# Intervention complexity in public health

James Thomas

# Opening

- What are ‘simple’ public health interventions?
- What are ‘complex’ public health interventions?

- Poll
  - Can anyone name or describe a simple intervention in public health?

# About me

- Worked in the EPPI-Centre for a long time
- Systematic reviews – mostly for Department of Health & Social Care / PHE
- Addressing questions beyond effectiveness
- Also interested in making the review process more efficient using new technologies
- Cochrane roles:
  - Review author
  - Co-convenor Qualitative and Implementation Methods Group
  - Co-Senior Scientific Editor Cochrane Handbook
  - Co-lead on Project Transform: support Cochrane with information technologies (EPPI-Reviewer and machine learning)

# Acknowledgements


- MRC methodology project ‘MACH’ - Mark Petticrew, Alison O’Mara-Eves, Theo Lorenc, G.J. Melendez-Torres, Sian Thomas, Lambert Felix, Katy Sutcliffe, Dylan Kneale
- Papers / thinking from many people including Diane Finegood, Penelope Hawe, Harry Rutter, Alan Shiell, Martin White + many more
- The EPPI-Centre team

# Outline

- Discuss some of the main issues relating to complexity in public health
  - Arising from the nature of public health interventions
  - Arising from epistemology
  - Arising from a limited evidence base
- Discuss “what can we do?”

# For example: Face masks / coverings

- A simple mechanism: a barrier preventing / reducing SARS-CoV-2 from entering or leaving the mouth / nose
- Some studies address an exact question of efficacy – finding that masks can indeed prevent virus particles from moving in both directions
- Do masks ‘work’ then?

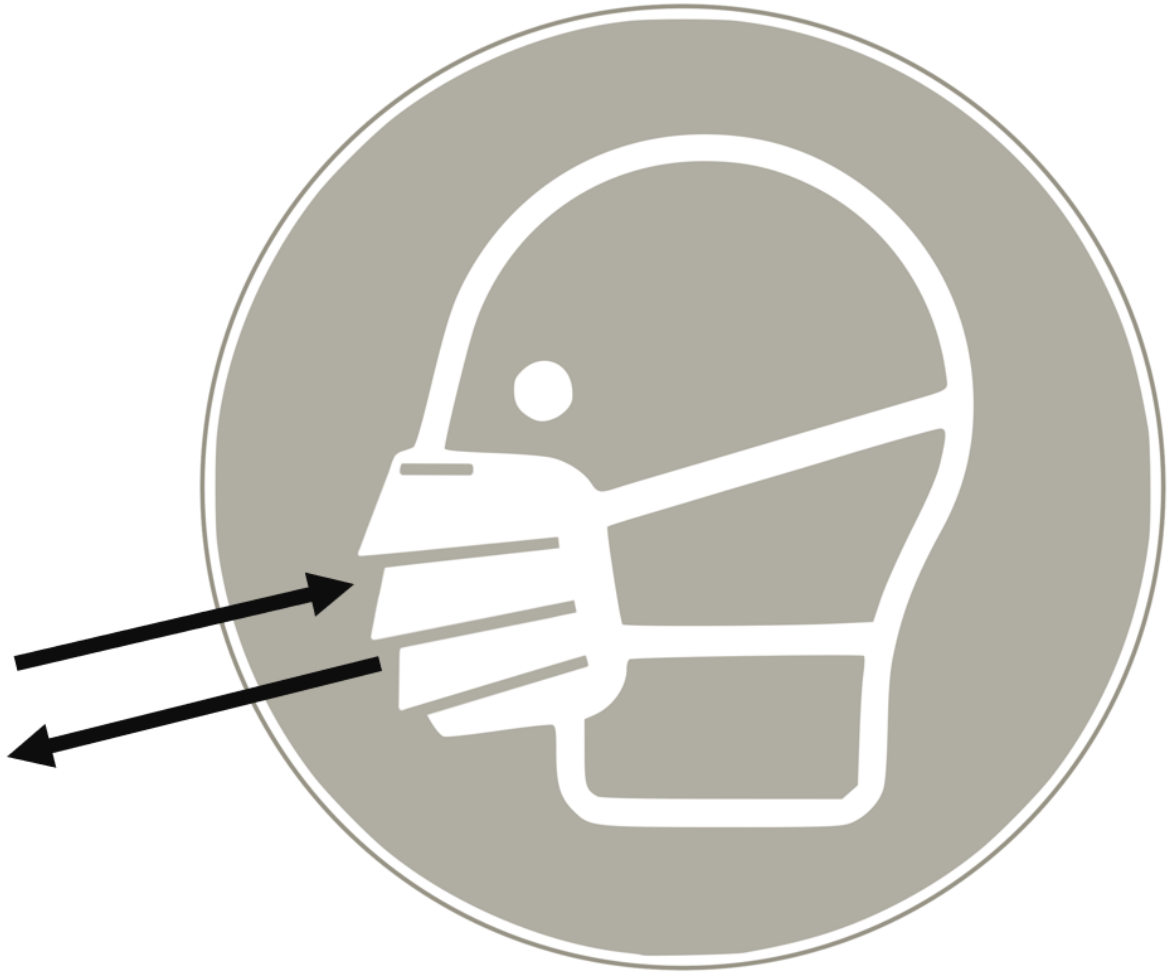


Image from: https://en.wikipedia.org/wiki/Face_masks_during_the_COVID-19_pandemic

# Face coverings at scale

Moving from understanding the action of a barrier to a policy of using that barrier…

