Session 2: why integrate different types of research?

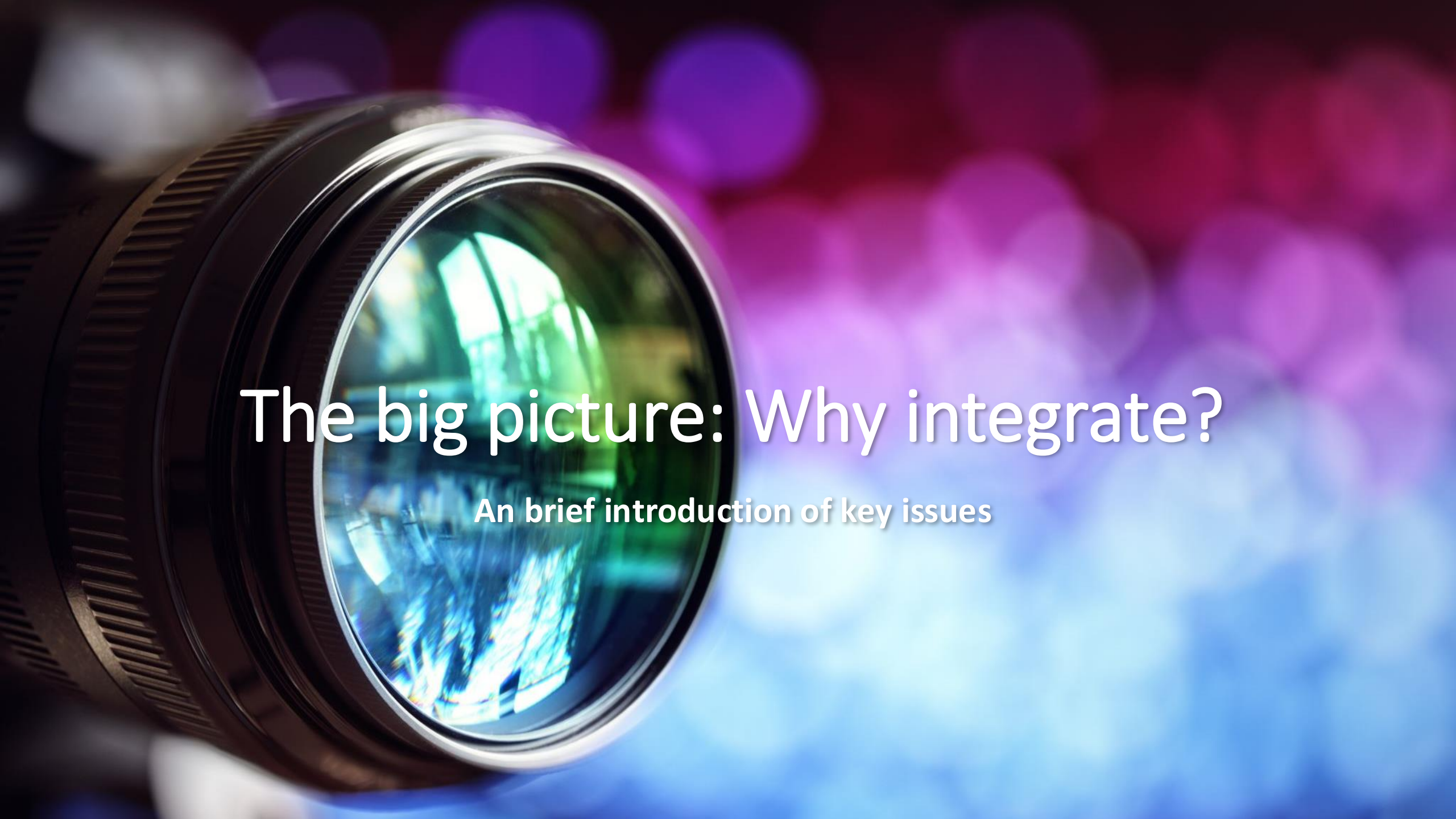
ESI Mixed methods evidence synthesis

25th and 26th September
Galway Bay Hotel

UCL

EPPI Centre
Evidence for Policy & Practice

CITY ST GEORGE'S UNIVERSITY OF LONDON



The big picture: Why integrate?

An brief introduction of key issues

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 + many more

Outline

- Introduce the ‘big picture’ issues relating to mixed methods reviewing
- Epistemic priorities
- Talk through why mixed methods reviews are needed:
  - The types of question asked by decision-makers
  - The context within which decisions are enacted
  - Epistemic challenges
- Move into small-group discussion activity

Outline

- **Starting from a ‘conventional’ effectiveness perspective**
- **Consider how conventional reviews make causal claims**
- **Examine how this model breaks down at times**
- **Look at how mixed methods helps to solve this problem**
- **Consider how mixed methods reviews make causal claims**
- **Consider how mixed methods reviews expand the range of questions that evidence syntheses can address**

Epistemic priorities

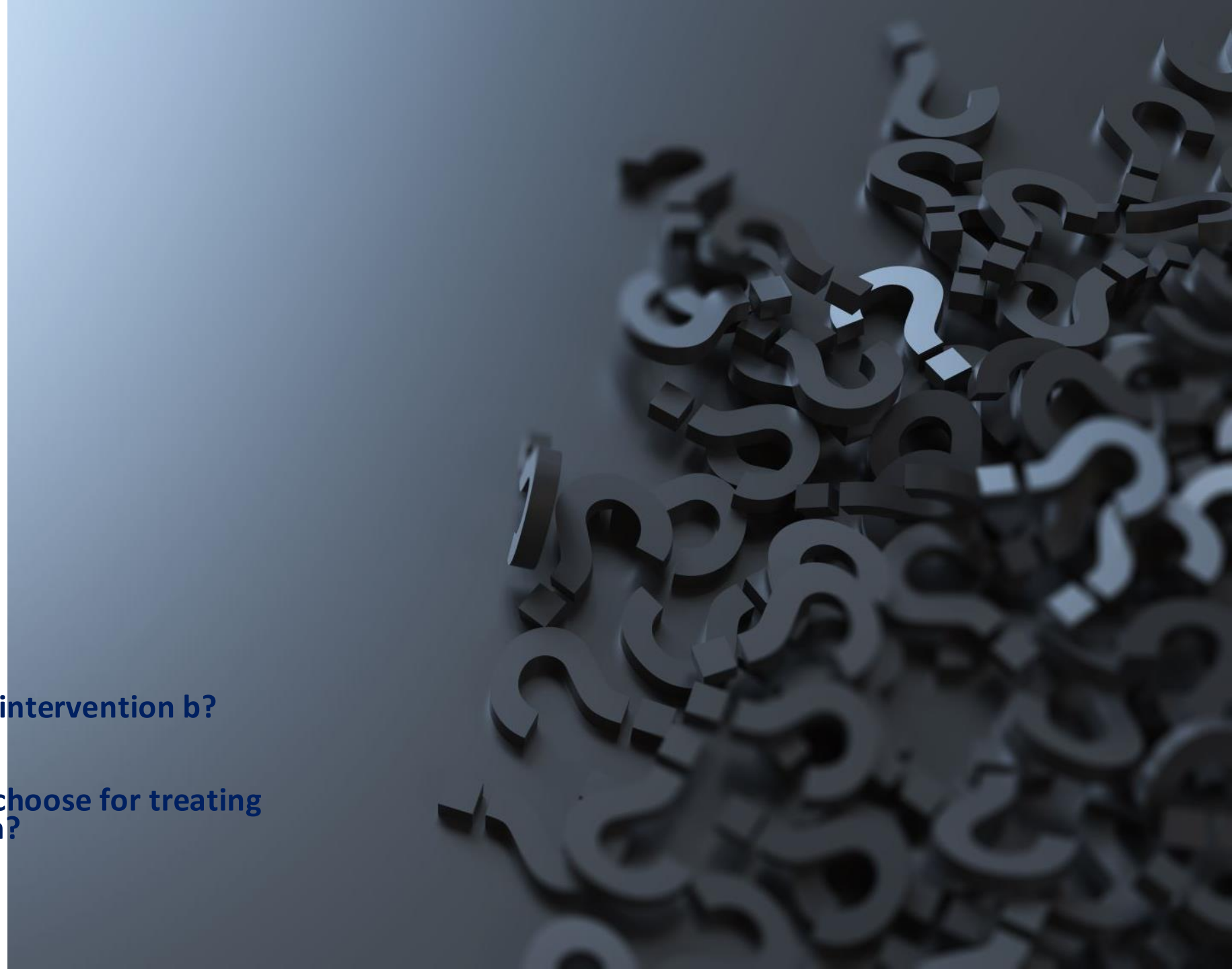
- Epistemic security in causal thinking
    - Counterfactual, probabilistic and regularity accounts
    - Mechanistic accounts
- Epistemic (in)justice in selecting which perspectives are important

