Characterising interventions:

Why and how?

Susan Michie

This talk

• The problem of imprecise reporting of behaviour change (BC) interventions

• Developing a taxonomy of BC techniques

• Application
  – Systematic reviewing
    • To identify effective techniques
  – Process measures in BC trials
    • To identify mechanisms of change
  – Evaluation of services
    • Example of smoking cessation – conference presentation

• Next steps
Where are we?

- Evidence for effective interventions across a wide range of behaviours, \textit{NICE, 2007}
  - But often modest and inconsistent effects
- How to improve?
- Need to strengthen our understanding of
  - intervention content (techniques)
  - how best to synthesise evidence across studies
  - causal mechanisms of behaviour change (theory)

The problem of imprecise reporting of behaviour change (BC) interventions

- Interventions often “complex”
  - several potentially interacting techniques
- Poorly described, difficult to replicate
  - Interventions often described vaguely e.g. “persuasive communication”
  - Where protocols with more detail are available, terminology is variable
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, Steptoe et al. <em>AJPH</em> 2001</td>
<td>“educating patients about the benefits of lifestyle change, <em>encouraging</em> them, and <em>suggesting what changes</em> could be made”</td>
</tr>
<tr>
<td>Effects of internet <em>behavioral counseling</em> on weight loss in adults at risk for Type 2 diabetes, Tate et al. <em>JAMA</em> 2003</td>
<td>“feedback on self-monitoring record, <em>reinforcement, recommendations for change, answers</em> to questions, and general <em>support</em>”</td>
</tr>
</tbody>
</table>

Biomedicine vs behavioural science … example of smoking cessation effectiveness

**Varenicline** *JAMA, 2006*
- **Intervention content**
  - Activity at a subtype of the nicotinic receptor where its binding produces agonistic activity, while simultaneously preventing binding to α4β2 receptors
- **Mechanism of action**
  - None mentioned

**Behavioural counselling** *Cochrane, 2005*
- **Intervention content**
  - Review smoking history & motivation to quit
  - Help identify high risk situations
  - Generate problem-solving strategies
  - Non-specific support & encouragement
- **Mechanism of action**
  - None mentioned
Reporting of behavioural interventions needs to be more scientific ...

- To replicate interventions
  - to build an evidence base
  - to implement effective interventions

- To test and understand mechanisms of change

- To improve intervention effectiveness ... need to understand
  - not just that interventions work,
  - but also how they work
    - Which techniques are the "active" ingredients?
    - What is their theoretical basis?


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

The content: How to report?

- Develop a parsimonious list (taxonomy) of conceptually distinct and defined techniques that can be reliably used in specifying interventions

- An example
  - 26 techniques definitions tested across 3 reviews (2 of PA & HE)
  - Developed coding manual of definitions
  - 195 intervention evaluation reports, 78 tests of reliability
  - Mean agreement 93%. Mean and median Kappas = .79 (sd .17)
  - 75% of tests generated Kappas > 0.7; all but 2 \( p < .01 \)

Abraham & Michie (2008) A taxonomy of behavior change techniques used in interventions. *Health Psychology*

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### Intervention techniques

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
This shows ...

- Discrete techniques can be reliably identified in intervention descriptions across behavioural domains
- Independent coders can be trained to use our taxonomy
- Feasible to develop a common taxonomy of behaviour change techniques

Further work ....

- Extended to 40 techniques reliably identified with improved definitions
  - with French and Sniehotta

- 137 identified by
  - brainstorming of 4 clinical/health psychologists
  - consulting textbooks for training applied psychologists in BC techniques
  - Definitions extracted: 74.7% agreement

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Which techniques are the “active” ingredients?

• Usual meta-analysis
  – overall effect of heterogeneous interventions

• Technique-based meta-regression
  – classify interventions into component techniques
  – meta-regression to look at effects of
    • individual techniques across interventions
    • theoretically based combination of techniques
What is effect of self-regulation interventions aimed at increasing physical activity and healthy eating?

- **Inclusion criteria**
  - Interventions using behavioural and/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
  - With Whittington, McAteer, Abraham

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*
Combination of techniques

• Core self regulatory processes:
  – self-monitoring of behaviour
  – setting goals
  – specifying action plans
  – feedback on performance
  – reviewing goals

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 $d=0.26$
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The intervention “ProActive”  

• Based on psychological theory and evidence
• Specified in detailed protocols/manuals
• Delivered by trained professionals in 5 sessions over 12 months
• Results
  – Increased activity by equivalent of 20 minutes per day
• My question
  – What worked?
    • Assess fidelity of delivery
  – 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 from which techniques drawn

- Theory of Planned Behaviour (Ajzen)
- Relapse Prevention Theory (Marlatt)
- Self-regulation (control) theory (Carver & Scheier)
- Operant Learning Theory (Skinner)
**Process linking theory and behaviour change**

- Theories of behaviour change
  - Techniques in manual
    - Delivery of techniques by professional
      - Participant response to intervention
        - Physical activity

**Understanding the process**

- Which techniques caused change?
- Which theories best accounted for change?
- Method
  - 27 participants selected to study in depth
  - Intervention manual specified **208 behaviours** for delivering the **14 techniques**
  - Intervention sessions tape recorded, transcribed & reliably coded
### 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>
<td></td>
</tr>
<tr>
<td>Self-monitoring</td>
<td></td>
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<tr>
<td>Review goals</td>
<td></td>
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<td>Use rewards</td>
<td>Operant Learning Theory</td>
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<td>Use prompts</td>
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<td>Build support</td>
<td></td>
</tr>
<tr>
<td>Generalise skills</td>
<td>Relapse Prevention Theory</td>
</tr>
<tr>
<td>Build habits</td>
<td></td>
</tr>
<tr>
<td>Prepare for setbacks</td>
<td></td>
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</tbody>
</table>
How were techniques distributed over the theories? (a) in protocol (b) delivered

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 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>
</table>

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.

Conclusion
Characterising intervention: Why & how?

• To improve behavioural science
  – Techniques and their descriptors need to be consensual as well as reliable
    • Equivalent of British National Formulary for drugs
  – Techniques need to be linked with “mechanisms of action” (theory)
    • to understand how change is effected
    • to develop more effective interventions