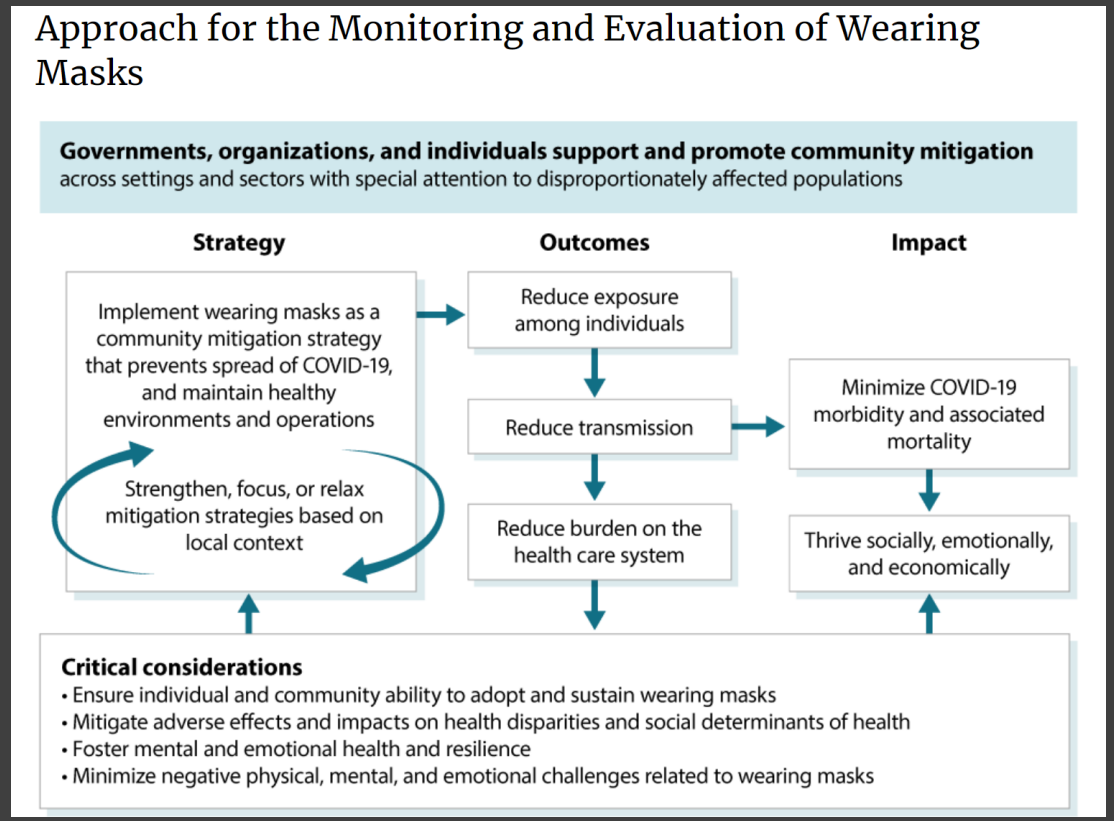




Image from: https://www.cdc.gov/coronavirus/2019-ncov/php/mask-evaluation.html

# The politics of face coverings!

When interventions are introduced into a system, outcomes can be unpredictable



Source: Dr Ellie Murray's Twitter profile

# Describing complex public health interventions…

- Equates to ‘describing public health interventions’
  - It’s hard to think of a ‘simple’ intervention once you take account of how and where it is to be introduced
- Important to note: ‘complexity’ isn’t a property of an intervention
- Complexity arises when we want to understand its impact, and stems from
  - The nature of public health interventions
  - How we ‘know’ in public health (epistemology)

# Characteristics of public health interventions

| Types of intervention | Different ‘levels’ of intervention | Media / mode of delivery very heterogeneous | Common features |
|---|---|---|---|
| • Behaviour change; policy / legislative change; service provision; providing resources; changing norms / attitudes / beliefs | • Individual<br>• Family<br>• Community<br>• Population | • Leaflets, counselling, vaccines, service availability, legislative, environmental change…<br>• Multiple components are common | • The ‘distance’ between intervention and expected health outcome<br>• The ‘indirectness’: e.g. the fact that a change in legislation or behaviour is intended to result in a change in health outcomes<br>• The length of time over which effects are expected |

# ‘Complex’ intervention

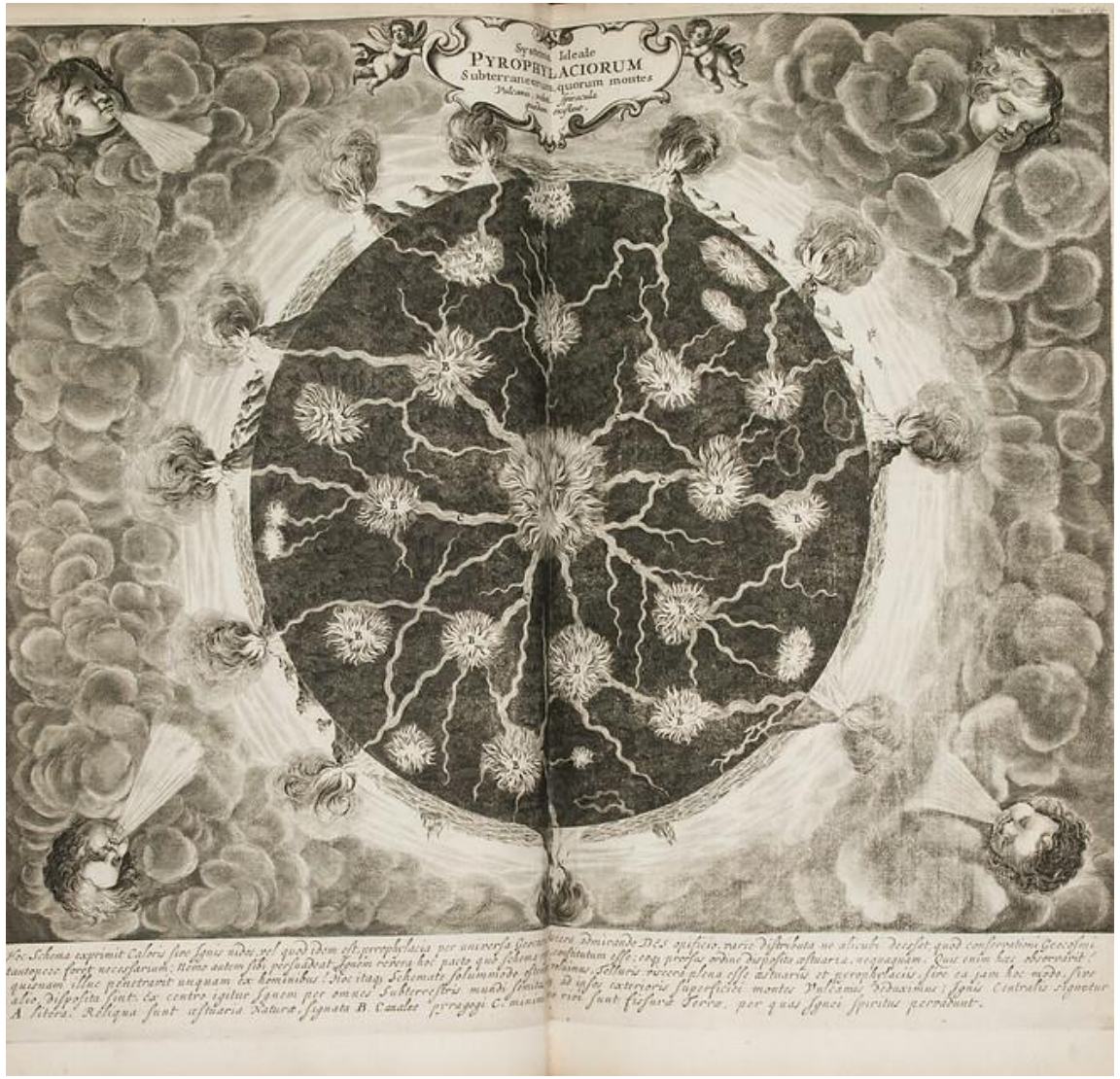
- Once defined as an intervention with many parts
- Is that complex? Or just complicated?
- ‘True’ complexity:
  - non-linear effects
  - Phase changes
  - Feedback loops
  - Intervention timing
  - Causal pathways less well understood
  - Less predicable

