

# Applying behavioural science to combating antimicrobial resistance

Dr. Fabiana Lorencatto

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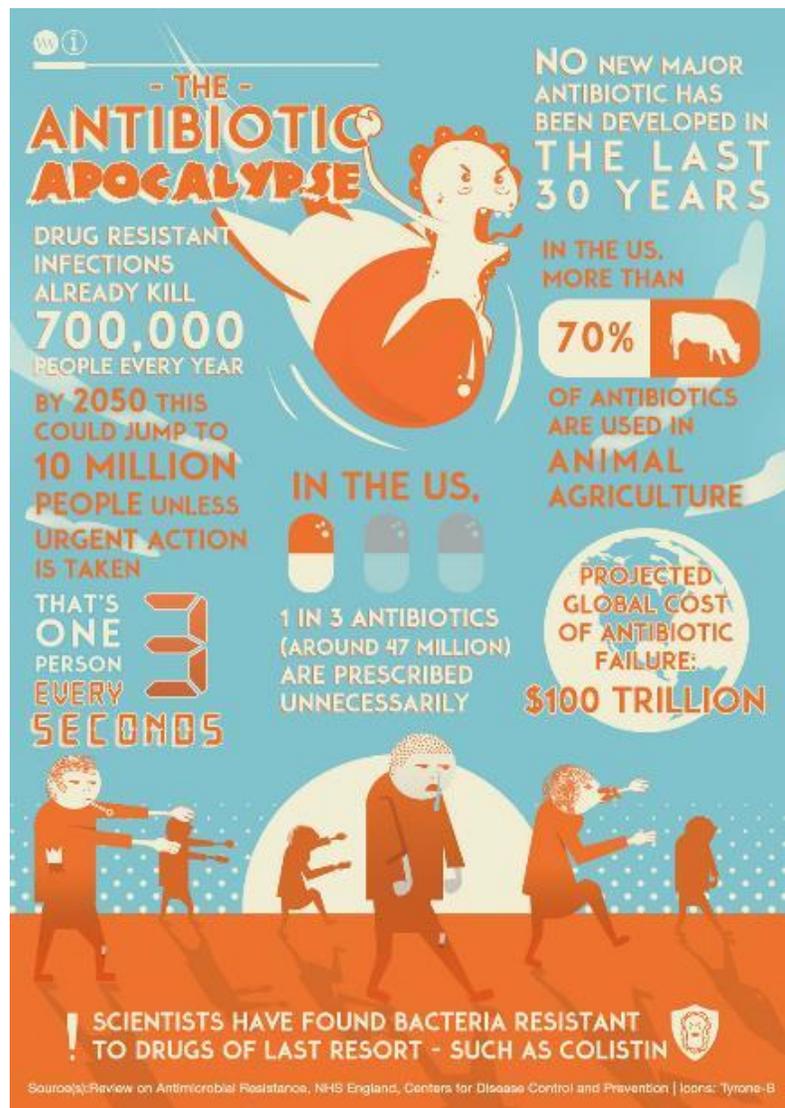


@UCLBehaveChange  
@Fabilorencatto



- Why is behaviour change important to antimicrobial resistance?
- Limitations typical approaches to developing antimicrobial stewardship interventions
- Highlight how behavioural science can be applied to:
  - Explore what factors influence antimicrobial stewardship behaviours
  - Systematically design interventions
- Examples and recommendations





## Overuse of antibiotics 'risks return to dark ages of life-threatening surgery'

Warning comes as report shows 3 million common surgical procedures could be hazardous if infections become resistant to antibiotics



## Antibiotic madness: A fifth of prescriptions given out by GPs are to patients who do not need them

- Overuse of antibiotics means many germs have evolved and become resistant
- Yet doctors continue to hand out antibiotics for the most minor of conditions
- Researchers found 41 per cent of patients with a cough were given antibiotics

## CAUSES OF ANTIBIOTIC RESISTANCE



Antibiotic resistance happens when bacteria change and become resistant to the antibiotics used to treat the infections they cause.



**What do these all have in common?  
All of these are forms of human behavior...**



Poor infection control  
in hospitals and clinics



Lack of hygiene and poor  
sanitation



Patients not finishing  
their treatment



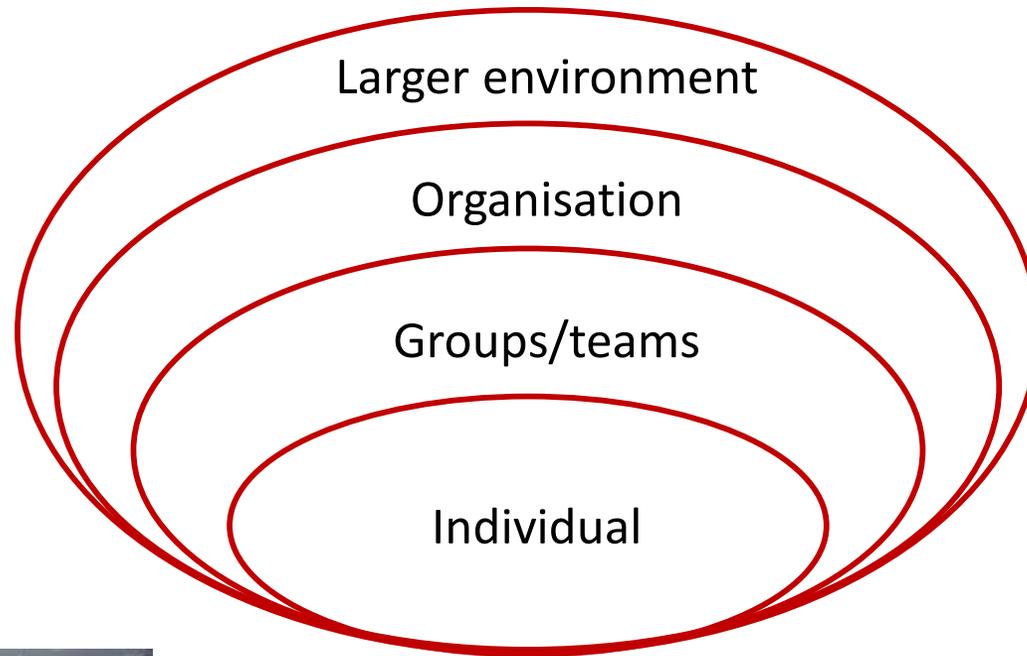
[www.who.int/drugresistance](http://www.who.int/drugresistance)

