Modelling health behaviours using social science theory

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DISCLAIMER!

- I am a social scientist with a primary focus on qualitative data

- I am <u>not</u> a mathematical modeller, and I have never done mathematical modelling

- Please take what I present here with this in mind!

Having said that, we're more similar than you might think…

- Some people say "*you're our saviour!*"
  - Thank goodness you're here, now we'll have all the answers!

- While others say "*your science is no good!*"
  - Soft, unscientific, unactionable
  - Rubbish in, rubbish out

- The reality is of course more nuanced – both disciplines have played a major role over the course of the pandemic, but we've also seen our own limitations

So let's support each other!

Theories of health behaviour

- Helpful to understand how interventions can work, in terms of:
  - Programme development (<u>prediction</u> of what could happen)
  - Evaluation (<u>explanation</u> of what did happen)

- Practically very important:
 - "*There's nothing more practical then a good theory*"

[Note: these 'theories' are often called 'models' – we'll avoid that term here to avoid confusion]

BUT…

- A comprehensive theory needs to take into account
  - Structural and policy-related factors, <u>and</u>
  - Individual-level factors

- Unfortunately, more comprehensive also =
  - More complicated
  - More difficult to use

- Mathematical modelling needs to find a balance between *<u>comprehensive</u> and <u>usable</u> behavioural theories* to be sure that we get meaningful, actionable results

Health Action Model (='Theory')

- Could you use mathematical modelling on this for explanatory or predictive purposes?

- It may be useful to give insights into the wider process, but several variables are not easily quantifiable...
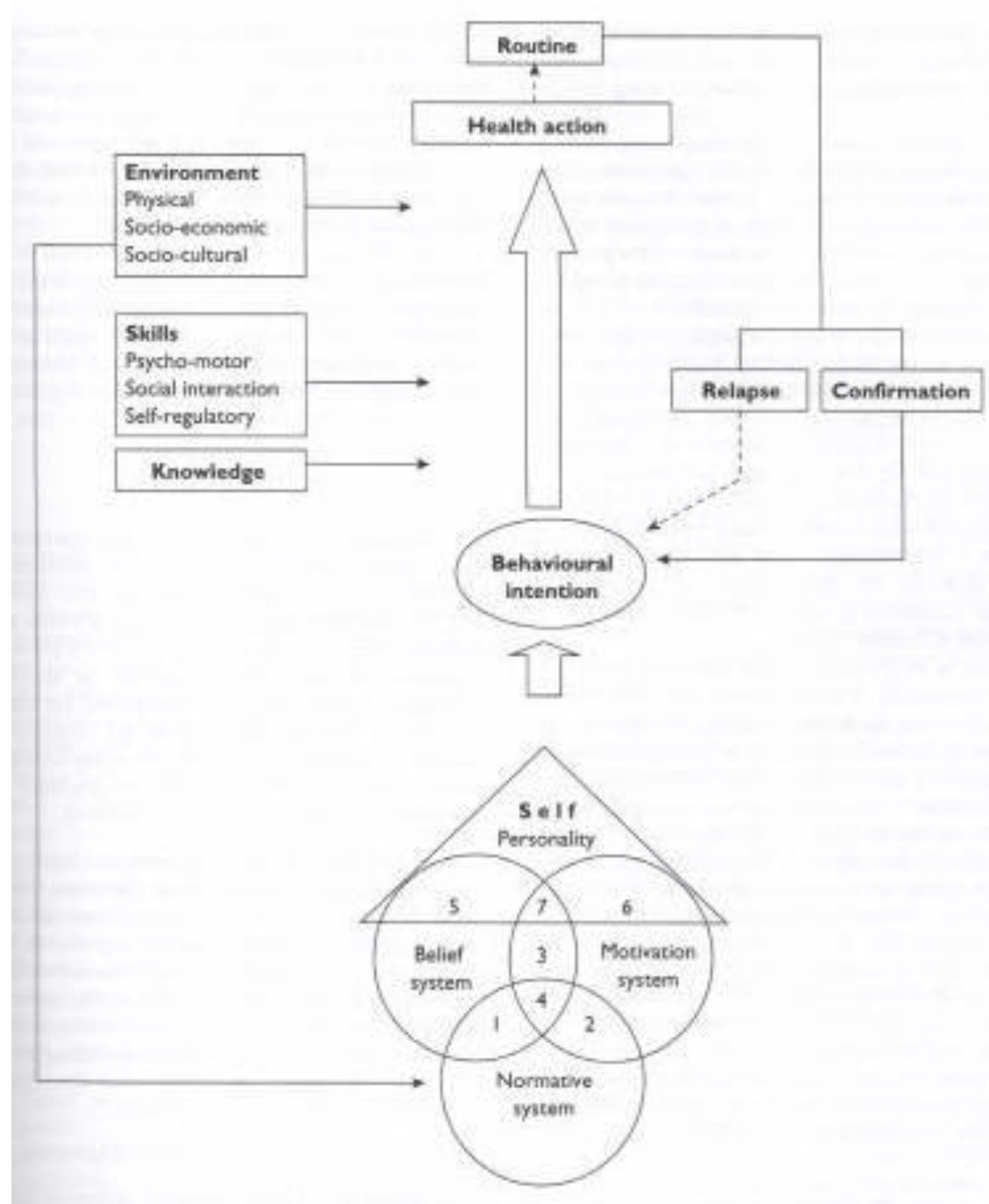
Four theories for discussion