# ‘Knowing’ in public health is hard

- Understanding the effect of even a ‘simple’ intervention is hard, because the effect is generated by the interaction between intervention and context
  - i.e. it’s often not the intervention: it’s people’s individual and corporate behaviours that produce the outcome
- Understanding what gives rise to an outcome in one context may have as much to do with the context, as the intervention itself
- This means that it’s often important to consider the context within which an intervention is implemented in considerable detail

# Complex adaptive system

- The interaction of intervention with the system within which it is introduced becomes the focus
- Outcomes: a property of the system
- Interventions as ‘perturbations’ in a system
- The system may respond in unforeseen ways
- Doesn’t change what is actually happening



# An additional layer of complexity: the existing evidence base

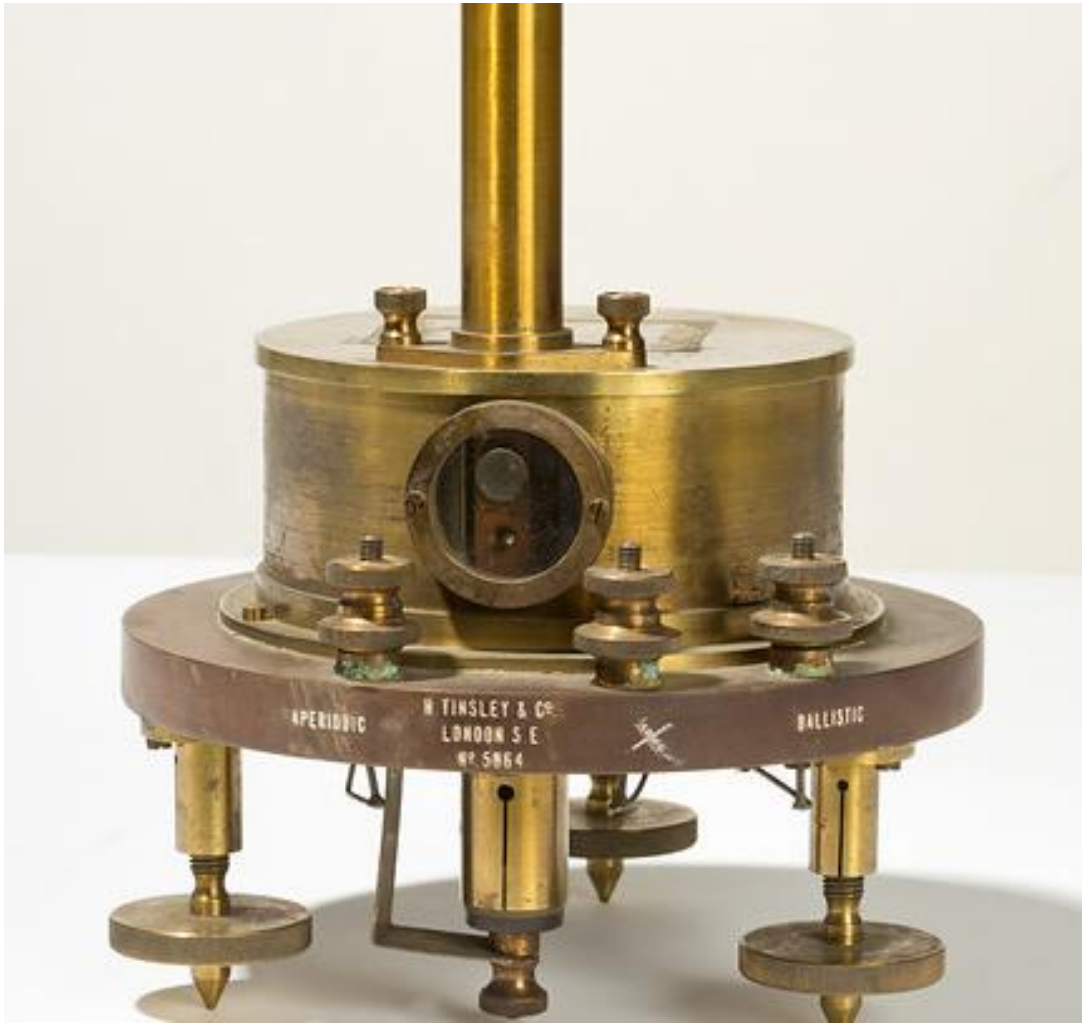
- There’s little money in public health!
- E.g. <1% of trials on COVID-19 addressed BESSI last year (Behavioural, Environmental, Social and Systems Interventions) (Paul Glasziou)
- It makes the evidence base in PH much more uncertain: the quantity of evaluations is comparatively smaller
- We have almost NO replication studies
  - The number of ways that intervention studies differ from one another vastly exceeds the number of studies available
  - Classical statistical ways of investigating heterogeneity are essentially useless