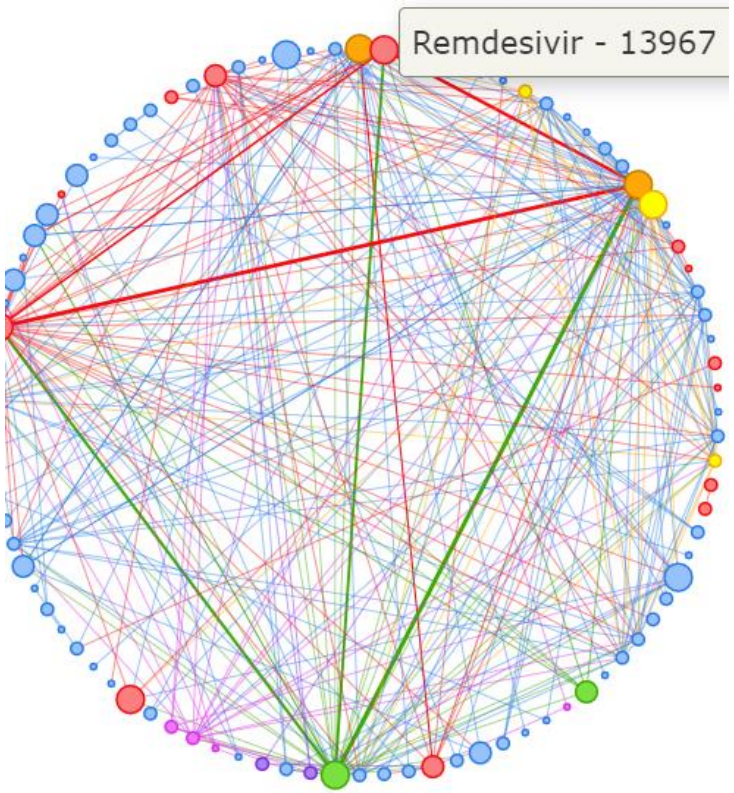
- Challenge: we need to consider how to provide evidence to inform real world decisions
- BUT
- We are more secure with some accounts than others

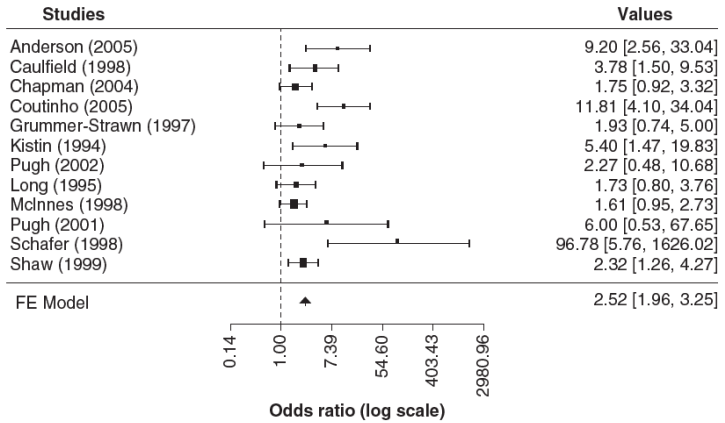
Types of question

Is intervention a better than intervention b?

Which intervention should I choose for treating condition x in this population?







Traditional pair-wise comparisons

Network meta-analysis

Both provide strong causal claims

[COVID-19 NMA (covid-nma.com)](covid-nma.com)

Simple – and strong – causal model

- **The synthesis of randomized trials provides strong evidence of effect**
- **This works when we can be fairly certain that our cause is the reason we see an effect – we have a strong counterfactual**
- **The question then is:**
  - **how often the cause has the effect of interest**
  - **how large is the effect?**
  - **and how consistent?**

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**

- **Question: do masks 'work'?**

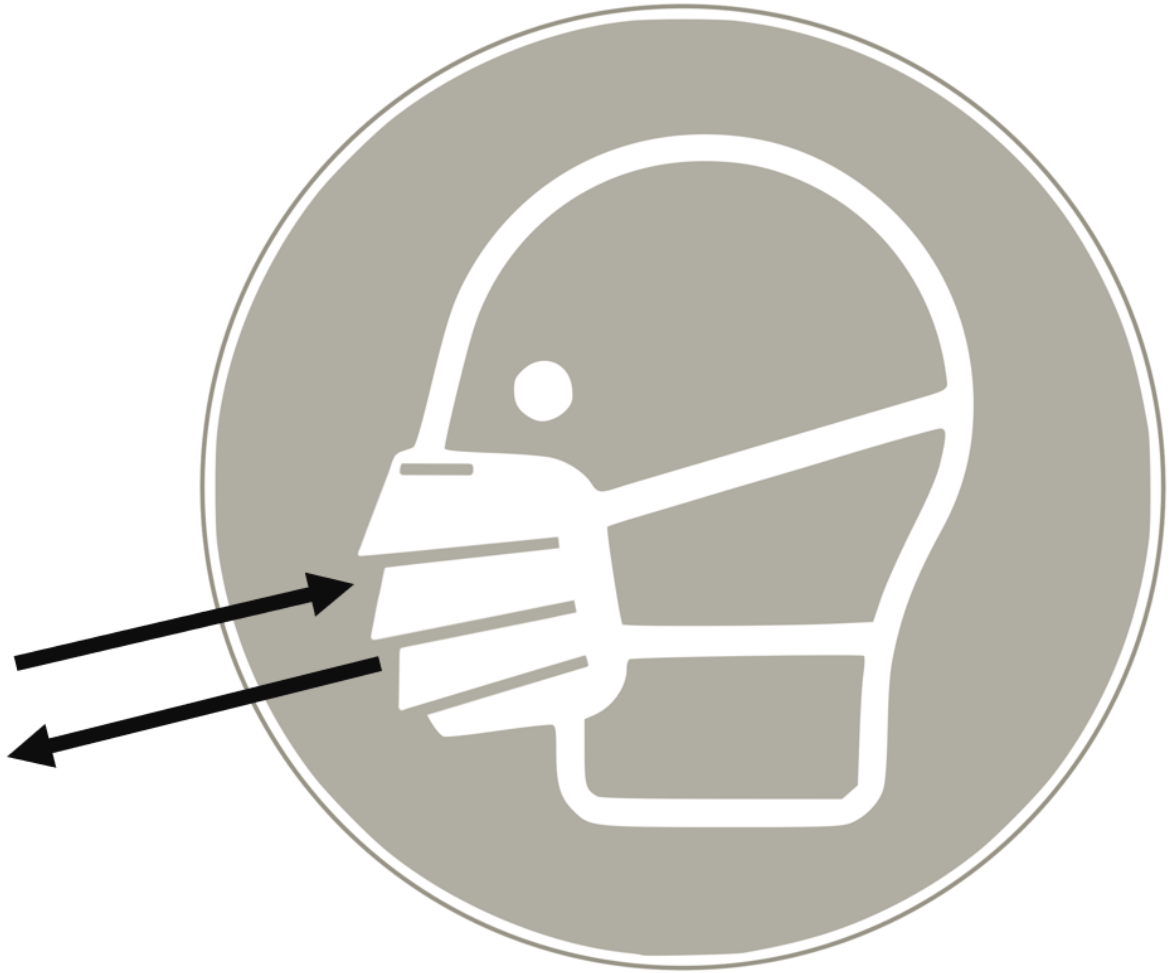


Image from: https://en.wikipedia.org/wiki/Face_masks_during_the_COVID-19_pandemic

“Do masks work..?”