**#AntibioticResistance**



World Health  
Organization

- ...of many different types of **people and roles** at different levels in **organisations, networks and systems**





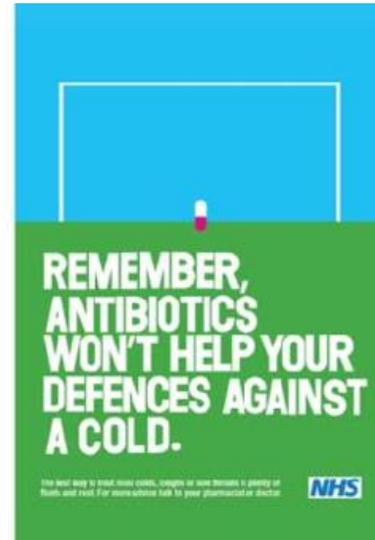
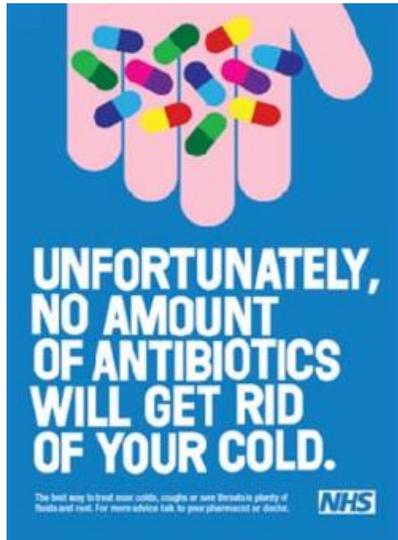
## UK Five Year Antimicrobial Resistance Strategy 2013 to 2018



AIM: to **reduce antibiotic use** by 15% by 2024

- 1) Improve **hygiene practices** to stop the spread of infectious diseases
- 2) Reduce the overuse or false **prescription** of antimicrobial drugs
- 3) Increase **adherence to evidence-based guidelines**

- Patient and public



## Effectiveness of interventions to improve the public's antimicrobial resistance awareness and behaviours associated with prudent use of antimicrobials: a systematic review <sup>FREE</sup>

Lesley Price ✉, Lucyna Gozdzielewska, Mairi Young, Fraser Smith, Jennifer MacDonald, Joanna McParland, Lynn Williams, Darren Langdridge, Mark Davis, Paul Flowers

*Journal of Antimicrobial Chemotherapy*, Volume 73, Issue 6, June 2018, Pages 1464–1478,  
<https://doi.org/10.1093/jac/dky076>

Published: 14 March 2018 [Article history](#) ▼



- Aim to tackle antibiotic over use and misuse
- E.g. rates of inappropriate prescribing
- 20% primary care
- 30-40% in hospitals
- Up to 75% in care homes

## Antimicrobial Stewardship (AMS)

‘coordinated interventions designed to improve and measure the appropriate use of antimicrobials by promoting the selection of the optimal antimicrobial drug regimen, dose, duration of therapy, and route of administration’ (IDSA, 2019)

## Hundreds of AMS interventions designed + evaluated to date

- 200+ antimicrobial stewardship programmes secondary care (Davey et al. 2017)
- ~100 primary care (Bradley et al. in prep)
- ~20 care homes (Crayton et al. under review)

## Test effectiveness combination of **wide range of behavioural interventions**

- Education, reminders, feedback, persuasion, etc.

## Do they work?

- ...Overall, **yes**
  - Increased appropriate use of antibiotics, compliance with antimicrobial policies
  - Reduce length of hospital admissions, duration of antibiotic treatment, costs
  - No associated increase in mortality (Davey et al. 2017)

- Wide variation and differences in effects of similar interventions
- e.g. Davey et al. effect interventions using dissemination of educational materials as main component:

**3.1%**



**50.1%.**

- Unclear what makes one intervention more effective than another, in different settings, contexts

*'Hunches...Common sense'*

*'just educate'*

*'guidelines'*

*'it worked elsewhere'*

*lack rationale...*

**ISLAGIATT  
principle**

**It Seemed Like A  
Good Idea At  
The Time**

*Prof. Martin Eccles, implementation researcher, UK*

# Why is this a problem?



1. Examine the problem

2. Ma

3. Pre



**Key principle for successful change:**

**'Choice of intervention(s) should be informed by the determinants (i.e. barriers/facilitators) that influence current behavior'**

Hulscher & Prins, 2017



'There is, however, an urgent need for the **development and testing of *planned behavioural change interventions*** where an **assessment of the likely barriers and facilitators informs the choice** of the intervention components.' (Hulscher & Pins, 2017)