1. Health Belief Model (equivalent to 'Health Belief Theory')
   - Easy to use, but incomplete

2. The 5Cs
   - More comprehensive, but some elements hard to quantify

3. COM-B
   - Quite complete, but difficult to use in full

4. Socio-ecological theory
   - Covers everything, but in a non-specific way

1. Health Belief Model

- One of the first psychological models of human behaviour, initially proposed in the 1950s

- HBM includes:

    i. *Perceived susceptibility* – Subjective assessment of risk of developing a health problem

    ii. *Perceived severity* – Subjective assessment of the severity of a health problem and its potential consequences

    iii. *Perceived benefits* – An individual's assessment of the value or efficacy of engaging in a health-promoting behaviour to decrease risk of disease

    iv. *Perceived barriers* – An individual's assessment of the obstacles to behaviour change

    v. *Cues to action* – A cue, or trigger, for prompting engagement in health-promoting behaviours

    vi. *Self-efficacy* – An individual's perception of his or her competence to successfully perform a behaviour

[Rosenstock IM: Historical origins of the health belief model. Health Educ Monogr 2:328, 1974]

- Widely used (e.g. to study acceptance of COVID-19 vaccinations and adherence to COVID-19 measures)
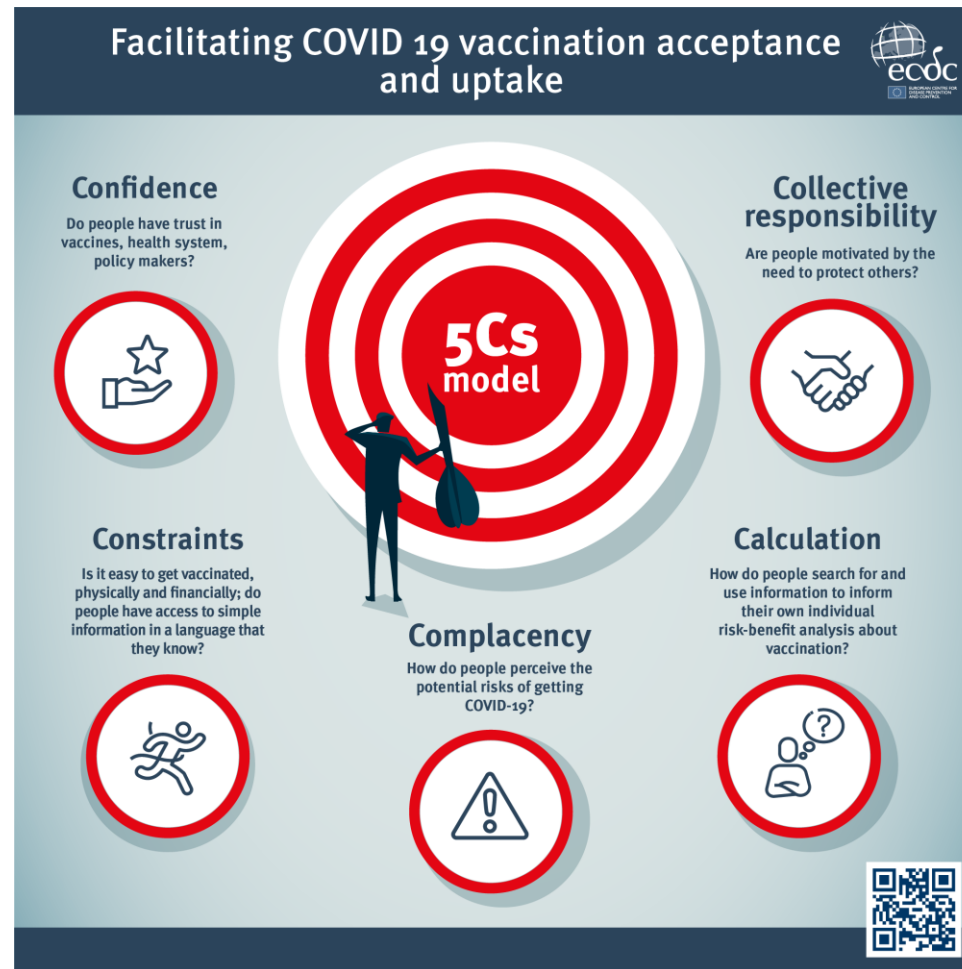- All the variables are quite easily measured