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

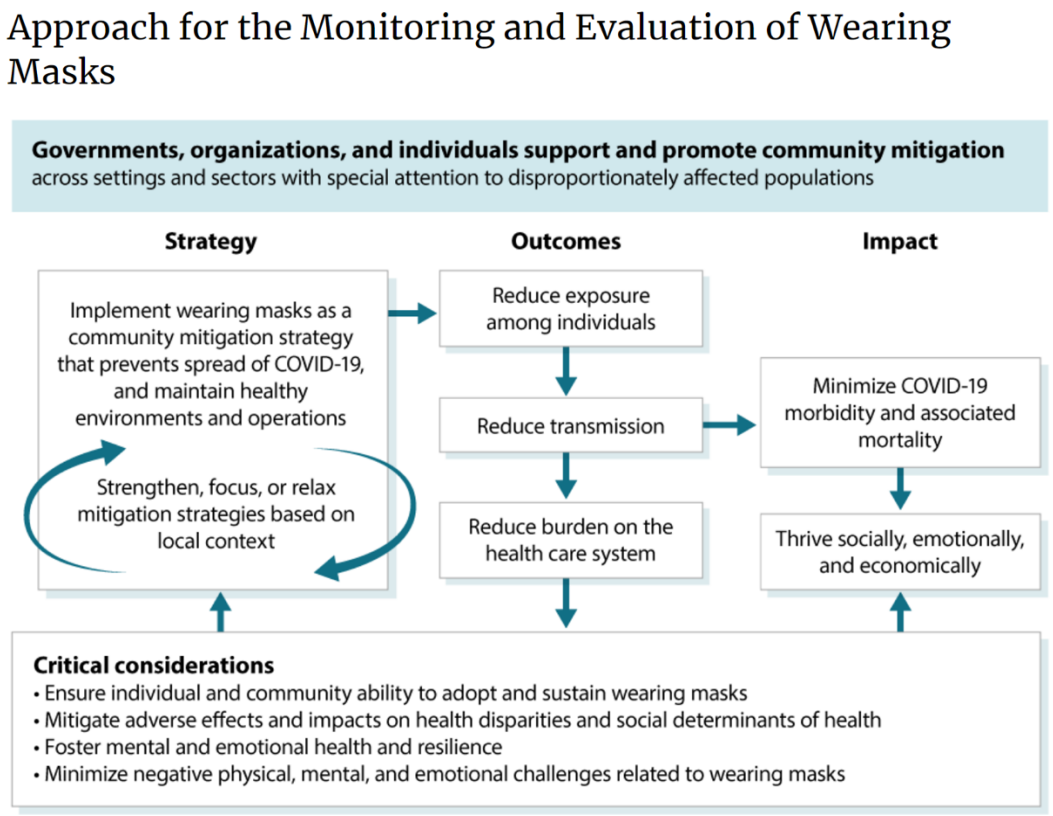


Image from: https://www.cdc.gov/coronavirus/2019-ncov/php/mask-evaluation.html

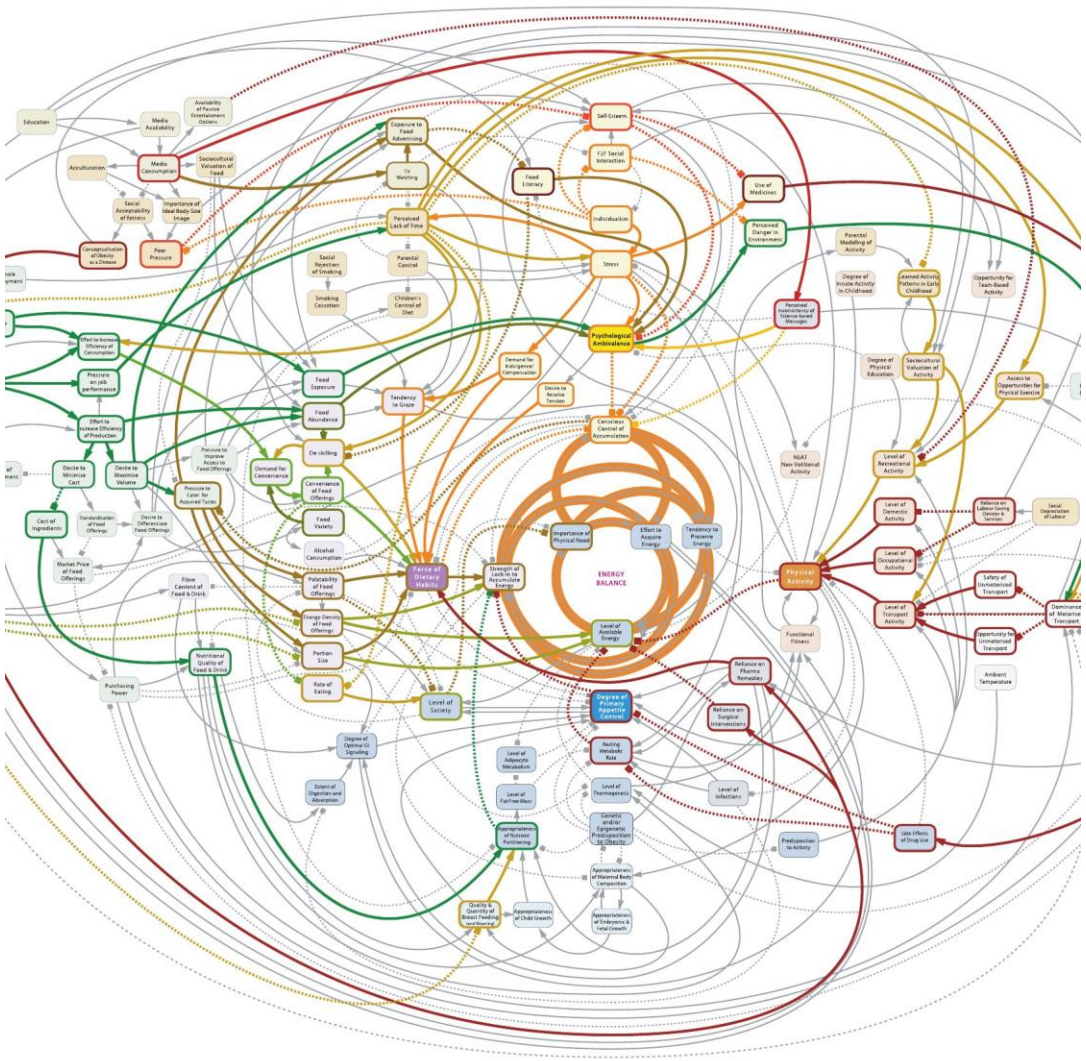
Source: Dr Ellie Murray's Twitter profile

… do masks work?

When interventions are introduced into complex contexts, they can generate unintended consequences

‘Complex’ intervention

- **Non-linear effects**
- **Phase changes**
- **Feedback loops**
- **Causal pathways less well understood**
- **Less predicable**



Challenging to understand causality in linear, predictable ways…

- **The linear model of causation can break down when:**
  - **there are long causal pathways between intervention and outcome**
  - **there are many possible factors influencing intervention outcome**
  - **intervention replication is rare / impossible**
  - **‘examples’ of interventions differ**
    - **selection of components**
  - **lots of heterogeneity**

Community engagement to reduce inequalities in health: a systematic review, meta-analysis and economic analysis

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Declared competing interests of authors: none

Published XXXX 2013
DOI: 10.3310/phrXXXXX

This report should be referenced as follows:

O'Mara-Eves A, Brunton G, McDaid D, Oliver S, Kavanagh J, Jamal F, *et al.* Community engagement to reduce inequalities in health: a systematic review, meta-analysis and economic analysis. *Public Health Res* 2013;1(X).

Slides on this review from: Thomas, Brunton O'Mara-Eves (2013) Community engagement strategies to reduce health inequalities… SPHR@L seminar, LSHTM, October 10th

We'll never have 'enough' data…

PUBLIC HEALTH RESEARCH

VOLUME 1 ISSUE 4 NOVEMBER 2013
ISSN 2050-4381

Table 14 Primary health issues targeted by the interventions in studies included in the meta-analysis (n=131)

Primary health issue	Frequency	%
Substance abuse	18	13.7
Cardiovascular disease	14	10.7
Breastfeeding	13	9.9
Obesity prevention/weight reduction	13	9.9
Smoking cessation	12	9.2
Public health/health promotion/prevention	8	6.1
Antenatal (prenatal) care	7	5.3
Cancer prevention	6	4.6
Diabetes prevention/management	6	4.6
Physical activity	6	4.6
Healthy eating/nutrition	5	3.8
Parenting	5	3.8
Immunisation	4	3.1
Injury prevention	4	3.1
Smoking/tobacco prevention	3	2.3
Child illness and ill health	2	1.5
Disabilities and chronic illness	2	1.5
Child abuse prevention	1	0.8
Hypertension	1	0.8
Infant mortality	1	0.8

- **E.g. a systematic review addressing complex questions**
- **131 studies in the meta-analysis**
  - **Approximately 50% 'sound' in terms of RoB**
- **At least 200 possible covariates**
- **We need > 10 times more research**