# What can we do?

- Be clear about the question asked
- Broaden our conceptual and epistemic horizons
- Engage in methodological development

# Clarity about research question 1: what do we need to know?

- What question is actually being asked:
  - E.g.‘do masks work?” – is this the barrier; the wearing; the request to wear; the request for whom to wear in what context…?
  - i.e. define the PICO!
- But what *type* of question is being asked?

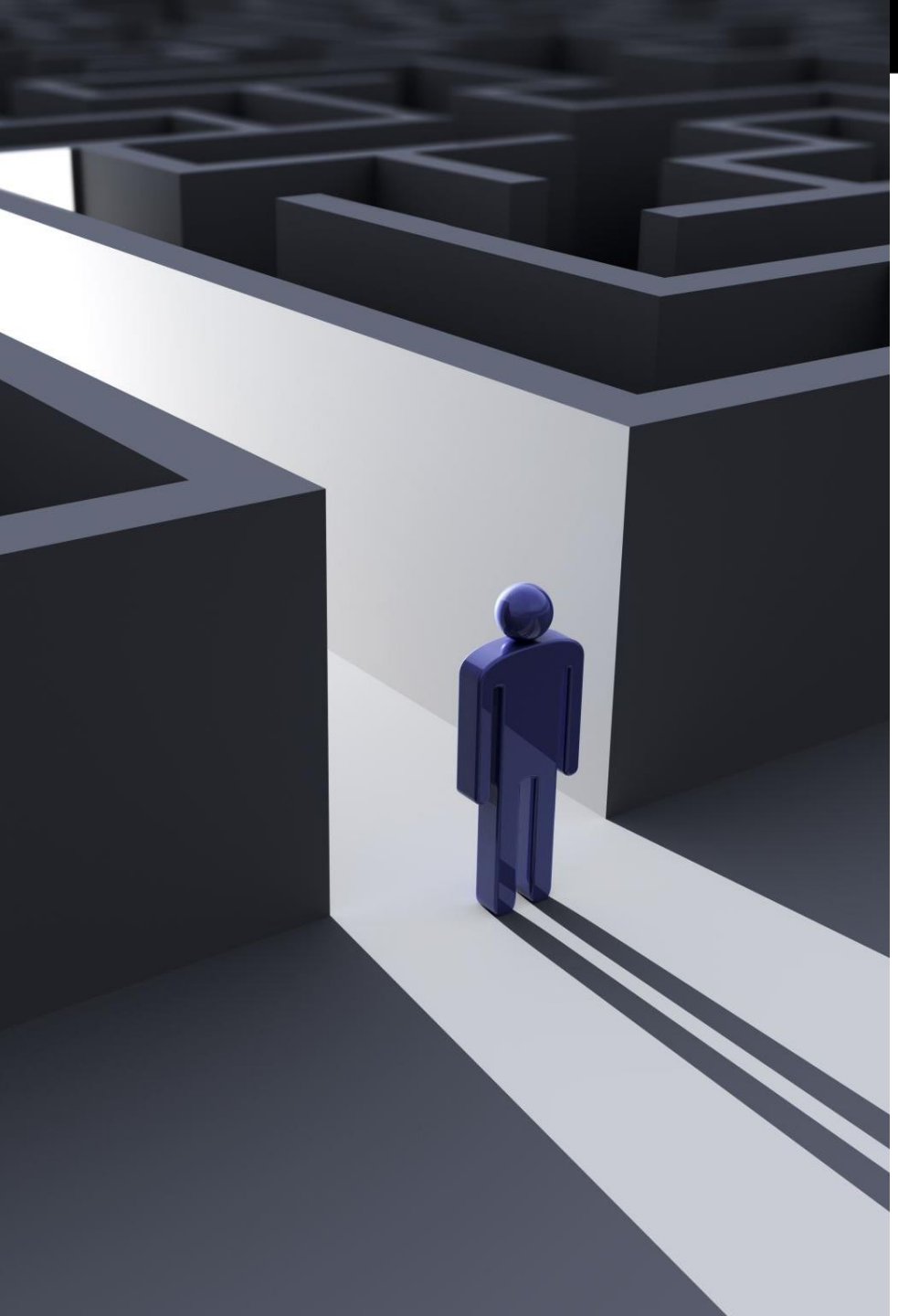



## Clarity about research question 2: what type of question are we actually asking here?

- Questions often are not concerned with how often / reliable / large a given effect is
  - Because there is no single effect
- Questions focus on explanation and understanding
  - Why was the effect observed in that situation?
  - What drives differences in outcomes between studies?

