Improving health by changing behaviour:
health professionals, the public and patients

Susan Michie
Professor of Health Psychology,
University College London, UK
This talk

1. The role of behaviour in health
2. Analysing behaviour using COM-B and TDF
   – Example: Increase hand hygiene behaviour amongst hospital staff
3. Behaviour change techniques
   – Example: Improve GP management of lower back pain
4. Designing interventions: the Behaviour Change Wheel
5. If time, applying theory to evidence synthesis
Behavioural risk factors: UK

- Study of 20,000 women & men 45-79 yrs with no known cardiovascular disease or cancer
- 4 x more likely to have died 11 years later if
  - smoked
  - physically inactive
  - ate <5 portions of fruit & veg/day &
  - drank > recommended alcohol limits

- controlled for age, gender, body mass index and socio-economic status

*Khaw et al. (2008) PLoS Med*
Behavioural risk factors: USA

• 48% *avoidable* deaths in 2000 from
  – smoking
  – alcohol use
  – poor diet
  – physical activity
  – unsafe sex
  – driving habits
  – violence
  *Mokdad et al, 2004*

• In addition, *patients*,
  – delay in seeking help
  – poor adherence to treatment & screening
  – not following health advice
Health professional behaviours affect health

- Many do not follow evidence-based guidelines for good practice e.g.
  - making referrals
  - giving advice
  - prescribing drugs
  - keeping hands clean

- Every one of these requires multiple behaviours at multiple levels – individual, organisational, state/national

- Each behaviour differs in context, barriers and drivers

Research

- Netherlands: 30-40% of patients did not receive ‘evidence-based’ health care
  Grol et al, 2001

- US: 20-25% received care that was unnecessary or even harmful
  Schuster et al, 2005
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
A method for developing behaviour change interventions

1. Target behaviour
   - Select (which?)
   - Specify (precisely what?)
2. Design intervention
   - Understand (COM-B)
   - Intervention functions
   - Behaviour Change Techniques
3. Deliver intervention
   - Mode of delivery
   - Policy categories
Which behaviours?

• Identify key specific behaviours
  – **Who** needs to do
    • **what** differently,
    • **when**,  
    • **where**,  
    • **how**?
  – Behaviours are often dependent on or influenced by  
    other behaviours
    • One’s own
    • Other people’s
Example .... hand hygiene in hospital staff

- Nurses and doctors
  - Cleaning hands in identified situations
- Infection control nurses
  - Conducting audits and feeding back results
- Staff responsible for distributing alcohol handrub
  - Ensuring that dispensers contain alcohol handrub

For each of these, who needs to do what, when, where, how?
Which behaviours to target?

- Assess candidate behaviours in terms of:
  - likely **impact** if undertaken
  - likelihood that such a behaviour will be **implemented**
    - ease, cost
    - preference, acceptability
  - **spillover**/generalisability to other behaviours and people
A method for developing behaviour change interventions

Target behaviour

Select (which?)

Specify (precisely what?)

Understand (COM-B)

Intervention functions

Behaviour Change Techniques

Mode of delivery

Policy categories

Design intervention

Deliver intervention
Understand the nature of behaviour in context

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

• Answering this is helped by a model of behaviour
  – COM-B
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*
Understand the behaviour
Example: increasing hand hygiene in hospital staff

- 5000 die a year in the UK, others disabled, due to hospital acquired infections (e.g. MRSA)
- Disinfecting hands effective in preventing infection
- Specific guidelines for clinical practice
- Poorly implemented
  - on average 40% occasions (5%–81%)
Opportunity
- Alcohol hand rub beside every bed

Motivation
- Persuasive posters
- Encouraging patients to ask

Capability
- No intervention
Capability

• Nurses have the capability to clean their hands
  – But not to
    • pay attention to this behaviour over other competing behaviours
    • develop routines for noticing when the behaviour does not occur, and plans for acting in future

• Train staff to set goals, observe their behaviour, develop action plans on the basis of feedback
  • Developed at UCL, based on behavioural theory
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**
Observe two staff member’s behaviour for 20 minutes

Give immediate verbal feedback

Full compliance = certificate for use at staff appraisal

OR

< full compliance = immediate goal-setting and action planning regarding observed non-compliance & repeat observation next month

MONTHLY FEEDBACK INTERVENTION
Co-ordinated by infection control team

= individual level component
MONTHLY FEEDBACK INTERVENTION
Co-ordinated by infection control team