We'll never have 'enough' data…

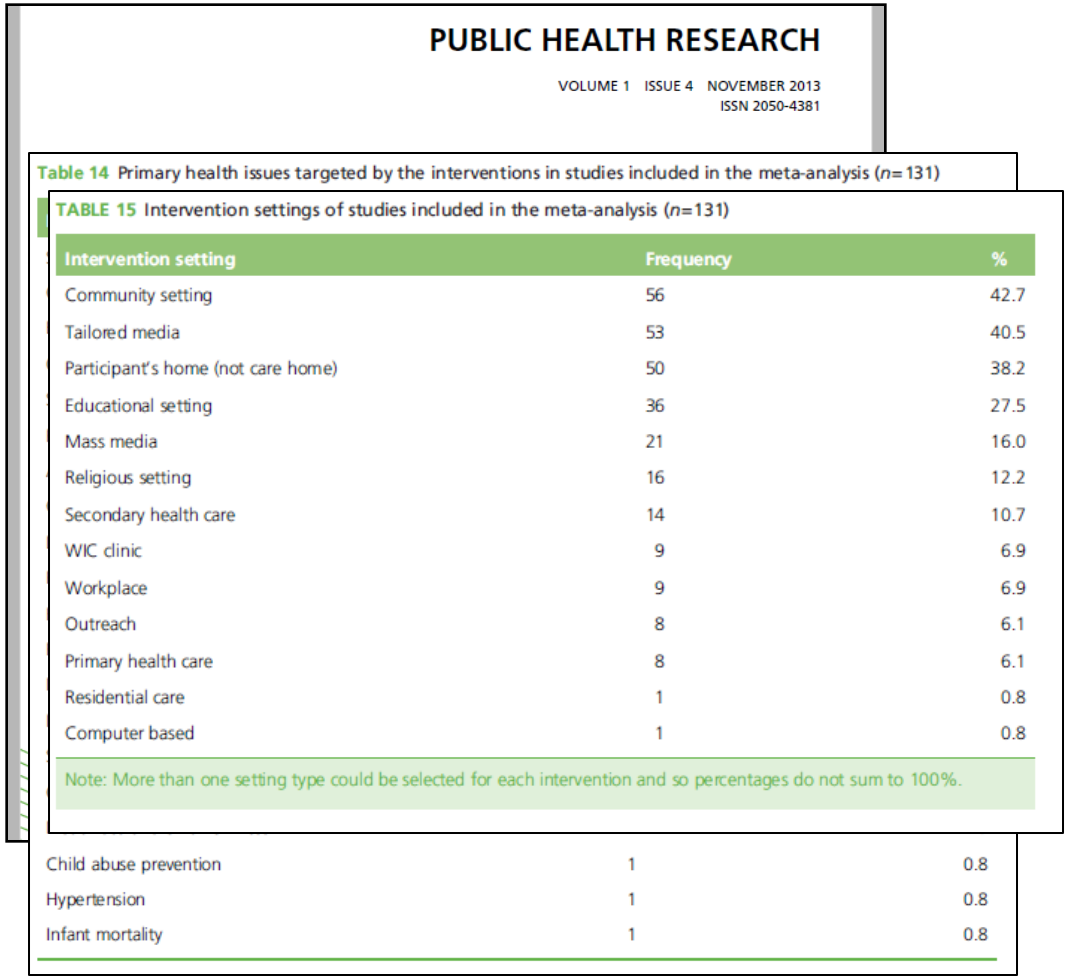

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TABLE 15 Intervention settings of studies included in the meta-analysis (n=131)

Intervention setting	Frequency	%
Community setting	56	42.7
Tailored media	53	40.5
Participant's home (not care home)	50	38.2
Educational setting	36	27.5
Mass media	21	16.0
Religious setting	16	12.2
Secondary health care	14	10.7
WIC clinic	9	6.9
Workplace	9	6.9
Outreach	8	6.1
Primary health care	8	6.1
Residential care	1	0.8
Computer based	1	0.8

Note: More than one setting type could be selected for each intervention and so percentages do not sum to 100%.

Child abuse prevention	1	0.8
Hypertension	1	0.8
Infant mortality	1	0.8

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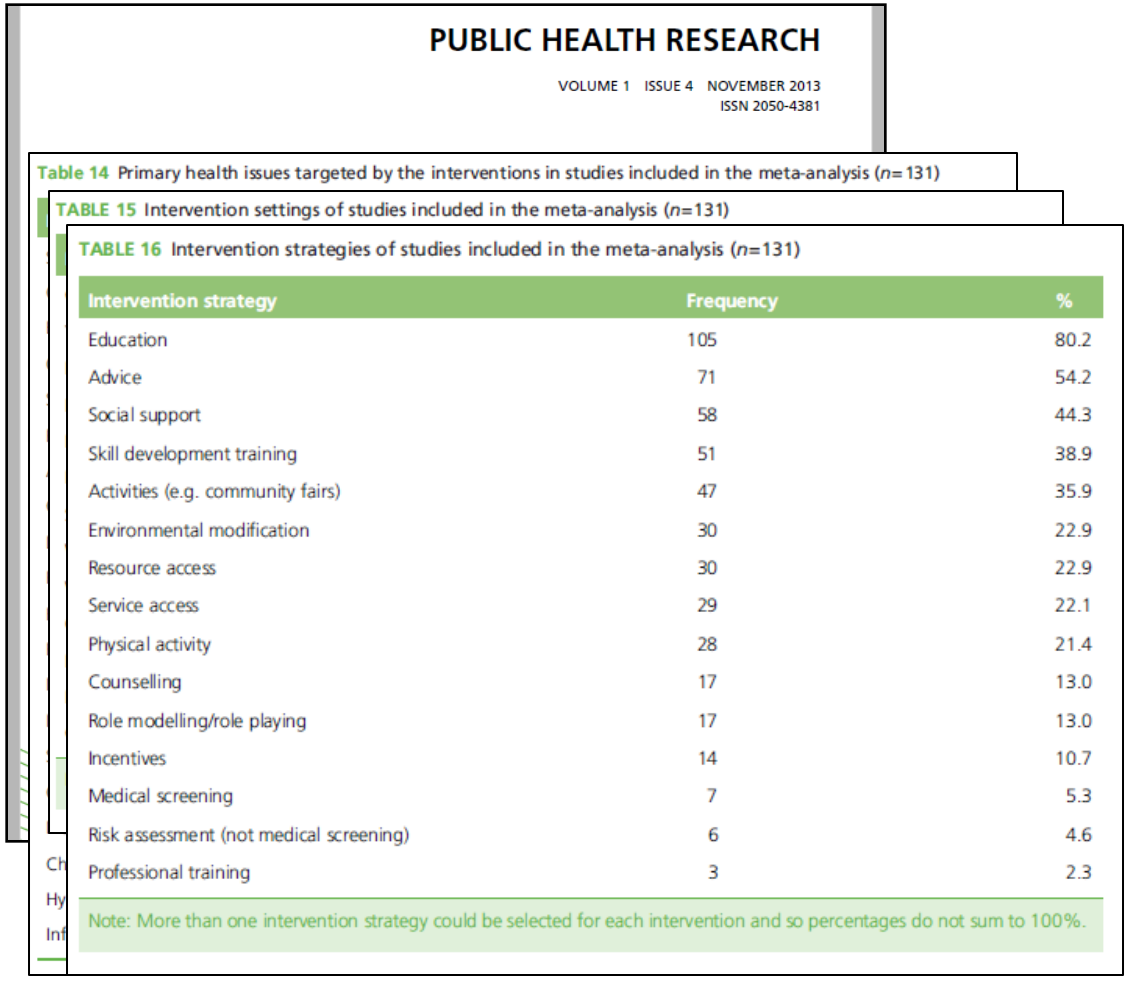

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TABLE 16 Intervention strategies of studies included in the meta-analysis (n=131)

Intervention strategy	Frequency	%
Education	105	80.2
Advice	71	54.2
Social support	58	44.3
Skill development training	51	38.9
Activities (e.g. community fairs)	47	35.9
Environmental modification	30	22.9
Resource access	30	22.9
Service access	29	22.1
Physical activity	28	21.4
Counselling	17	13.0
Role modelling/role playing	17	13.0
Incentives	14	10.7
Medical screening	7	5.3
Risk assessment (not medical screening)	6	4.6
Professional training	3	2.3

Note: More than one intervention strategy could be selected for each intervention and so percentages do not sum to 100%.

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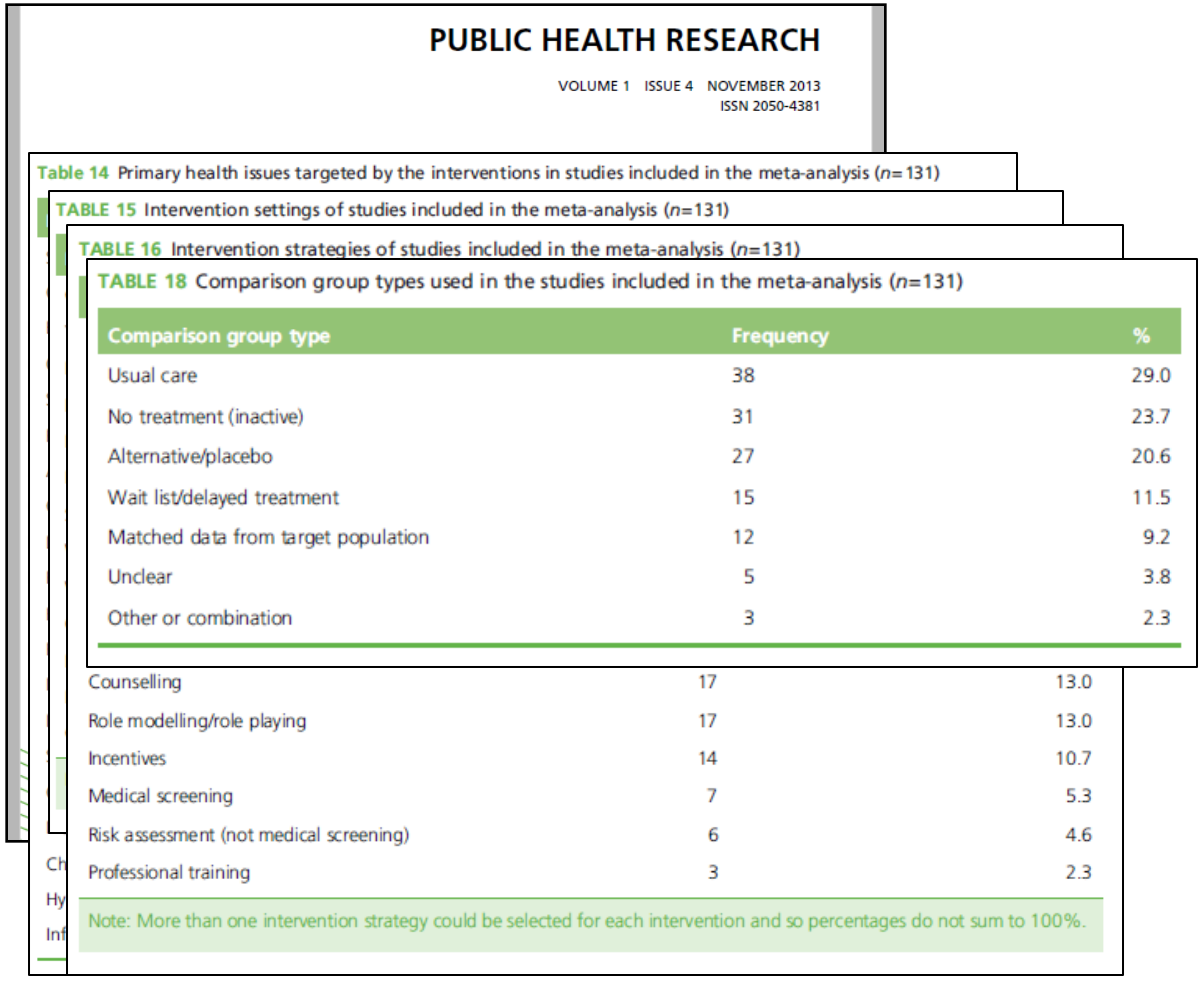