- BUT: reliance exclusively on HBM misses many/most of the (higher level, structural) variables that affect human behaviour

- Unfortunately, results from studies based on HBM can:
    - Be see as more accurate and reflective of the situation than they really are
    - Carry disproportionate weight in the minds of scientists/decision makers/the public

2. Understanding vaccination behaviours: The 5Cs model ('theory')

- Based on five antecedents that can affect an individual's vaccination behaviour:
  - Confidence
  - Complacency
  - Constraints
  - Calculation
  - Collective responsibility

Facilitating COVID 19 vaccination acceptance and uptake

Confidence
Do people have trust in vaccines, health system, policy makers?

Collective responsibility
Are people motivated by the need to protect others?

5Cs model

Constraints
Is it easy to get vaccinated, physically and financially; do people have access to simple information in a language that they know?

Complacency
How do people perceive the potential risks of getting COVID-19?

Calculation
How do people search for and use information to inform their own individual risk-benefit analysis about vaccination?

[Betsch C, Schmid P, Heinemeier D, Korn L, Holtmann C, Böhm R. Beyond confidence: Development of a measure assessing the 5C psychological antecedents of vaccination. PLOS ONE. 2018;13(12):e0208601. Available at: https://doi.org/10.1371/journal.pone.0208601]

Key populations to consider for COVID-19 vaccination

- Older age groups
- Socially-vulnerable populations (migrants, homeless, disabled etc.)
- Younger age groups (including children and adolescents who are eligible for vaccination)
- Parents
- Healthcare workers

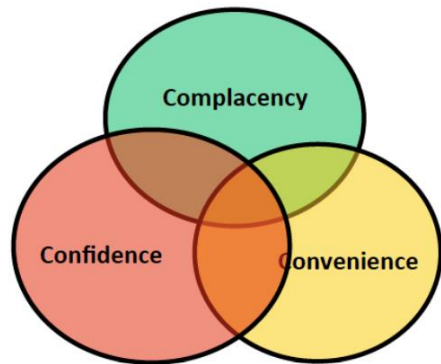**NOTE**: Identified sub-populations can be extremely heterogeneous

- This all creates challenges for mathematical modelling…

Data from hard-to-reach populations

- Marginalised ethnic minorities, undocumented migrants, people experiencing homelessness, and people with disabilities
  - Often face elevated risk of infection

- Challenges for uptake:
  - Access to COVID-19 vaccination (**C**onstraints)
  - Especially vulnerable to misinformation (especially migrants, ethnic minorities?) (**C**onfidence?)

There are quite a few theories of this type….