- = individual level component

= group level component

Observe two staff member’s behaviour for 20 minutes
Give immediate verbal feedback
Full compliance = certificate for use at staff appraisal

< full compliance = immediate goal-setting and action planning regarding observed non-compliance & repeat observation next month

Observe one group of staff members for 20 minutes
Feedback displayed, and given at ward meeting
Praise for compliance

< full compliance = ward level goal-setting and action planning regarding observed non-compliance/s
Findings: 60 wards in 16 hospitals in England

- Use of soap and alcohol hand rub tripled from 21.8 to 59.8 ml per patient bed day
- Rates of MRSA bacteraemia and C difficile infection decreased
  - Stone, Fuller, Savage, Cookson et al, BMJ, 2012
- Giving 1-1 feedback led to staff being 13-18% more likely to clean their hands
  - Fuller, Michie, Savage, McAteer et al, PLoS One, 2012
A method for developing behaviour change interventions

- Target behaviour
  - Select *(which?)*
  - Specify *(precisely what?)*
  - Understand *(COM-B)*
    - Optional elaboration *(TDF)*

- Design intervention
  - Intervention functions
  - BCTs

- Deliver intervention
  - Mode of delivery
  - Policy categories
Understanding the behaviour using theories

- To make theory more usable, a consensus exercise of
  - 18 researchers in health psychology
  - 14 implementation researchers from UK, Netherlands and Canada
- Generated and synthesised 33 theories and 128 constructs ....
- into 14 domains: the “Theoretical Domains Framework”
  - Elaboration of COM-B

Cane et al (2011) Validation of the theoretical domains framework for use in behaviour change and implementation research, Implementation Science
<table>
<thead>
<tr>
<th>COM-B</th>
<th>Theoretical Domains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical capability</td>
<td>Physical skills</td>
</tr>
<tr>
<td>Psychological capability</td>
<td>Knowledge</td>
</tr>
<tr>
<td></td>
<td>Cognitive and Interpersonal skills</td>
</tr>
<tr>
<td></td>
<td>Memory, Attention and Decision processes</td>
</tr>
<tr>
<td></td>
<td>Behavioural regulation</td>
</tr>
</tbody>
</table>
Sources of behaviour

TDF Domains

Soc - Social influences
Env - Environmental Context and Resources
Id - Social/Professional Role and Identity
Bel Cap - Beliefs about Capabilities
Opt - Optimism
Int - Intentions
Goals - Goals
Bel Cons - Beliefs about Consequences
Reinf - Reinforcement
Em - Emotion
Know - Knowledge
Cog - Cognitive and interpersonal skills
Mem - Memory, Attention and Decision Processes
Beh Reg - Behavioural Regulation
Phys - Physical skills
Interview questions to identify relevant domains

1. Knowledge
2. Skills
3. Memory, attention and decision processes
4. Behavioural regulation
5. Professional/social role and identity
6. Beliefs about capabilities
7. Optimism
8. Emotion
9. Beliefs about consequences
10. Intentions
11. Goals
12. Reinforcement
13. Environmental context and resources
14. Social influences

- How difficult or easy is it for them to do x?
- What problems have they encountered?
- What would help them?
- How confident are they that they can do x despite the difficulties?
- How capable are they of maintaining x?
- How well equipped/comfortable do they feel to do x?
Example: GPs managing low back pain: Australia

The implementation problem:

1. Too frequent referral for lumbar X-rays
2. Too infrequent recommendation to stay active

Used the Theoretical Domains Framework

- Comprehensive theoretically-based “diagnosis” of the implementation problem
- Elaboration of COM-B
- Gives more fine-grained basis for designing intervention

French, Green, O’Connor, MacKenzie, Francis, Michie, Buchbinder, Schattner, Spike, Grimshaw.