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TABLE 18 Comparison group types used in the studies included in the meta-analysis (n=131)

Comparison group type	Frequency	%
Usual care	38	29.0
No treatment (inactive)	31	23.7
Alternative/placebo	27	20.6
Wait list/delayed treatment	15	11.5
Matched data from target population	12	9.2
Unclear	5	3.8
Other or combination	3	2.3

Counselling	17	13.0
Role modelling/role playing	17	13.0
Incentives	14	10.7
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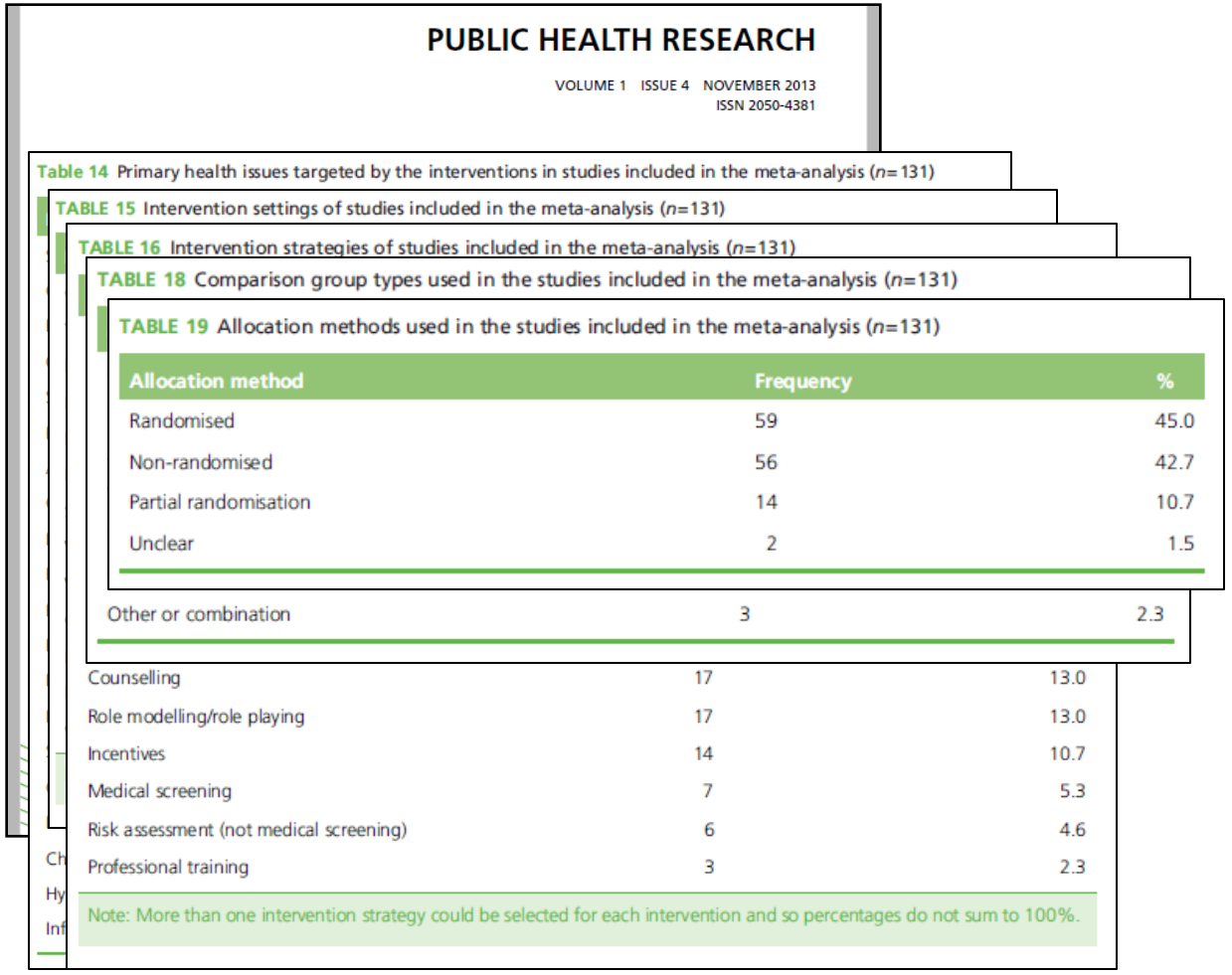

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TABLE 19 Allocation methods used in the studies included in the meta-analysis (*n*=131)

Allocation method	Frequency	%
Randomised	59	45.0
Non-randomised	56	42.7
Partial randomisation	14	10.7
Unclear	2	1.5
Other or combination	3	2.3

Counselling	17	13.0
Role modelling/role playing	17	13.0
Incentives	14	10.7
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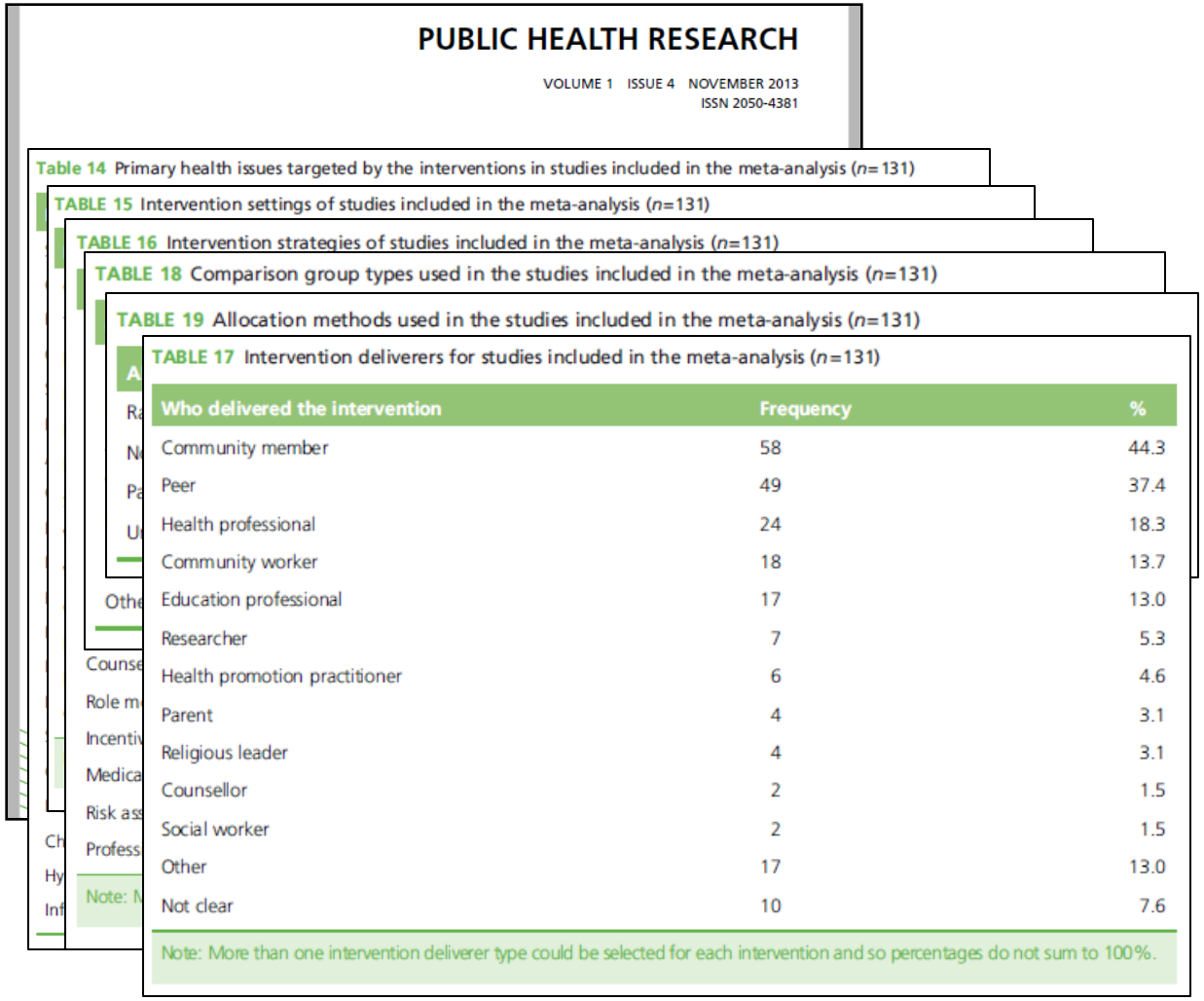

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TABLE 17 Intervention deliverers for studies included in the meta-analysis (n=131)

Who delivered the intervention	Frequency	%
Community member	58	44.3
Peer	49	37.4
Health professional	24	18.3
Community worker	18	13.7
Education professional	17	13.0
Researcher	7	5.3
Health promotion practitioner	6	4.6
Parent	4	3.1
Religious leader	4	3.1
Counsellor	2	1.5
Social worker	2	1.5
Other	17	13.0
Not clear	10	7.6

Note: More than one intervention deliverer type could be selected for each intervention and so percentages do not sum to 100%.