'Given that the extent to which current antibiotic stewardship programmes have incorporated insights and approaches from behavioural science is limited, there is an urgent need to **bring together key stakeholders** in the **design and delivery** of stewardship programmes and research experts **in improvement and social sciences to develop more impactful stewardship programmes.**' (Davey et al. 2017)

# Facilitated through application of behavioural and social science

Disciplines dedicated to scientifically studying human behaviour:



**Warning:  
no magic bullets  
or universal truths**

- Offer **theories, frameworks, methods** for **understanding what drives behaviour** and how to use this to most **effectively change it**

## Driving sustainable change in antimicrobial prescribing practice: how can social and behavioural sciences help?

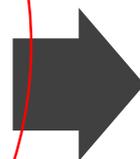
Fabiana Lorencatto ✉, Esmita Charani, Nick Sevdalis, Carolyn Tarrant, Peter Davey

*Journal of Antimicrobial Chemotherapy*, Volume 73, Issue 10, October 2018, Pages 2613–2624, <https://doi.org/10.1093/jac/dky222>

**Published:** 17 July 2018



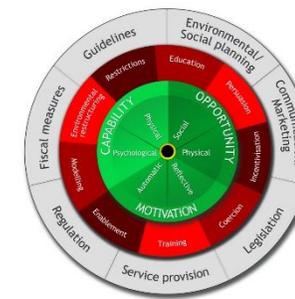
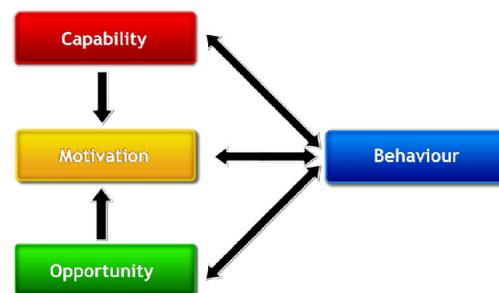
What behaviour are you trying to change?



Why is current behaviour as it is?  
What would it take to bring about change?



Matching choice of intervention strategy to behavioural diagnosis



# Step 1: Defining the problem in behavioural terms

- Tendency to think in terms of outcomes
- 'reduce infection rates' or 'infection control'  $\neq$  a behaviour
- Product of numerous discrete behaviours



**Hand-washing**

**Effective use of protective clothing**



**Cleaning surfaces**

**Maintaining appropriate isolation**



# Particularly important for AMS

- Multiple actions, actors, settings, time points

Identifying +  
diagnosing suspected  
infections

Diagnostics/ tests

Timely administration

Communication

with colleagues/ other HCPs

With patients and relatives

Decision making +  
prescribing

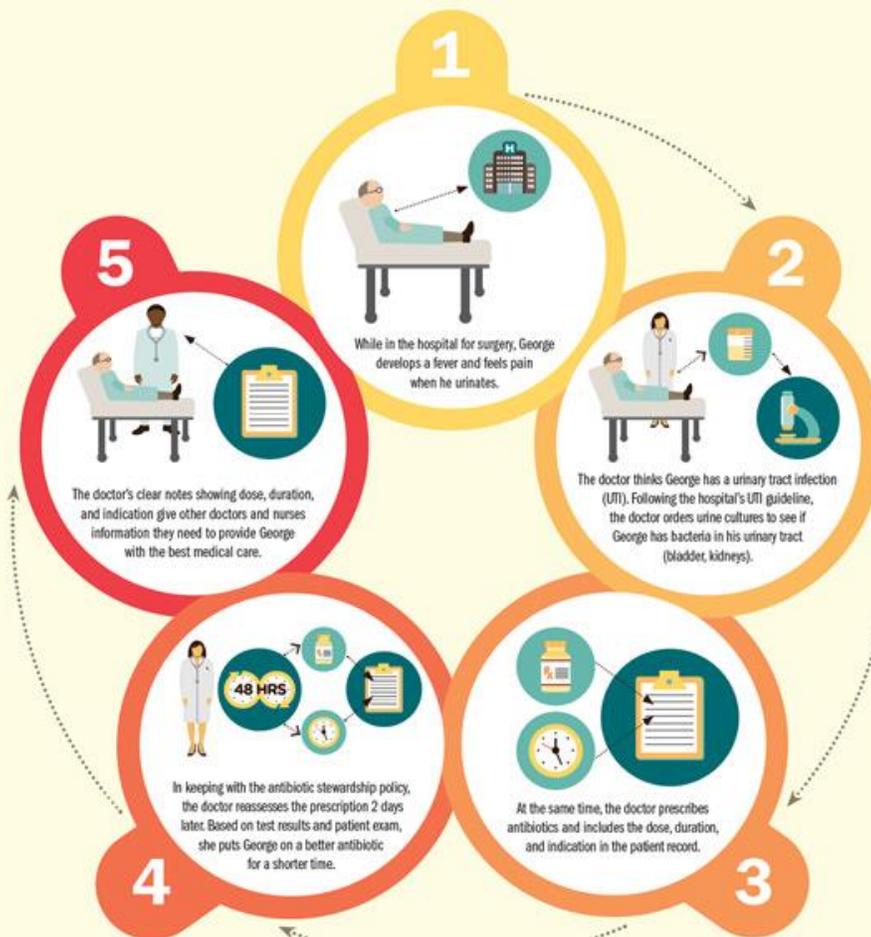
- choice, route, dose,  
duration of antibiotic

Reviewing, switching,  
stopping, de-  
escalating

Documenting  
decisions in records

## Improving antibiotic prescribing in hospitals

Key moments for improving the cycle of antibiotic prescribing practices



- Different behaviours and different actors will be driven by different influences
- Need to precisely specify which behaviours wish to target so that:
  - More likely to succeed if specific
  - You can conduct a more informative 'behavioural diagnosis'
  - Design more focused/ tailored interventions
  - Facilitate measurement and evaluation
  - Replicate and scale up
- Check - have we targeted the 'right' behaviour?