Assessing the problem

Theoretical assessment of implementation problem
- Theory domain questions about the 2 GP behaviours
- 11 Focus Groups of 42 GPs
- Thematic analysis: barriers & enablers, GP & patient perspective

Surveys based on interviews

Intervention development: Matrix of domains and techniques

Evaluation in cluster RCT
Interviews: Domains in which problems identified

- Skills
- Knowledge
- Beliefs about capabilities
- Environmental context and resources
- Social influences
- Professional role and identity
- Beliefs about consequences
- Motivation and goals
- Emotion
- Nature of the behaviours
- Memory and decision processes
- Behavioural regulation
Survey: Domains predicting intention to manage patients \textit{without} x-ray

- Beliefs about capabilities: 0.21 (0.11, 0.32), p=0.000
- Beliefs about consequences: 0.36 (0.25, 0.46), p=0.000
- Social influences: 0.28 (0.17, 0.38), p=0.000
- Professional role: 0.44 (0.30, 0.57), p=0.000
- Environment: -0.03 (-0.07, 0.02), p=0.285
- Knowledge: -0.18 (-0.84, 0.48), p=0.590
Domains predicting intention to advise patients to stay active

- Beliefs about capabilities: 0.24 (0.15, 0.33), p=0.000
- Beliefs about consequences: 0.12 (0.04, 0.21), p=0.003
- Social influences: 0.10 (0.02, 0.18), p=0.011
- Professional role: 0.21 (0.10, 0.32), p=0.000
- Environment: 0.00 (-0.08, 0.09), p=0.965
- Knowledge: -0.03 (-0.17, 0.10), p=0.617
- Memory: 0.17 (0.05, 0.30), p=0.007
A method for developing behaviour change interventions
Interventions made up of Behaviour Change Techniques (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
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. Social comparison
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.

Need an agreed, standard method of describing interventions

- To report interventions as accurately as possible
  - Replicate interventions in research to build evidence
  - Implement effective interventions
- To code and synthesise published reports in systematic reviewing
- Must be accessible and supported across
  - disciplines and countries
  - behaviours and contexts
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 counselling</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” <em>(Steptoe et al. AJPH 2001)</em></td>
</tr>
<tr>
<td>Effects of internet <em>behavioral counselling</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” <em>(Tate et al. JAMA 2003)</em></td>
</tr>
</tbody>
</table>
Biomedicine vs behavioural science … example of smoking cessation effectiveness

Varenicline  *JAMA, 2006*

- **Intervention content**

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

- **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
From behavioural analysis to intervention design

• Use a matrix of
  – Theoretical domains x Behaviour change techniques
Which behaviour change technique to use?

- Skills
- Beliefs about capabilities
- Professional role and identity
- Beliefs about consequences
- Motivation and goals
- Memory and decision processes
- Nature of the behaviours
- Behavioural regulation
- Emotion
- Social influences
- Environmental context and resources
- Knowledge
<table>
<thead>
<tr>
<th>Technique for behaviour change</th>
<th>Social/Professional role &amp; identity</th>
<th>Knowledge</th>
<th>Skills</th>
<th>Beliefs about capabilities</th>
<th>Beliefs about consequences</th>
<th>Motivation and goals</th>
<th>Memory, attention, decision processes</th>
<th>Environment and resources</th>
<th>Social influences</th>
<th>Emotion</th>
<th>Action planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal/target specified: behaviour or outcome</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>3 2 3</td>
<td>1</td>
<td>3 1</td>
<td>3 3 3 3</td>
<td>1 1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Monitoring</td>
<td>1</td>
<td>2</td>
<td>3 3 3</td>
<td>1 2 2</td>
<td>1 2 2</td>
<td>1 2 2</td>
<td>1 2 2</td>
<td>2</td>
<td>1 2</td>
<td>2</td>
<td>1 1 2</td>
</tr>
<tr>
<td>Self-monitoring</td>
<td></td>
<td>2 3 3</td>
<td>3 3 2 3</td>
<td>3 2 2 2</td>
<td>1 3 2 1</td>
<td>2 2 3</td>
<td></td>
<td>2</td>
<td></td>
<td>1 3</td>
<td></td>
</tr>
<tr>
<td>Contract</td>
<td>2 1</td>
<td>1</td>
<td>1</td>
<td></td>
<td>1 1</td>
<td>2 3 1 2</td>
<td>2</td>
<td></td>
<td>3 2</td>
<td></td>
<td>2 2 2</td>
</tr>
<tr>
<td>Rewards; incentives (inc Self-evaluation)</td>
<td>1 2 1</td>
<td>1</td>
<td>3 3 3</td>
<td>2 1</td>
<td>2 1 2</td>
<td>2 3 3 3</td>
<td>1 1 2</td>
<td>1</td>
<td>1 2</td>
<td>1 2 1</td>
<td>2 1 1</td>
</tr>
<tr>
<td>Graded task, starting with easy tasks</td>
<td>1</td>
<td>1</td>
<td>3 3 2</td>
<td>2 2 3</td>
<td>2</td>
<td>2 3 2 2</td>
<td>1 2</td>
<td>1</td>
<td>1</td>
<td>1 1</td>
<td>2 1*</td>
</tr>
<tr>
<td>Increasing skills: problem solving, decision making, goal setting</td>
<td>1 2</td>
<td></td>
<td>3 3 3 3</td>
<td>2 2 3 2</td>
<td>1</td>
<td>2 3 2</td>
<td>1 2</td>
<td>1</td>
<td>2</td>
<td>3 1</td>
<td></td>
</tr>
<tr>
<td>Stress management</td>
<td>1</td>
<td></td>
<td>1 2</td>
<td>1 1 1</td>
<td>1</td>
<td>1 2 1</td>
<td></td>
<td></td>
<td>1 3 2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Coping skills</td>
<td>1</td>
<td></td>
<td>2/3 3 1</td>
<td>2 2 2</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rehearsal of relevant skills</td>
<td>1</td>
<td></td>
<td>3 3 3 3</td>
<td>2 3 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Michie, Johnston, Francis, Hardeman & Eccles (2008)  
Applied Psychology: an International Review, 57, 660-680
The GP back management intervention