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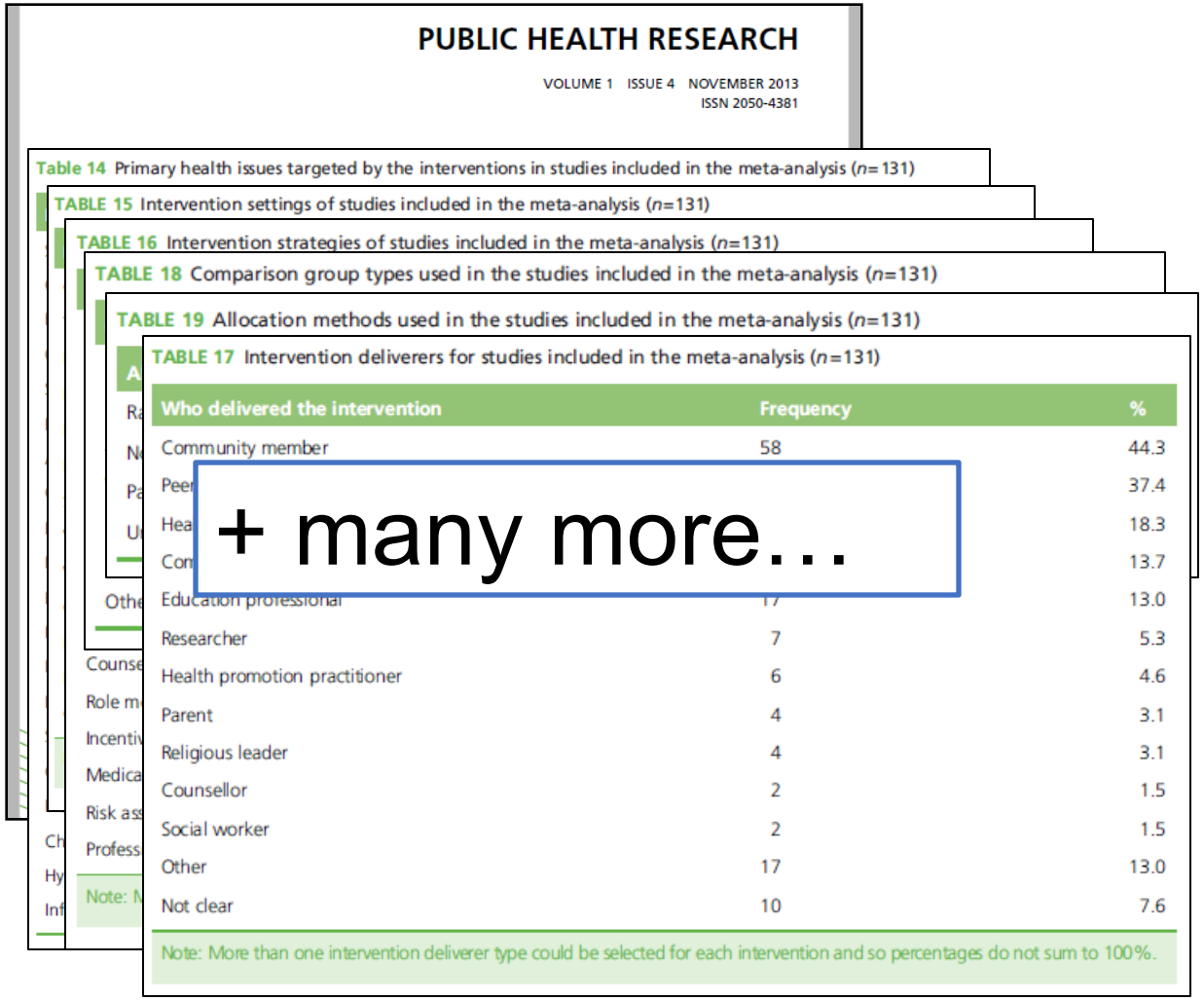

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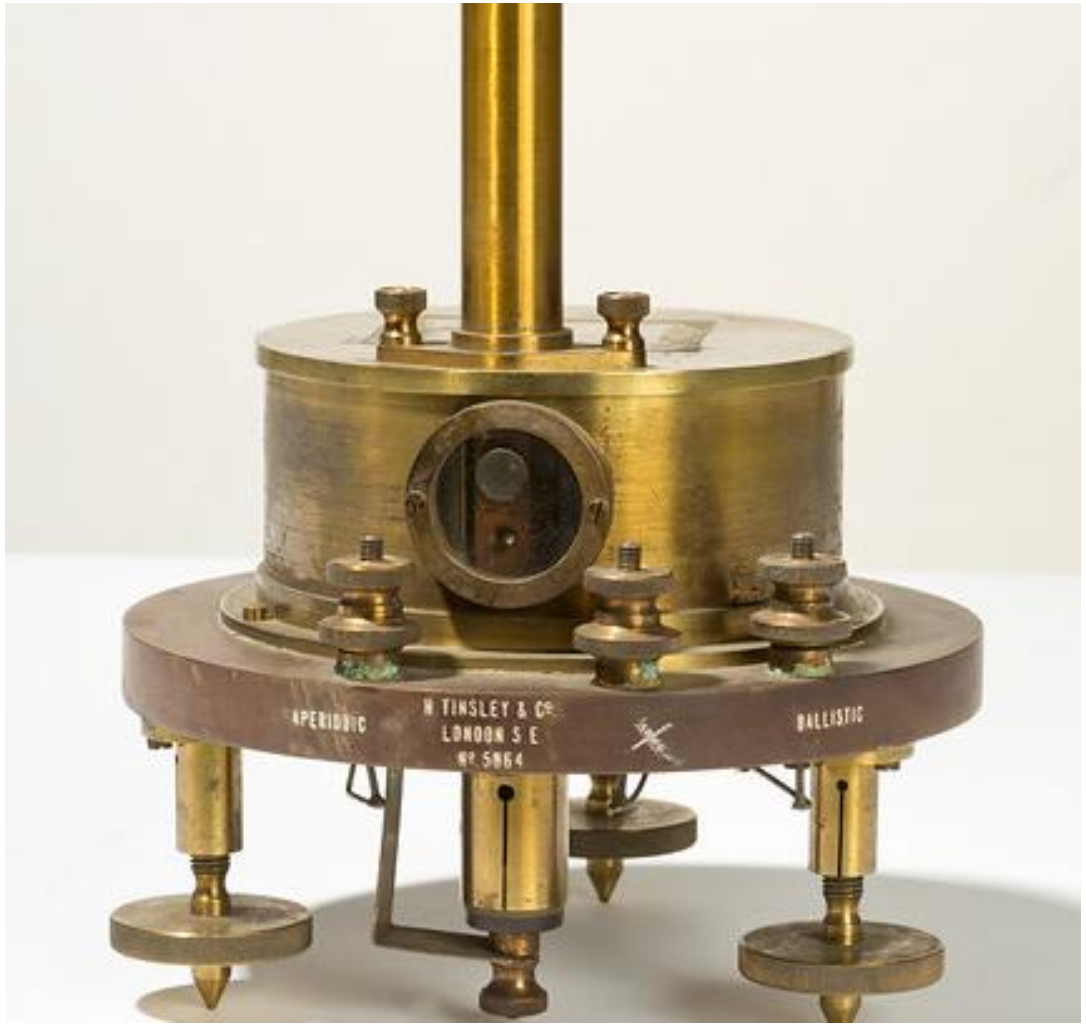
+ many more…

- **E.g. a systematic review addressing complex questions**
- **131 studies in the meta-analysis**
  - **Approximately 50% 'sound' in terms of RoB**
- **At least 200 possible covariates**
- **We needed >> 10 times more research**

We could not rely on a probabilistic causal account

- **Significant statistical heterogeneity was expected in this review**
- **“When operating across such a wide range of topics, populations and intervention approaches, however, there is a disjunction between the conceptual heterogeneity implied by asking broad questions and the methods for analysing statistical variance that are in our ‘toolbox’ for answering them”**
- **Potential confounding variables or interactions amongst variables made it difficult to disentangle unique sources of variance across the studies**
- **Emphasis on magnitude of the effects and “big picture” trends across studies**



The focus of our enquiry changed

- **Questions changed from looking at how often / reliable / large a given effect is**
- **Because there was no single effect**
- **Questions focused on explanation and understanding**
- **Why was the effect observed in that situation?**
- **What drives differences in outcomes between studies?**

In particular, we focused on questions which explained different aspects of how the ‘intervention’ ‘worked’

- **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?**

What did we do?