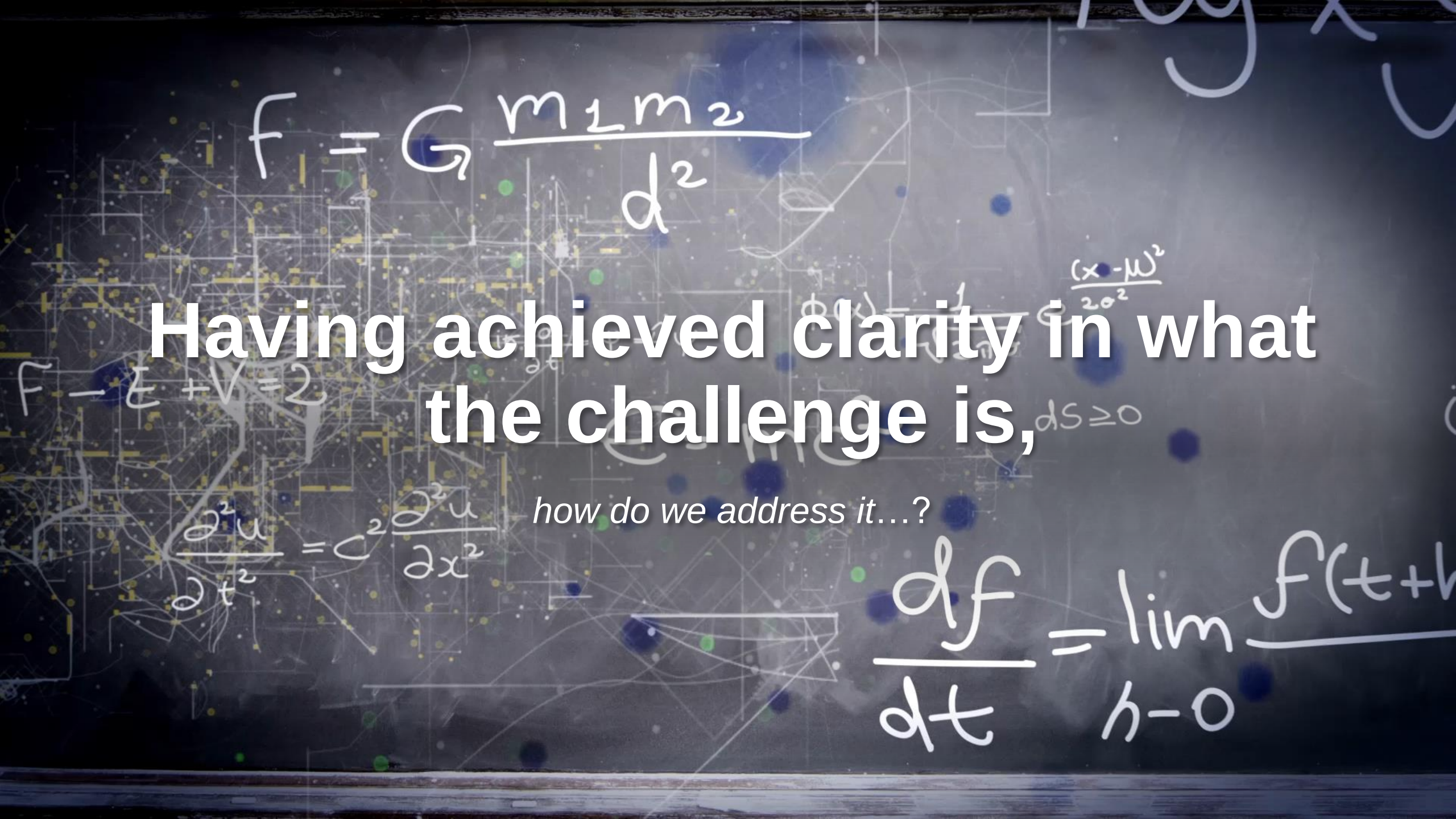

# Clarity about the research question 3: “why”?

- Under what circumstances does the intervention work
- What is the relative importance of, and synergy between, different components of multicomponent interventions?
- What are the mechanisms of action by which the intervention achieves an effect?
- What are the factors that impact on implementation and participant responses?
- What is the feasibility and acceptability of the intervention in different contexts?
- What are the dynamics of the wider system?



# The challenge for evidence synthesis…

- Questions asked in public health are challenging:
  - They seek to understand what drives differences in effect
  - They seek to understand *why* interventions have an effect
  - They ask about impacts at different (and hard to evaluate) levels
  - Some cannot be addressed in experimental research
- Methods for evidence synthesis originally evolved to address more clinical questions where causality was easier to establish experimentally
  - Public health evidence is less amenable to using these methods because of the lack of replication
- The key methodological challenge is: how do we provide methodologically rigorous evidence synthesis which addresses legitimate real-world questions?


Having achieved clarity in what the challenge is,
how do we address it…?

# Watch last week's presentations

# "broaden our horizons"

**Session 1: Evidence synthesis in public health: what we have learnt**

This was a two-hour session on 12 October 2021 with a series of presentations and Q&A. Chaired by **Joanne McKenzie** and **Carl Moons** (**Cochrane Methods Executive**).

Click on the presentation titles below to watch the recordings.

| | | |
|---|---|---|
| **Introduction to the session** | **Presentation 1: The importance of preparing for evidence synthesis in public health**<br>Download slides: [**PDF**] | **Presentation 2: Planning for and using non-randomised studies of interventions in public health evidence synthesis**<br>Download slides: [**PDF**] |
|  |  |  |
| **Karla Soares-Weiser**<br>Cochrane, Israel | **Eva Rehfuess**<br>Ludwig-Maximilians University Munich, Germany | **Hugh Waddington**<br>London International Development Centre, UK |
| **Presentation 3: Planning for and using qualitative evidence in public health evidence synthesis**<br>Download slides: [**PDF**] | **Presentation 4: Developing evidence maps to identify equity issues that could inform the design of a complex public health review**<br>Download slides: [**PDF**] | **Presentation 5: Planning for and using modelling studies in public health evidence synthesis**<br>Download slides: [**PDF**] |
|  |  |  |
| **Kate Flemming**<br>University of York, UK<br>**Andrew Booth**<br>University of Sheffield, UK | **Ashrita Saran**<br>Campbell South Asia, India | **Carlos Canelo-Aybar**<br>Cochrane Iberoamericano, Spain |