- **Often vague:** *'prescribing of antibiotics by hospital physicians'*
  - Which physician group? For which patients? When? Which antibiotics?
  - Reviewing/Switching/Stopping rather than prescribing?
- Review of behavioural specification in care homes AMS



## Whose behavior?

- ✓ **Clinicians (physicians, pharmacists, nurses, infection control practitioners, medical directors) n=13**
- ✓ Patients & family n=1
- ✓ Family & unspecified other n=1
- ✓ Both clinician & patient/family n=1
- ✓ Other unspecified n=4

## Which behaviours?

- ✓ **Prescribing n=16**
- ✓ Enacting stewardship role n=3
- ✓ Adherence to Guidelines n=2
- ✓ Monitoring of AKI & vancomycin trough levels n=1

- Asks: *precisely who would do what, differently, to which patients, that would lead to improved outcome?*

**Actor-** *who?*

**Action** – *needs to do what?*

**Context-** *where?*

**Timeframe-** *when?*

**Target-** *to whom?*

## A (more!) behaviourally specific example

Surgeons (**who**) working on the cardiac surgery ward (**where**) stopping antibiotics (**what**) 24 hours after surgery (**when**) for coronary artery bypass graft patients (**whom**)

(Sun et al 2011)

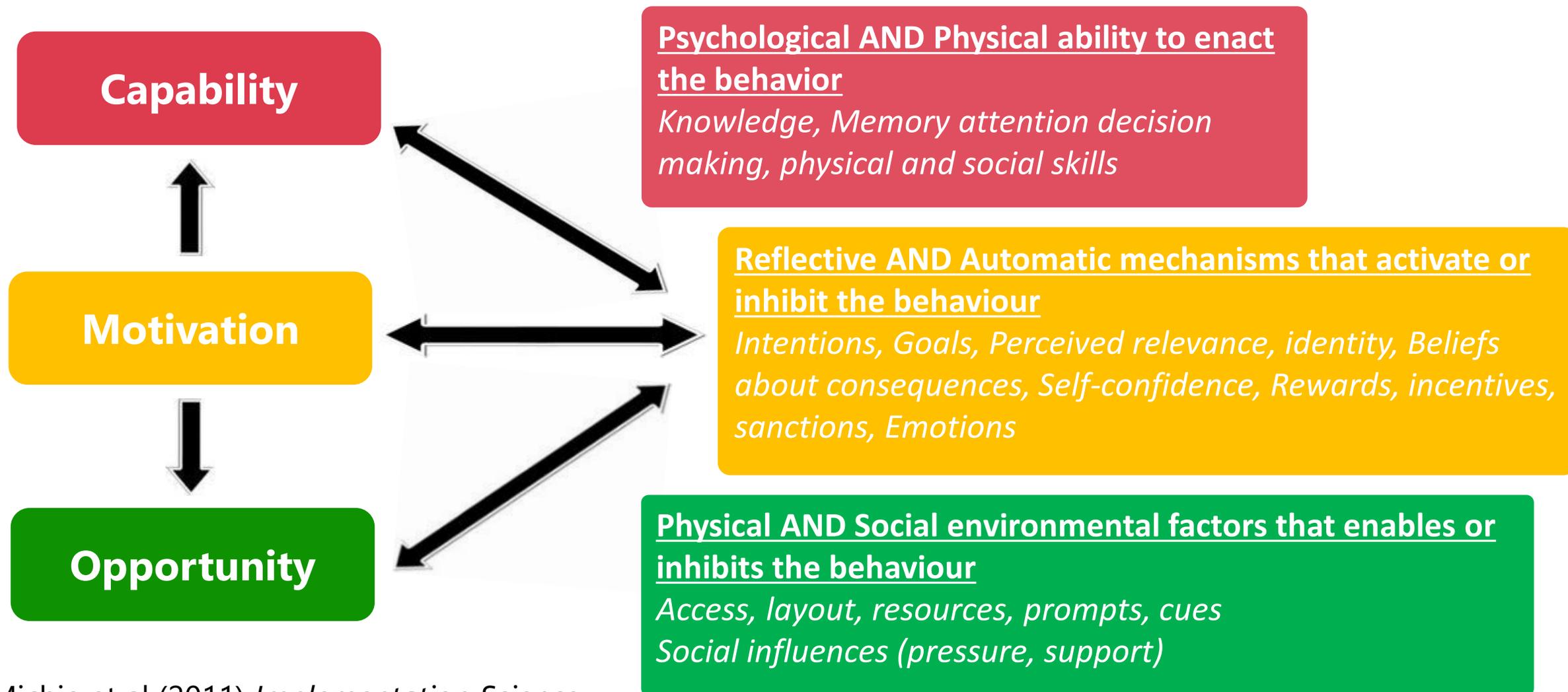
### Behavioural diagnosis

- **Why** are behaviours as they are?
- **What needs to change** for the desired behaviour/s to occur?
- ***Clinical practice is a form of human behaviour...***
- Answering these Qs helped by a **theory of behaviour change**



Prof. Susan Michie

Behaviour occurs as an interaction between three necessary conditions



**Capability**



Am I aware of what I need to do (guidelines/evidence)?  
Appropriate skills/training?  
How do I decide to do X?