Data

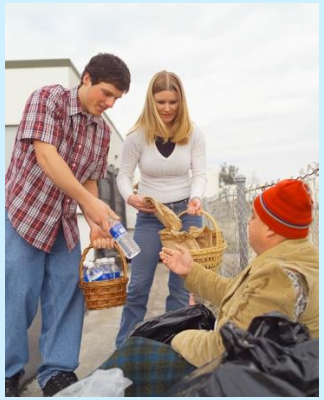
Theoretical Perspectives
from literature
review team & advisors

Intervention descriptions

Intervention processes
participation rates, perspectives*

Intervention outcomes
categories, effect sizes

Intervention costs/benefits*



Syntheses

Community engagement to reduce health inequalities

Theoretical synthesis

Meta-analysis
but huge heterogeneity

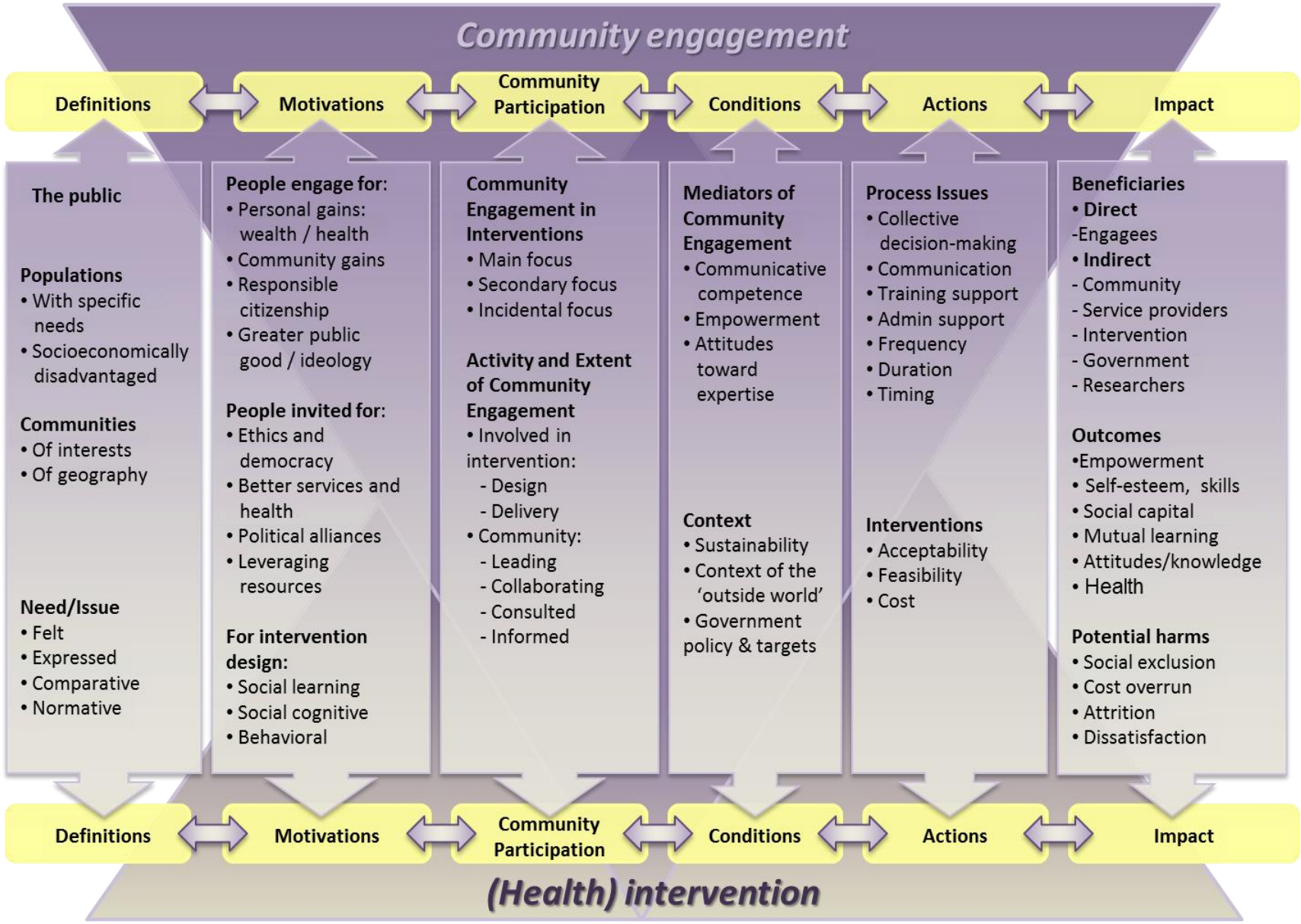
Theories of change
operationalised into an analytical model

Model exploration
explored variations in intervention effects in a theoretically grounded way

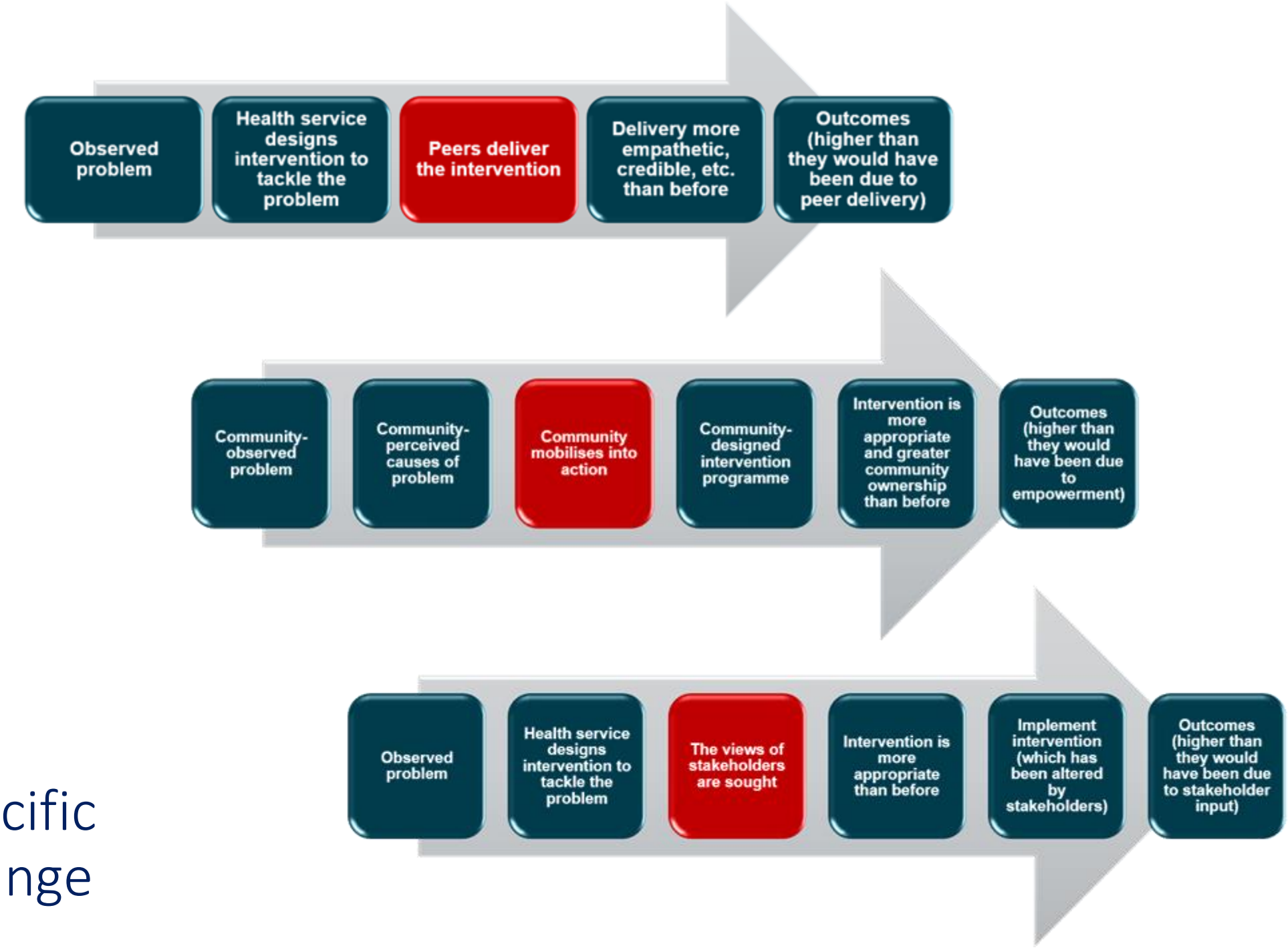
**also synthesised separately*

Slide from: Rees, Sutcliffe, Thomas (2013) Configurational 'qualitative' synthesis for evidence-based policy & practice… 21st Cochrane Colloquium, Quebec

Community Engagement in Interventions: Conceptual Framework



Developed specific theories of change



What was going on in the methods for that review?