https://methods.cochrane.org/2021-cochrane-methods-symposium

# Eva Rehfuess

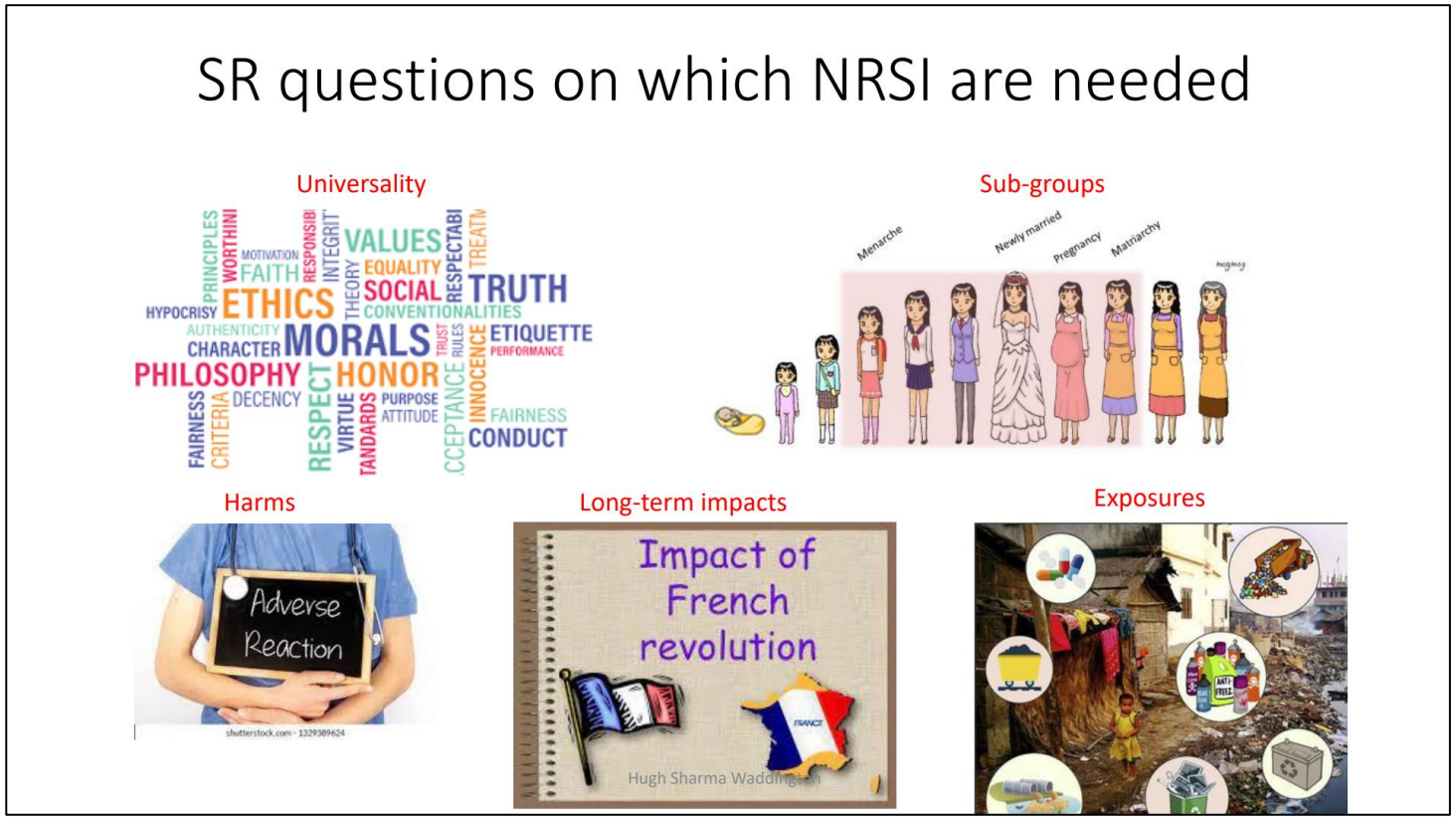
- “Broaden our horizons”
  - Decision-making
  - Stakeholder engagement
  - Use of logic models
  - Understand unintended consequences
  - Consider eligible study designs

## Nine tentative recommendations

1. Place your review in the **wider decision-making context**.
2. Consider undertaking a **scoping review** and/or other ways of **formal scoping**.
3. Make use of the potential of **stakeholder engagement**.
4. Compose your team to ensure **methodological and content expertise** as well as **sufficient manpower**.
5. Develop a **logic model** that accommodates a systems perspective and captures context and implementation issues.
6. Conceptualise **unintended consequences** from a societal perspective.
7. Define and **categorise PICO elements** with a view to evidence synthesis.
8. Carefully consider eligible **study designs** and decide on methods to appraise and synthesise these.
9. Decide on a relevant **threshold for grading** the evidence.