- Does our use of different theories and frameworks facilitate or hinder our collective work towards understanding health behaviours?

| Root cause	Definition
Access	The ability of individuals to be reached by, or to reach, recommended vaccines
Affordability	The ability of individuals to afford vaccination, both in terms of financial and non-financial costs (e.g., time)
Awareness	The degree to which individuals have knowledge of the need for, and availability of, recommended vaccines and their objective benefits and risks
Acceptance	The degree to which individuals accept, question or refuse vaccination
Activation	The degree to which individuals are nudged towards
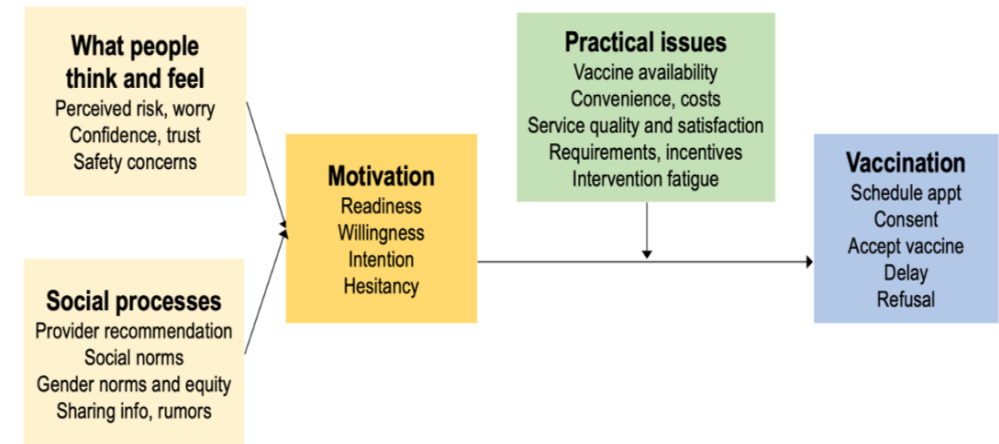
3Cs   5As   BeSD

# 3. COM-B – 'A new method for characterising and designing behaviour change interventions'
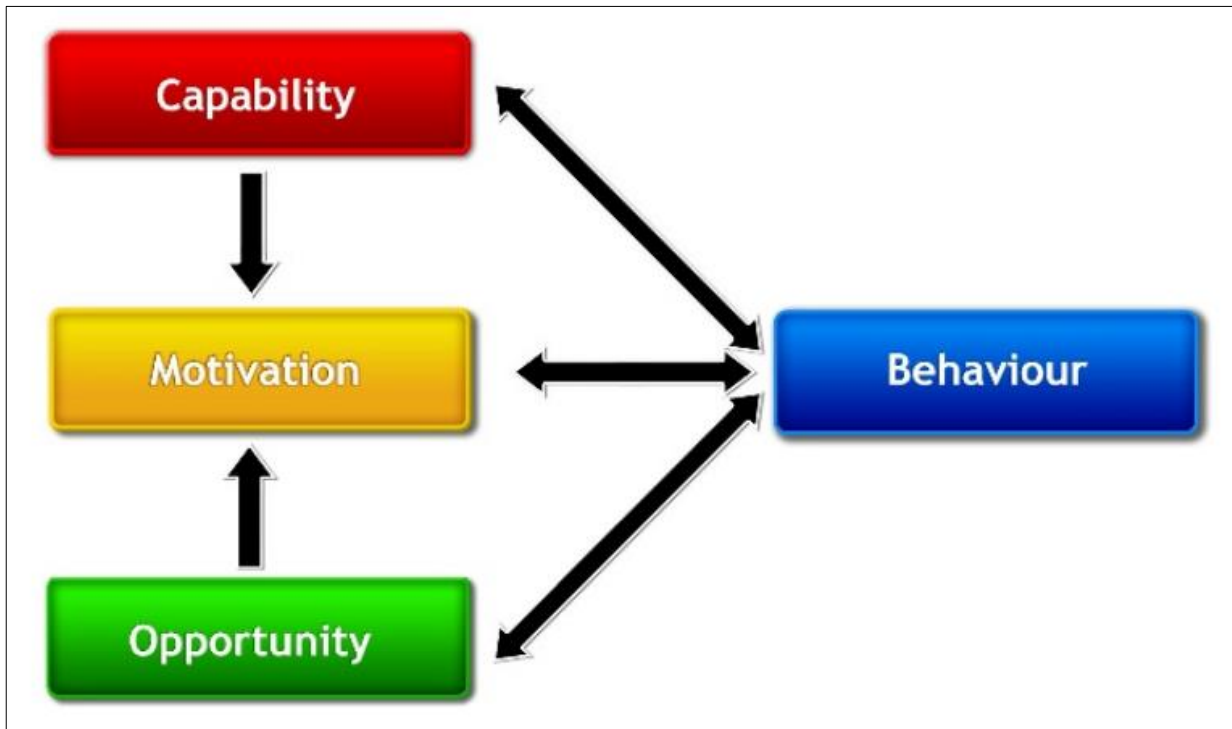
- Capability: The psychological and/or physical ability to engage in a behaviour