**Motivation**



Is doing X part of my clinical role?  
What will happen if I do X? What if I don't do X?  
Is it a priority?  
How confident am I?  
How worried/ concerned?

**Opportunity**



Do I have sufficient resources (time/ staff/ equipment) to do X?

Is doing X influenced by my peers, managers, other professional groups, patients, relatives?

Open Access

Research

## BMJ Open Antibiotic prescribing in long-term care facilities: a qualitative, multidisciplinary investigation

Aoife Fleming,<sup>1</sup> Colin Bradley,<sup>2</sup> Shane Cullinan,<sup>1</sup> Stephen Byrne<sup>1</sup>

Newlands et al. *Implementation Science* (2016) 11:11  
DOI 10.1186/s13012-016-0372-z

Implementation Science

RESEARCH

Open Access

## Barriers and facilitators of evidence-based management of patients with bacterial infections among general dental practitioners: a theory-informed interview study



Rumana Newlands<sup>1</sup>, Eilidh M. Duncan<sup>1\*</sup>, Maria Prior<sup>1</sup>, Paula Elouafkaoui<sup>2,3</sup>, Andrew Elders<sup>4</sup>, Linda Young<sup>3</sup>, Jan E. Clarkson<sup>2,3</sup>, Craig R. Ramsay<sup>1</sup> and for the Translation Research in a Dental Setting (TRiADS) Research Methodology Group



Drug safety | Free Access

## Doctors' perspectives on the barriers to appropriate prescribing in older hospitalized patients: a qualitative study

Shane Cullinan, Aoife Fleming, Denis O'Mahony, Cristin Ryan, David O'Sullivan, Paul Gallagher, Stephen Byrne

Open access

Research

## BMJ Open Qualitative study using interviews and focus groups to explore the current and potential for antimicrobial stewardship in community pharmacy informed by the Theoretical Domains Framework

Leah Ffion Jones,<sup>1</sup> Rebecca Owens,<sup>1</sup> Anna Sallis,<sup>2</sup> Diane Ashiru-Oredope,<sup>3</sup> Tracey Thornley,<sup>4</sup> Nick A Francis,<sup>5</sup> Chris Butler,<sup>6</sup> Clodna A M McNulty<sup>1</sup>

**Capability**



**Motivation**



**Opportunity**

Understanding of AMR? What antibiotics can/cannot treat?  
Use of/ awareness of guidelines for antibiotic prescribing?  
Procedures for diagnosing/treating infections?

Consequences of prescribing vs not prescribing an antibiotic?  
Will it make a difference to AMR? Concerns/fears around this?  
Is promoting antimicrobial stewardship part of their role?  
Competing priorities? Incentives to use antibiotics less?

Team working dynamics and communication? Availability of diagnostic tests, different types of antibiotics? Time? Costs?  
Influence of patients and their relatives, other healthcare professionals?

✓ All were aware of AMR and growing public health threat

Capability

## However...

- Poor clinical microbiology knowledge, incorrect dose adjustment (Chaves, 2014)
- **Variable knowledge of guidelines for antibiotic prescribing** (Fleming, 2014)
- **Lack of training and guidelines specific to patient group / care setting** (Cullinan, 2014)
- **Uncertainty around diagnosis** of infection in patients with comorbidities, unclear signs of infection (Fleming, 2014)
- **Unaware own antibiotic prescribing** practices, local **AMR rates, targets** (Fleming, 2014)

## Motivation

- **Fear/anxiety** of missing something and potential harm to patients if antibiotic not prescribed [all]
- **Alternative** treatments/ local measures to remove source of infection **won't work**, or sometimes **make things worse** [Newlands et al. 2016]
- Mixed views as to whether own practice/ prudent use of antibiotics **will make a difference to AMR** [all]
- Many clinical issues to discuss/address...antimicrobial stewardship **not seen a key issue....other competing demands** [all]
- **Confidence deviating from guidelines** based on **clinical judgement/expertise**

(Fleming et al. 2014)

## Physical:

- **Lack of diagnostic equipment + timely** interpretation of microbiology **test results** [Fleming, 2014; Newlands, 2016]
- Lack of time + high work load = **no time + no quality improvement culture** [all]
- Competing priorities + resource constraints (e.g. surgery) = responsibility for and communication about antimicrobial decision making becoming diffuse/ uncoordinated [Rawson et al. 2016]

## Social:

- Prescribing etiquette/hierarchies- unwritten social rules, override policy and guidelines [Charani, 2013]
- Doctors prescribe but **nurses key gate-keeper role** communicating care issues and organising clinical assessments....their influence sometimes **felt as a pressure** by doctors and pharmacists [Fleming, 2014]
- **Pressure from patient /families → doctors prescribing medicines not completely happy with** [Cullinan, 2014]
- Pharmacists keen to expand role to AMS but **not empowered/ limited opportunity to meet as team**

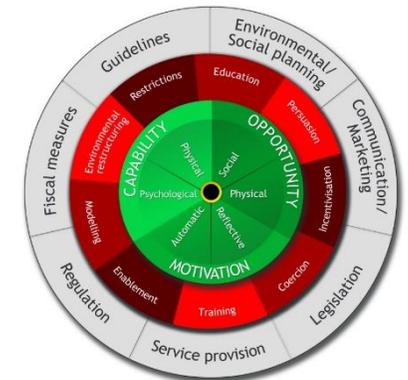
Opportunity

### 3. Moving from diagnosis to intervention

- No single influence on antimicrobial prescribing<sup>1</sup>
- **Complex behaviour influenced by equally complex combination of factors**
  - beyond knowledge deficits...
- Need to **consider broad range of strategies** to change behaviour
  - - beyond education...
- And **match choice of strategy to behavioural diagnosis**

