>Persuasion</td>
<td>Using communication to induce positive or negative feelings or stimulate action</td>
<td>Using imagery to motivate increases in physical activity</td>
</tr>
<tr>
<td>Incentivisation</td>
<td>Creating expectation of reward</td>
<td>Using prize draws to induce attempts to stop smoking</td>
</tr>
<tr>
<td>Coercion</td>
<td>Creating expectation of punishment or cost</td>
<td>Raising the financial cost to reduce excessive alcohol consumption</td>
</tr>
<tr>
<td>Training</td>
<td>Imparting skills</td>
<td>Advanced driver training to increase safe driving</td>
</tr>
<tr>
<td>Restriction</td>
<td>Using rules that limit engagement in the target behaviour or competing or supporting behaviour</td>
<td>Prohibiting sales of solvents to people under 18 to reduce use for intoxication</td>
</tr>
<tr>
<td>Environmental restructuring</td>
<td>Changing the physical or social context</td>
<td>Providing on-screen prompts for GPs to ask about smoking behaviour</td>
</tr>
<tr>
<td>Modelling</td>
<td>Providing an example for people to aspire to or imitate</td>
<td>Using TV drama scenes involving safe-sex practices to increase condom use</td>
</tr>
<tr>
<td>Enablement</td>
<td>Increasing means/reducing barriers to increase capability or opportunity</td>
<td>Behavioural support for smoking cessation, medication for cognitive deficits, surgery to reduce obesity, prostheses to promote physical activity</td>
</tr>
</tbody>
</table>
## Policy categories

<table>
<thead>
<tr>
<th>Policy category</th>
<th>Example</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication / marketing</td>
<td>Using print, electronic, telephonic or broadcast media</td>
<td>Conducting mass media campaigns</td>
</tr>
<tr>
<td>Guidelines</td>
<td>Creating documents that recommend or mandate practice. This includes all changes to service provision</td>
<td>Producing and disseminating treatment protocols</td>
</tr>
<tr>
<td>Fiscal</td>
<td>Using the tax system to reduce or increase the financial cost</td>
<td>Increasing duty or increasing anti-smuggling activities</td>
</tr>
<tr>
<td>Regulation</td>
<td>Establishing rules or principles of behaviour or practice</td>
<td>Establishing voluntary agreements on advertising</td>
</tr>
<tr>
<td>Legislation</td>
<td>Making or changing laws</td>
<td>Prohibiting sale or use</td>
</tr>
<tr>
<td>Environmental/ social planning</td>
<td>Designing and/or controlling the physical or social environment</td>
<td>Using town planning</td>
</tr>
<tr>
<td>Service provision</td>
<td>Delivering a service</td>
<td>Establishing support services in workplaces, communities etc.</td>
</tr>
</tbody>
</table>
Selecting interventions and policies

<table>
<thead>
<tr>
<th>Restriction</th>
<th>Environmental restructuring</th>
<th>Modelling</th>
<th>Persuasion</th>
<th>Incentivisation</th>
<th>Coercion</th>
<th>Education</th>
<th>Training</th>
<th>Enablement</th>
</tr>
</thead>
</table>
Consensus of at least 3 of 4 raters for:

<table>
<thead>
<tr>
<th>Techniques</th>
<th>Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Build motivation</td>
<td>Theory of Planned Behaviour</td>
</tr>
<tr>
<td>Give information</td>
<td></td>
</tr>
<tr>
<td>Set goals</td>
<td>Self-regulation Theory</td>
</tr>
<tr>
<td>Develop action plans</td>
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<tr>
<td>Self-monitoring</td>
<td></td>
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<tr>
<td>Review goals</td>
<td></td>
</tr>
<tr>
<td>Use rewards</td>
<td>Operant Learning Theory</td>
</tr>
<tr>
<td>Use prompts</td>
<td></td>
</tr>
<tr>
<td>Build support</td>
<td></td>
</tr>
<tr>
<td>Generalise skills</td>
<td></td>
</tr>
<tr>
<td>Build habits</td>
<td></td>
</tr>
<tr>
<td>Prepare for setbacks</td>
<td>Relapse Prevention Theory</td>
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</tbody>
</table>
How was the intervention *received* by participants?

Participants talk about behaviour change or maintenance was reliably coded into 17 components of four theories e.g.

<table>
<thead>
<tr>
<th>Example from transcript</th>
<th>Theoretical component</th>
<th>Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thinking about benefits of activity e.g. losing weight</td>
<td>Attitude</td>
<td>Theory of Planned Behaviour</td>
</tr>
<tr>
<td>Parking car further away so has to walk further</td>
<td>Action plan</td>
<td>Self-regulation Theory</td>
</tr>
<tr>
<td>Asking partner to remind him</td>
<td>Cue to action</td>
<td>Operant Learning Theory</td>
</tr>
</tbody>
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