- Motivation: The reflective and automatic processes that make us want or need to perform the behaviour more than any other competing behaviours at that moment

- Opportunity: Physical and social factors that prompt or facilitate a given behaviour

The Behaviour Change Wheel
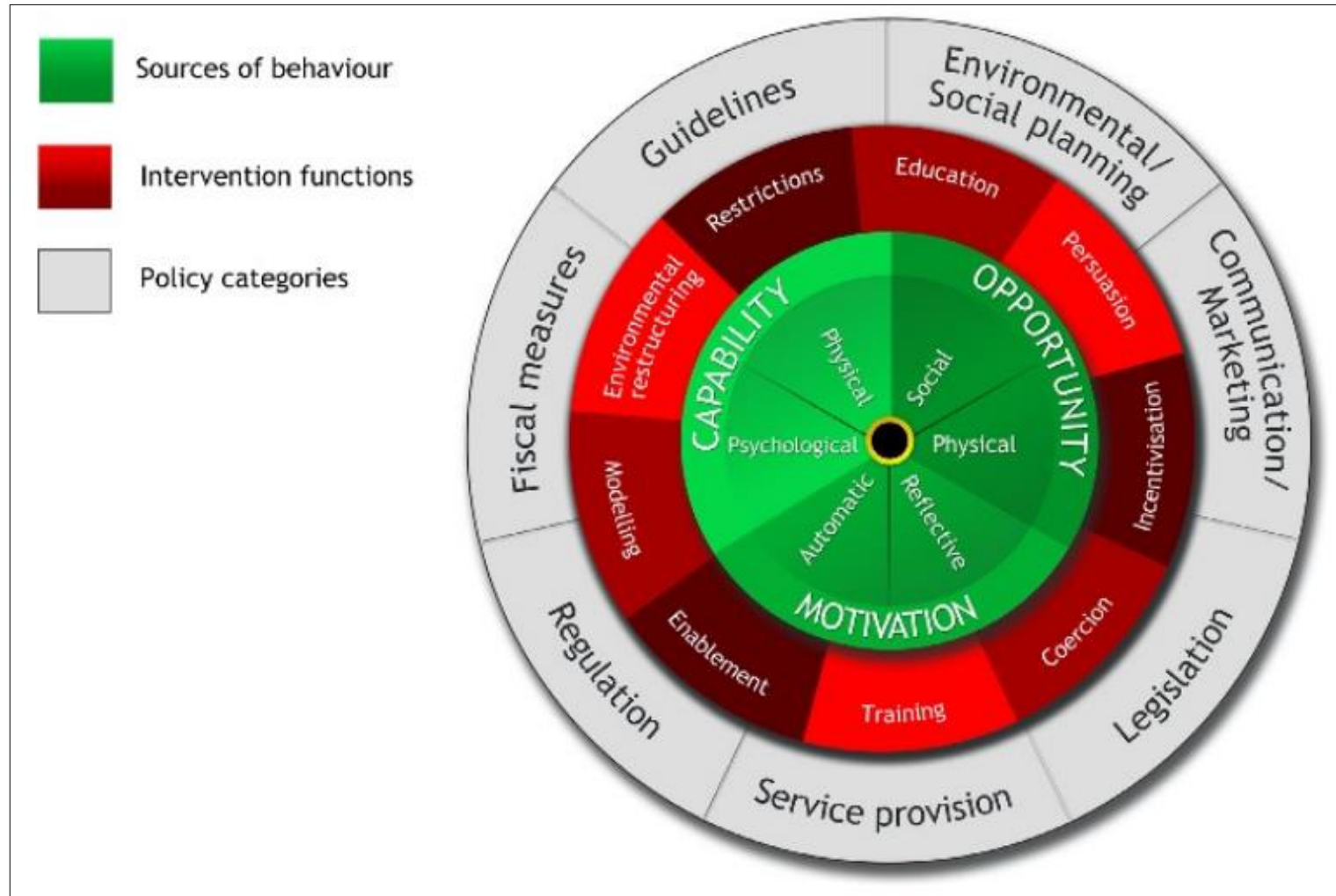
- <u>Intervention</u> = activity aimed at changing behaviour