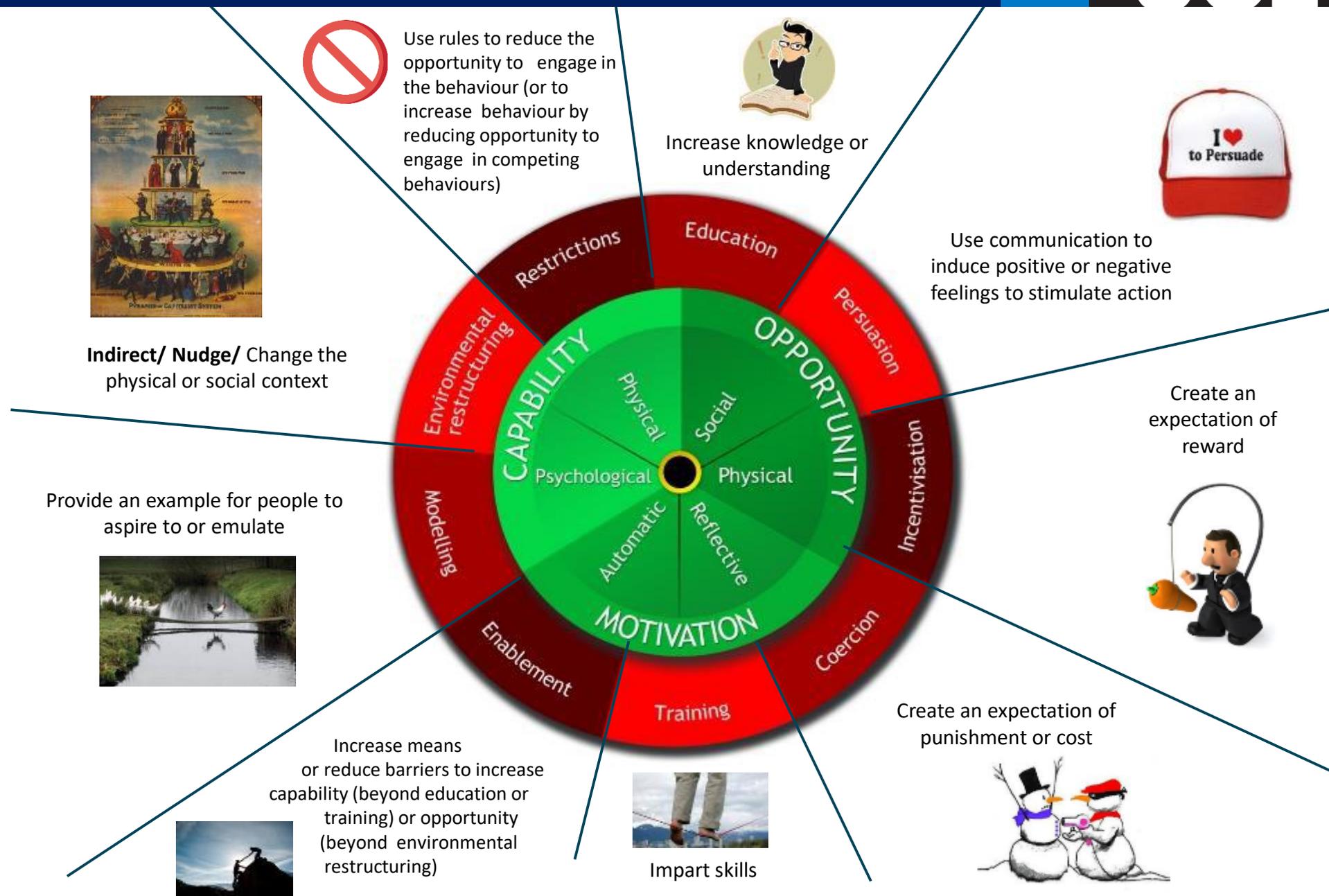


- To outline/define variety of options and aid selection
- Several such frameworks to date:
  - Review of 19 frameworks related to health promotion, environment, culture change, social marketing etc
  - Overlapping, none comprehensive
  - None linked to model of behaviour change
  - Different assumptions/emphasis around what drives behaviour (attitudes, unconscious biases, social environment)
- So developed a synthesis of the 19 frameworks



# The behaviour change wheel

- Behavioural theory at its core
- 9 Intervention Functions:
- 'broad categories of means by which an intervention can change behaviour'



Indirect/ Nudge/ Change the physical or social context



Provide an example for people to aspire to or emulate



Increase means or reduce barriers to increase capability (beyond education or training) or opportunity (beyond environmental restructuring)



Impart skills



Increase knowledge or understanding



Use communication to induce positive or negative feelings to stimulate action



Create an expectation of reward



Create an expectation of punishment or cost

To change ...

**Capability**

**Motivation**

**Opportunity**

Consider one or more of ...