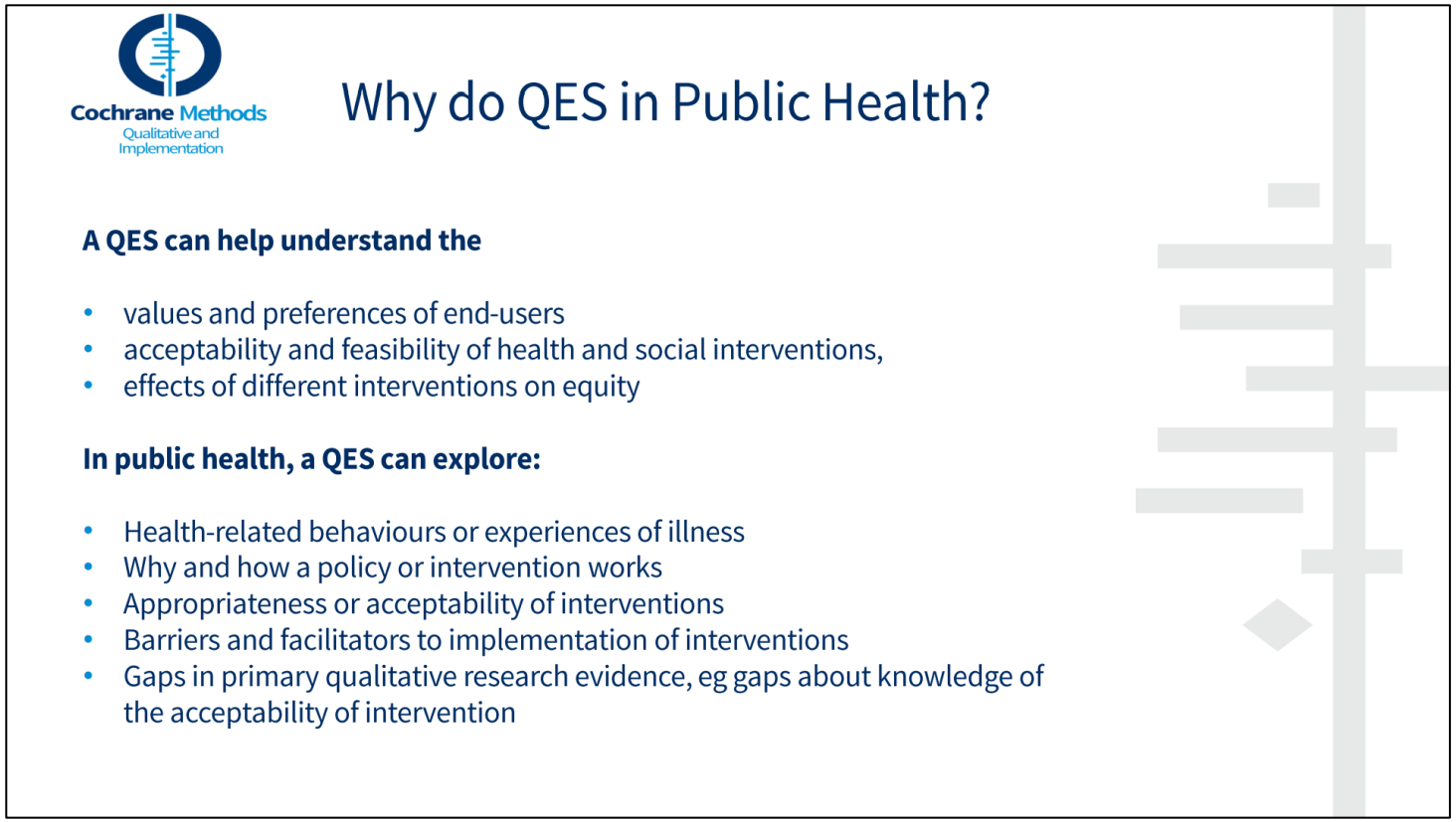
# Hugh Waddington

- “Broaden our horizons”
- There are systematic review questions that *require* non-randomized evidence to answer



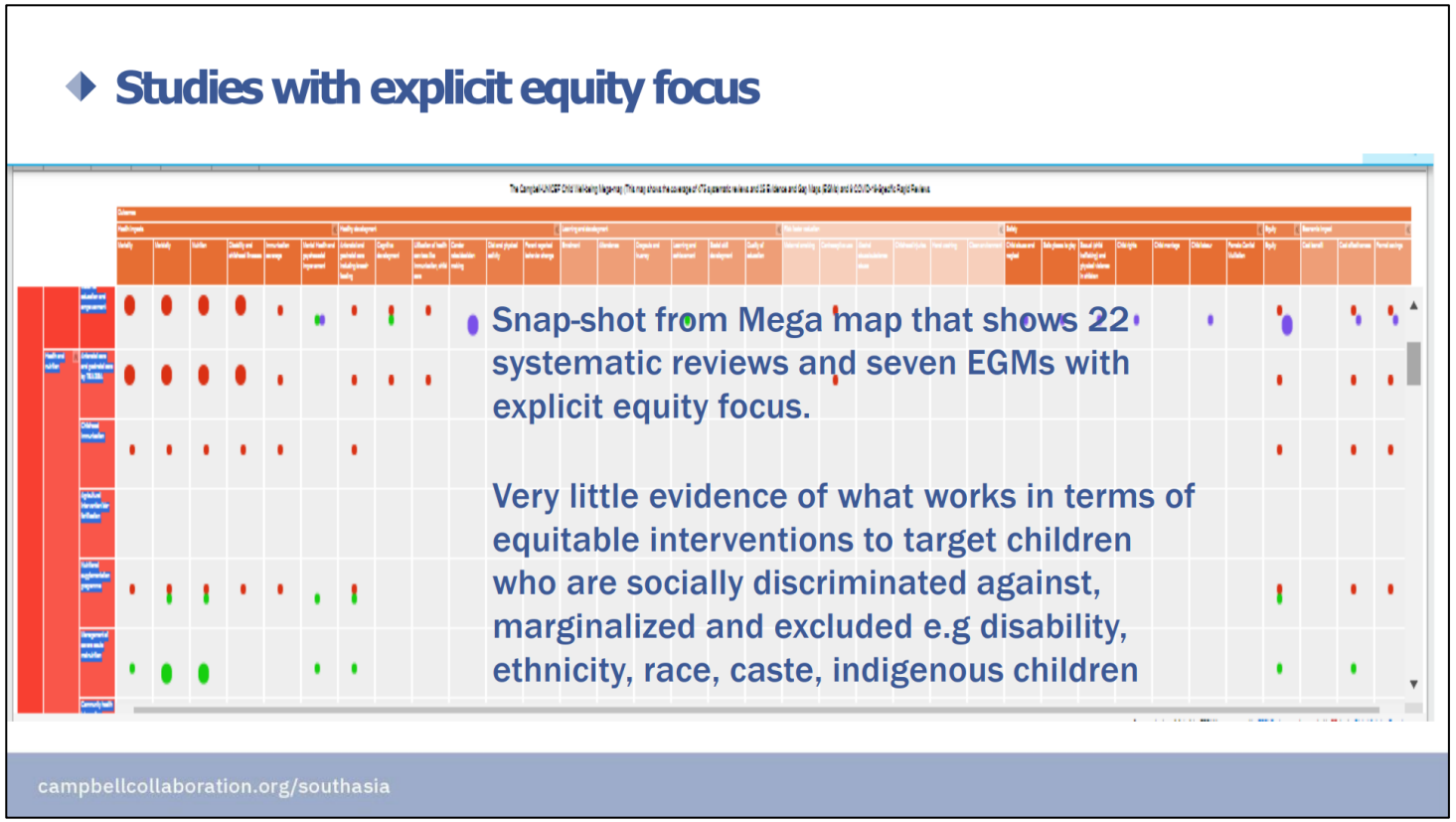
# Kate Flemming and Andrew Booth

- “Broaden our horizons”
- Qualitative evidence is required to address public health questions