- <u>Policy</u> = actions on the part of the authorities that enable or support interventions

- *Which, if any, of these should be included in mathematical modelling, and how?*
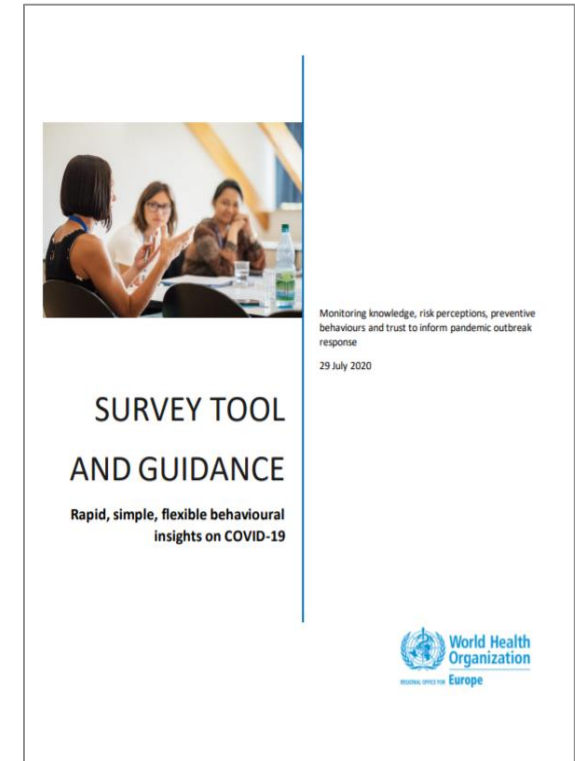
4. Socio-ecological theory
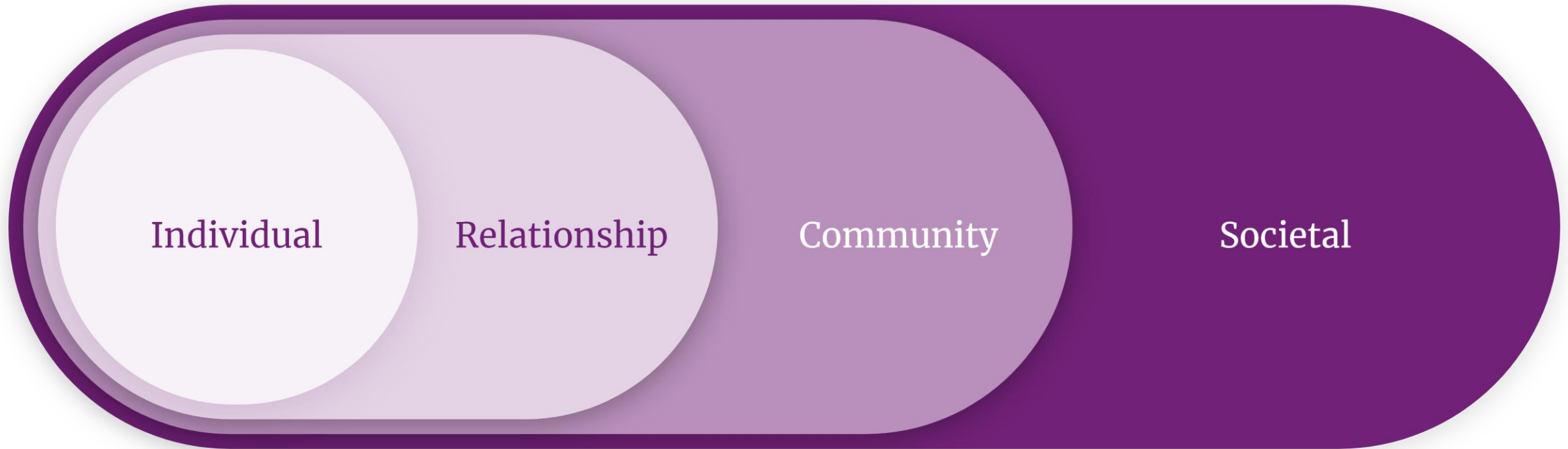
- Very useful for reminding us of the different levels that shape behaviours
- But how to quantify, and weight the different elements?
- Would such a theory have any application in mathematical modelling at all?