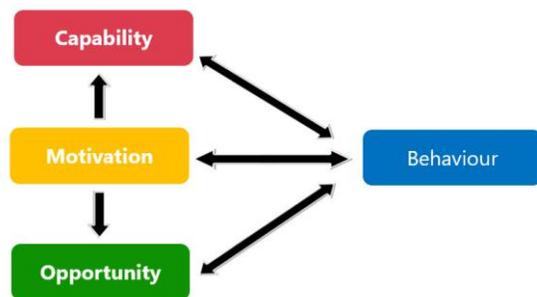
**Education – Training (i.e. build knowledge and skills)**

**Persuasion - Incentivisation - Coercion - Modelling  
(i.e. increase motivation to engage in target behaviour;  
reduce motivation competing behaviours)**

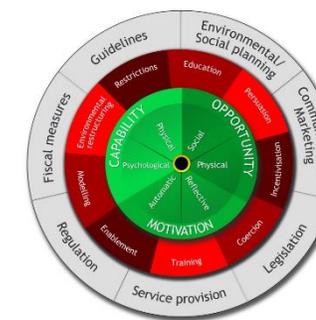
**Restriction- Environmental Restructuring – Enablement  
(i.e. to increase opportunity target beh/ reduce  
competing behaviours)**

# Interlinked tools to facilitate intervention design

	Intervention functions								
	Education	Persuasion	Incentivisation	Coercion	Training	Restriction	Environmental/ restructuring	Modelling	Enablement
Physical capability									
Psychological capability									
Physical opportunity									
Social opportunity									
Automatic motivation									
Reflective motivation									



Based on expert consensus



## **A**ffordability

Can it be delivered within an acceptable budget?

## **P**RACTICABILITY

Can it be delivered as designed and to scale?

## **E**ffectiveness/ **C**ost-effectiveness

How well does it work and is it worth the cost?

## **A**CCeptability

Is it judged appropriate to relevant stakeholders (policy makers, practitioners, the public) and engaging for potential users?

## **S**ide-effects/safety

Does it have unwanted side-effects or unintended consequences?

## **E**quity

Will it reduce or increase disparities in health/wellbeing/standard of living?

e.g. Conducting behavioural diagnosis using COM-B

- High rates of inappropriate antibiotic use in care homes – contributing to antimicrobial resistance
- Applied COM-B to explore factors influencing **antibiotic prescribing**
- Semi-structured interviews with general practitioners, consultants, nurses and community pharmacists.
- Structured interview questions around COM-B

Open Access

Research

## BMJ Open Antibiotic prescribing in long-term care facilities: a qualitative, multidisciplinary investigation

Aoife Fleming,<sup>1</sup> Colin Bradley,<sup>2</sup> Shane Cullinan,<sup>1</sup> Stephen Byrne<sup>1</sup>



**Capability**

Understanding of AMR? What antibiotics can/cannot treat?  
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**Motivation**

Consequences of prescribing vs not prescribing an antibiotic?  
Will it make a difference to AMR? Concerns/fears around this?  
Is promoting antimicrobial stewardship part of their role?  
Competing priorities? Incentives to use antibiotics less?

**Opportunity**

Team working dynamics and communication? Availability of diagnostic tests, different types of antibiotics? Time? Costs?  
Influence of patients and their relatives, other healthcare professionals?

- **Unaware** own **antibiotic prescribing** practices, local **AMR rates, targets + guidelines** for appropriate antibiotic use in nursing homes
- **Uncertainty around diagnosis** of infection in long term care patients with comorbidities



**Capability**

- **Fear** potential harm or hospitalization of vulnerable, patients if antibiotic not prescribed
- Many clinical issues to discuss in team meetings...antimicrobial stewardship **not seen a key issue....other competing demands**



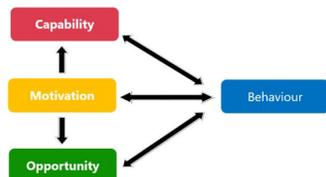
**Motivation**

- **Lack of diagnostic equipment + interpretation** of microbiology **test results**
- **Nurses** acting as **gate-keeper** role, communicating care issues and organising clinical assessments...their influence sometimes felt as a **pressure** by doctors and pharmacists



**Opportunity**





Barriers	COM-B	BCW Functions	BCTs	Strategy example
<p><b>Unaware</b> of own <b>antibiotic prescribing</b> practices, local <b>AMR rates, targets</b> and <b>guidelines</b> for appropriate antibiotic usage in care home context</p>	<p><b>Capability</b> (Psych)</p> <p><b>Motivation</b> (reflective)</p>	<p><b>Persuasion</b></p> <p><b>Education</b></p>	<p>-<b>Goal setting</b></p> <p>-<b>Monitoring</b></p> <p>-<b>Feedback on beh</b></p> <p>-<b>Discrepancy between beh and goal</b></p> <p>-<b>Social comparison</b></p>	<p><b>Audit and feedback:</b></p> <p>-<b>Set targets</b> for antibiotic use (based on <b>guidelines</b>)</p> <p>-<b>Monitor practice</b> locally</p> <p>-Provide <b>feedback on current practice, outlining deviations from guidelines/targets</b> and <b>benchmarking against other care homes</b></p>