# Ashrita Saran

- “Broaden our horizons”
  - Map research activity
  - Recognise that we must not allow the questions we ask to be constrained by the evidence available



## Carlos Canelo-Aybar

- “Broaden our horizons”
- The value of modelling studies
- Address questions where there is limited evidence
- Where RCTs are impossible
- Extrapolation

## Why models?

- “A framework representing variables and their interrelationships to describe observed phenomena or predict future events”
- Modelling studies are particularly relevant when there is limited evidence, no RCTs (i.e. it is not feasible or is unethical) or observational studies, or when there is a need to extrapolate results to different target groups or to a long horizon time

# Broaden our horizons

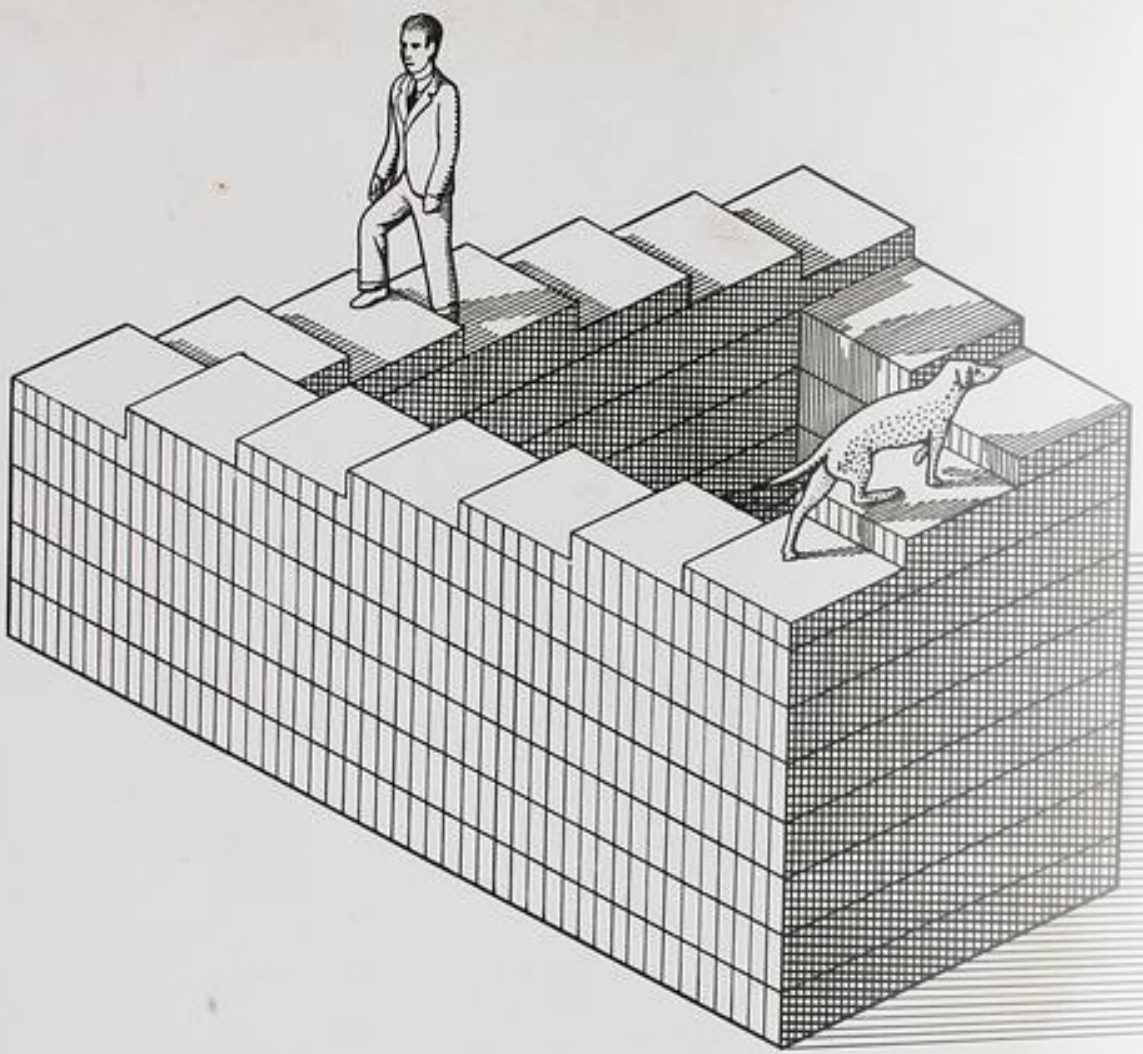
- Avoid falling prey to Harry Rutter's 'dangerous olive'…
- We need to focus on the research question – and not allow the available evidence or accepted methods to limit our understanding of what it is possible to know


Image from: https://whatsthepont.blog/2016/05/17/the-dangerous-olive-of-evidence-and-stop-chasing-innovation-behfest16/

# This takes conventional methods to an uncomfortable place

- Poll: How should non-randomized / theoretical evidence be used?
  - Hypothesis generation only
  - Making causal claims

Photo from: ‘The Ridge’ – Danny Macaskill
https://www.youtube.com/watch?v=xQ_IQS3VKjA



# The end (?)

- Consideration of ‘complexity’ is needed when considering the impact of any public health intervention
- It is hard to ‘know’ in public health because of:
  - The very nature of public health interventions
  - Epistemological challenges
  - The limited evidence base available
- Some methods for evidence synthesis are available
- But methodological development is needed

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# Thank you


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