Example of data collected using a broad, non-specific theoretical framework

- Survey tool on behavioural insights on COVID-19 from the WHO Regional Office for Europe:
  - Tracks behaviours and attitudes towards preventive measures and policies, including vaccination
  - Freely available for use by all countries
  - Allows comparisons between and within countries, and *over time*

Variable	Items relate to	Validation of psychological construct	Value in relation to study objectives	Standard analysis conducted
	Self-assessed severity in case of contracting COVID-19	McCaul, K. D., & Weinstein, N. D. (2007). Meta-analysis of the relationship between risk perception and health behavior: the example of vaccination. Health psychology, 26(2), 136.	below) related to risk perceptions	
Preparedness and Perceived self-efficacy	Self-assessed COVID-19 self-protection and avoidance ability	Psychological construct: preparedness Validated items adapted from: Bandura, A. (2006). Guide for constructing self-efficacy scales. *Self-efficacy beliefs of adolescents*, 5(1), 307-337. Psychological construct: perceived self-efficacy Validated items adapted from: Renner, B., & Schwarzer, R. (2005). The motivation to eat a healthy diet: How intenders and nonintenders differ in terms of risk perception, outcome expectancies, self-efficacy, and nutrition behavior. *Polish Psychological Bulletin*, 36(1), 7-15.	Allows to identify possible patterns in behaviours/perceptions (see below) related to self-efficacy	Results are shown for the entire sample

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Variable: Preparedness and Perceived self-efficacy

[random order of items]

Next, we would like to know about you own practices related to COVID-19.

I know how to protect myself from coronavirus Not at all [*] [*] [*] [*] [*] [*] [*] Very much so

For me avoiding an infection with COVID-19 in the current situation is... Extremely difficult [*] [*] [*] [*] [*] [*] [*] Extremely easy

Please click CONTINUE to proceed

Geographical disparities in data availability

- Responses to an ECDC call to participate in a survey on behavioural and social science research capacity not evenly spread across different regions of the EU/EEA

- Comparable behavioural data for modelling is not available in all EU/EEA countries

- Countries with lower-than-average COVID-19 vaccination coverage are under-represented:
  - More need (misinformation levels higher, vaccination coverage lower), but less capacity

Risk of over-generalising findings between countries

- Findings from modelling of behaviours on one country cannot be extrapolated to other countries or to the whole EU
  - e.g. 'X measure is more effective than Y measure' – as during the pandemic

- Historical, cultural, political factors all play a huge role in the way a measure is implemented
  - Implementation of a measure in one setting is not necessarily the same as implementation of the 'same' measure in another
  - Nature and extent of implementation is premised on many factors, not least <u>trust</u>

- Also: interpretation of survey questions by participants may not be the same in different settings

Conclusion 1 - All theories are inadequate, but theories are still needed

- Theories are not all equally useful for mathematical modelling

- Proximal variables are easier to measure accurately, and it is easier to assess an association between proximal variables and behaviour

- Linkages are more complex as the variables become more distal, and more difficult to measure and weight

- BUT an exclusively individual-focused model (e.g. Health Belief Model), based on proximal variables, will provide an incomplete picture

- Distal variables are still highly influential, and they do need to be considered

Conclusion 2 - Highlight the inherent weaknesses in the theory you use in your modelling

- Even the best analysis of the best data will be incomplete

- Important always to acknowledge the weakness in any mathematical model that is concerned with human behaviour

- *Beware the tyranny of unwarranted quantitative authority!*

Conclusion 3 – The need for methodological development

- Don't just take the easy option and go for the Health Belief Model – by itself it's just not good enough!

- Most behavioural theories were not designed with mathematical models in mind

- The door is open for methodological innovation in this field

- We need to create a happy medium so that the behavioural theories used for mathematical modelling are:

  - Pragmatic and usable
  - Able to accurately take into account the key structural and cultural factors that impact on behaviour

Thank you for listening!