- Delivered to GPs as
  - Educational small group workshops
    - Increase knowledge
  - Led by GP facilitator
    - Social influence
- Behaviour change techniques
  - Persuasive communication
    - Change beliefs about consequences
  - Modelling, role playing and rehearsal
  - Scripting, action planning
    - Increase beliefs about capabilities
Sample of interventions using this approach

**Australia**
- Improving implementation of guidelines for acute low back pain in primary care
  - McKenzie et al.
- Diagnosis and post-diagnosis management of people with dementia
  - Green et al.
- Implementing preconception care guidelines in the general practice setting
  - Mazza et al.

**Canada**
- Chiropractors compliance with diagnostic imaging guideline recommendations for spine disorders
  - Bussieres et al.

**Finland**
- Guidelines on tobacco and nicotine dependency treatment
  - Kinnunan et al.

**Ireland**
- Primary care practitioners' HPV-related behaviours
  - McSherry et al.

**Netherlands**
- Blood transfusion management in elective hip and knee arthroplasties
  - Voorn et al.

**UK**
- Physicians’ transfusion practice
  - Eccles et al.
- Hospital staff hand hygiene
  - Sheldon et al.
- A suite of dental guidelines across Scotland
  - Clarkson et al.

Michie et al. >150 citations (Web of Knowledge)
A method for developing behaviour change interventions

Target behaviour

Select (which?)

Specify (precisely what?)

Understand (COM-B)

Intervention functions

Behaviour Change Techniques

Mode of delivery

Policy categories

Deliver intervention

Use Behaviour Change Wheel to select broad intervention functions
Understand the behaviour
Need a framework for designing interventions with following criteria:

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

Useable by, and useful to, policy makers, service planners and intervention designers
Do we have an adequate framework?

- Systematic review identified 19 frameworks to classify behaviour change interventions
  - relating to health, environment, culture change, social marketing etc.
- Evaluated using 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>
An integrated framework

• Synthesis of 19 frameworks
• Model of behaviour at the hub of a wheel
• 9 intervention functions
  – each include one or more behaviour change techniques
• 7 policy categories
  – that could enable or support these interventions to occur

Model of behaviour at the hub of the wheel
Interventions: activities designed to change behaviours
Intervention functions

Policies:
decisions made by authorities concerning interventions

Putting COM-B, the Theory Domains Framework and the Behaviour Change Wheel together
This talk

1. The role of behaviour in health
2. Analysing behaviour using COM-B and TDF
   - Example: Increase hand hygiene behaviour amongst hospital staff
3. Behaviour change techniques
   - Example: Improve GP management of lower back pain
4. Designing interventions: the Behaviour Change Wheel
5. If time, applying theory to evidence synthesis
In summary .... To change behaviour ....

• Start by understanding the problem
  – Identifying the behaviours
    • Who, what, where, when
  – Understand the behaviours
    – COM-B, TDF
    – Before designing the intervention

• Consider the full range of effective interventions and supporting policies

• Identify behaviour change techniques
  – In primary research and evidence synthesis
Acknowledgements

• Key collaborators in this work
  – Prof Marie Johnston, UCL and University of Aberdeen
  – James Cane
  – Prof Robert West, UCL

• Funder

MRC Medical Research Council