Systematic, transparent, step-wise-approach for choice of intervention strategy



COM-B	Barrier/Enabler	Functions	Techniques	Examples
<b>Capability</b> (Chaves, 2014)	poor microbiology knowledge, incorrect dose adjustments (e.g. vancomycin)	Education Enablement	Social support (practical) Instruction on how to perform behavior	Pharmacist to dose vancomycin to reduce errors Develop specialty specific guidelines, clarify indications Increase undergraduate + CPD education
<b>Motivation</b> (Fleming, 2014)	Unaware of own antibiotic prescribing practices, local AMR rates, targets and guidelines for appropriate antibiotic usage in care home context	Persuasion Enablement	-Goal setting -Monitoring -Feedback on beh -Discrepancy between beh and goal -Social comparison	Audit and feedback: -Set targets for antibiotic use (based on guidelines) -Monitor practice locally -Provide feedback on current practice, outlining deviations from guidelines/targets and benchmarking against other care homes
<b>Opportunity Physical</b> (social) (Charani, 2013)	Juniors adhere to guideline vs prescribing norms	Modelling Enablement	Identification of self as role model, credible source	Foster leadership role of senior doctors; endorsement of guidelines by peers from same specialty

## Audit and feedback: effects on professional practice and healthcare outcomes (Review)

Ivers N, Jamtvedt G, Flottorp S, Young JM, Odgaard-Jensen J, French SD, O'Brien MA, Johansen M, Grimshaw J, Oxman AD



- ✓ Delivered **more than once**
- ✓ In **writing and verbally**
- ✓ By a **respected peer/colleague** (rather than external source/regulator)
- ✓ Targets behaviours with room for improvement
- ✓ Accompanied by **explicit recommendations and action plans for change**
- ~ Uses **multiple comparators** (i.e. top 10% peers, regional)
- ~ Not punitive in **tone**

- Still early days... primarily at behavioural diagnosis stage...
- Growing evidence base demonstrating effectiveness of interventions using behavioural science
- E.g. Intervention informed by multiple behavioural science theories
- Trained clinicians in **using point of patient tests (CRP) and communication skills**
- Significant **decrease in antibiotic prescribing** across six European countries when received training in one, more so if both
- No accompanying significant changes to hospital admissions, costs, repeat consultations

Little P, Stuart B, Francis N, Douglas E, Tonkin-Crine S, Anthierens S, Cals JW, Melbye H, Santer M, Moore M, Coenen S. Effects of internet-based training on antibiotic prescribing rates for acute respiratory-tract infections: a multinational, cluster, randomised, factorial, controlled trial. *The Lancet*. 2013 Oct 5;382(9899):1175-82.

Tonkin-Crine S, Walker AS, Butler CC. Contribution of behavioural science to antibiotic stewardship. *BMJ: British Medical Journal (Online)*. 2015 Jun 25;350.

## Watch this space:

- Two ESRC-funded multidisciplinary programmes
- **Preserving Antibiotics through Safe Stewardship**
- **Antibiotic Research in Care Homes**
- Epidemiologists, anthropologists, sociologists, psychologists, ID clinicians, designers, etc.
- Applying BCW approach to design AMS interventions



@arch\_antibiotic @PASS\_antibiotic

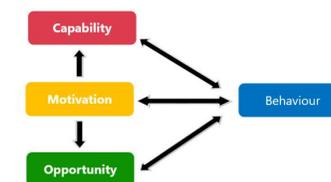
<http://arch-antibiotics.org.uk/>



- Behaviour change is key to tackling AMR
- Behaviourally complex issue: multiple behaviours, actors, settings
- Yet behaviour change not often considered when designing interventions to improve AMS
- Need for a step-change in approach: systems thinking and interdisciplinary collaboration



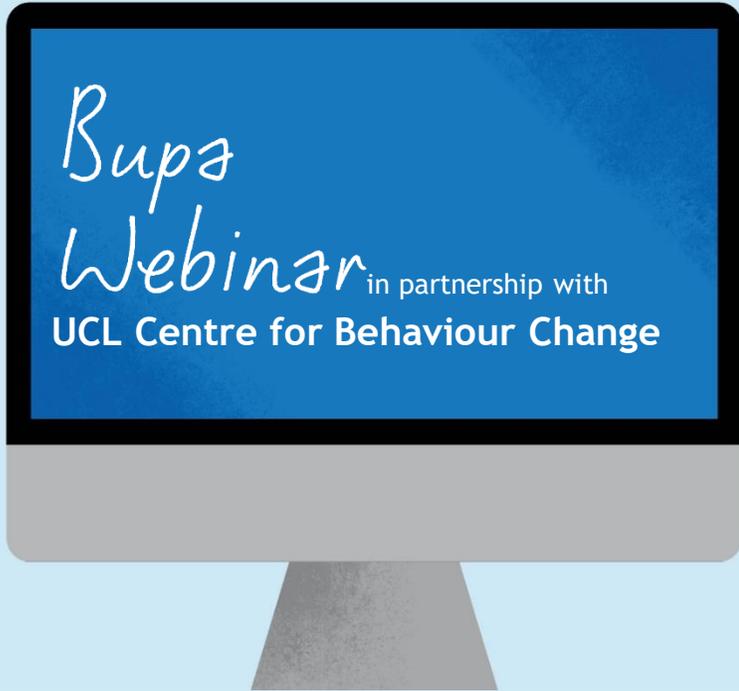
- ✓ Where possible, avoid 'rushing' to intervention and ISLIGIATT
- ✓ Be specific about what (and who/where/when/whom) you wish to change.
- ✓ Ask why would people change? What is driving behaviour?
- ✓ Look beyond education: consider full range of intervention strategies and match to behavioural diagnosis
- ✓ Look beyond AMR: at evidence in broader behaviour change literature
- ✓ Be transparent and systematic: to maximise cumulative learning and aid implementation



# Applying behavioural science to combating antimicrobial resistance

Dr. Fabiana Lorencatto  
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Thursday 12<sup>th</sup> December 2019



## Thank you

## Any questions?

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