- **We used a (large) number of trials to evaluate intervention effects using meta-analysis**
- **We used detailed information about the content of intervention from trial reports**
- **We drew on theoretical literature**
- **We undertook a qualitative evidence synthesis (QES)**
- **We used the theoretical literature and the QES to understand differences in broad classes of intervention**
- **The QES and other theoretical outputs were useful in their own right**

Mixed methods

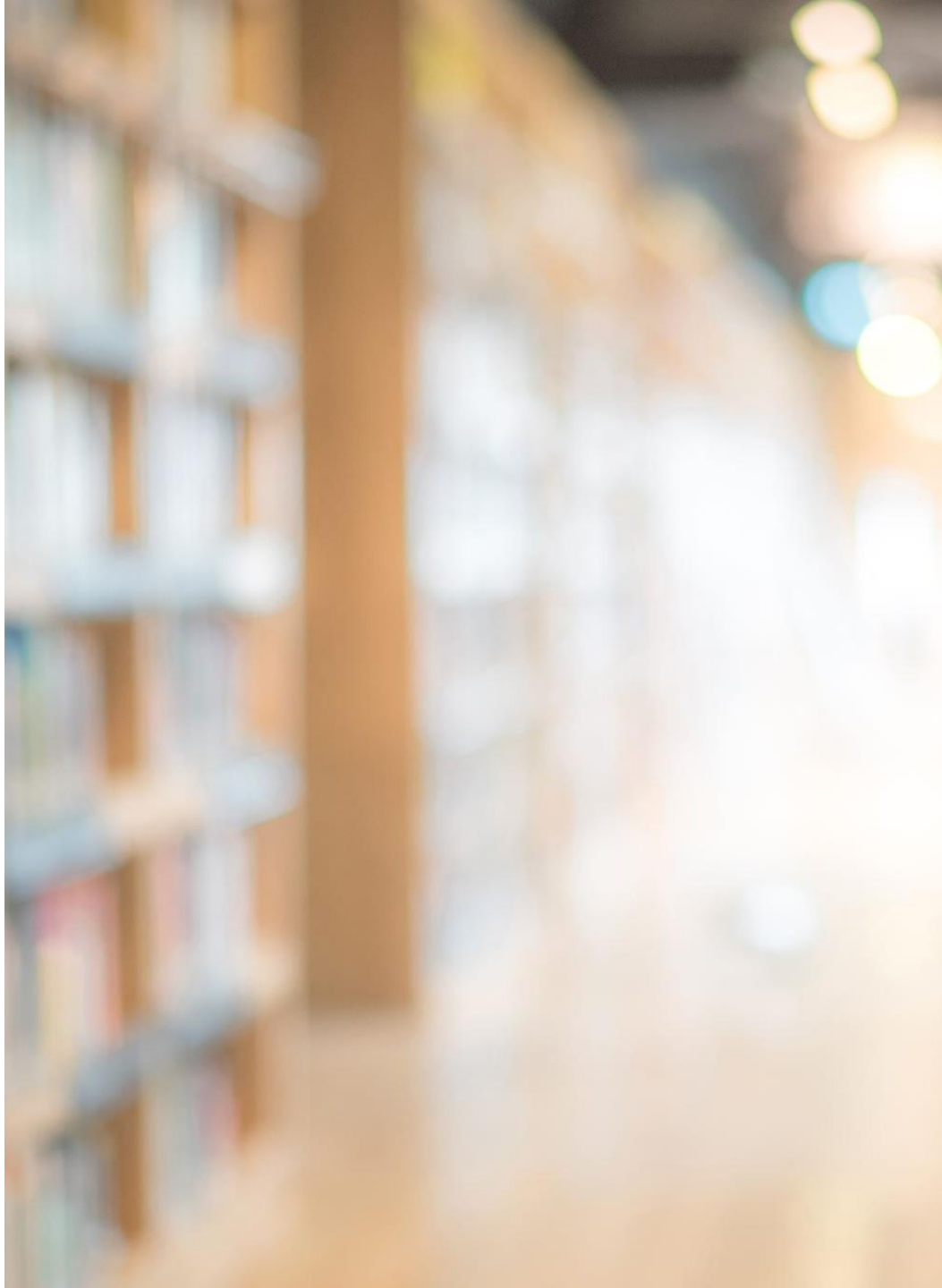
- **Enabled the review to generate empirically-based theories with which to understand heterogeneity between trials**
- **By using qualitative studies we increased diversity of perspective within the review**
- **Statistical assumptions were questioned, but not 'broken'**
- **Utilised the relative strengths of the different studies (e.g. didn't convert between numeric and theoretical data)**

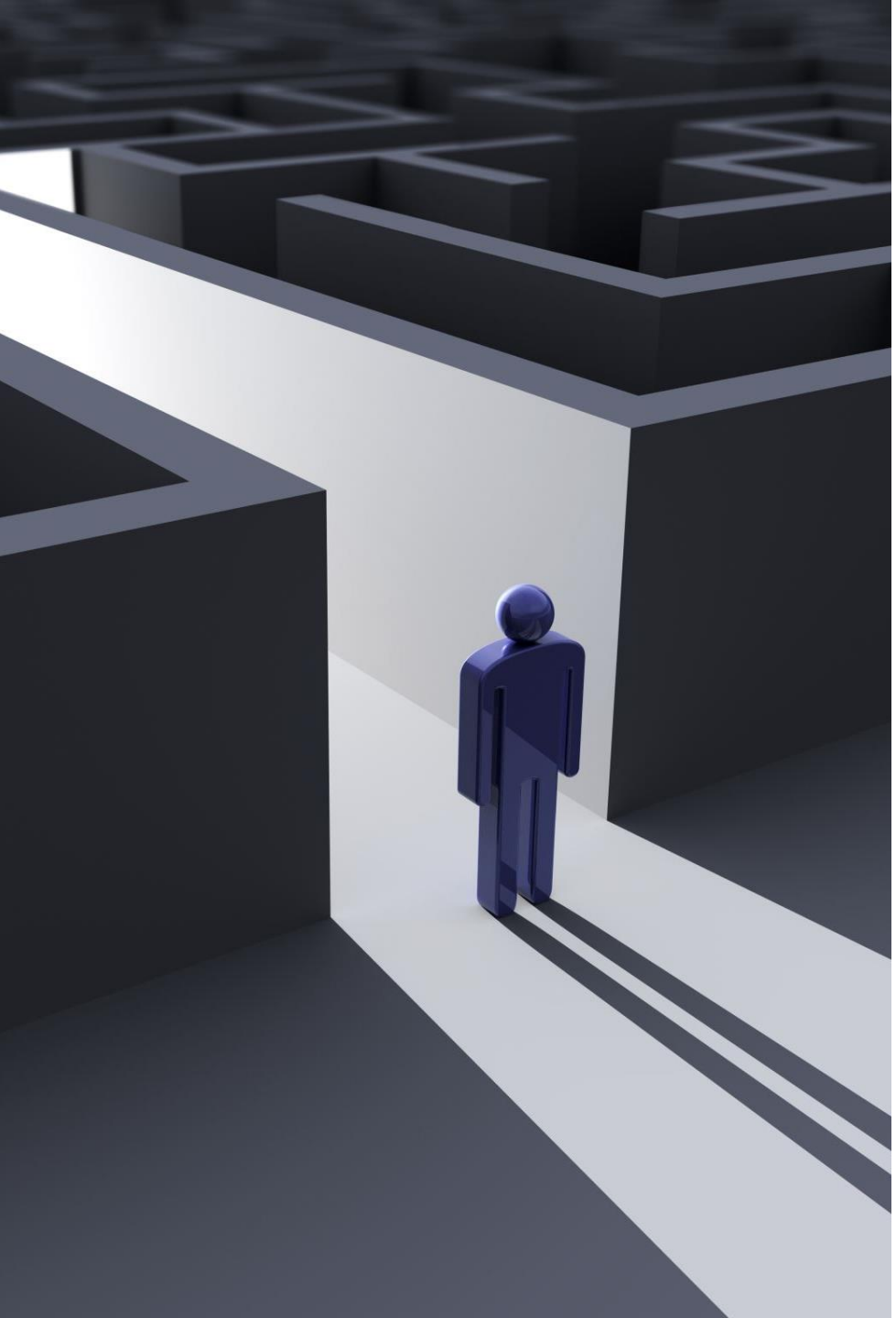
In short: conventional methods of evidence synthesis don't work when addressing non-conventional questions (or in intervention complexity)

- **Systematic reviews are traditionally good at addressing questions of size and consistency of effect**
- **We found that high conventional epistemic security takes few risks, but comes at a high cost in terms of utility**
- **Less good at questions of how and why we see variations in effect**
- **Mixed methods evidence synthesis is an essential way forward**

What's the alternative?

- **Arguably, this paradigm means abandoning the possibility of evidence-informed policy & practice in many areas**





This review encapsulates challenge for evidence synthesis broadly…

- **The question being asked – and its context – is critical: the more we stick to answering questions for which we can give epistemically secure answers, the less we can address questions that decision-makers ask**
- **“We usually already know before the review starts that the evidence is likely to be ‘weak’, or ‘mixed’, because complex phenomena are difficult to evaluate, and so ‘hard tests’ of hypotheses are uncommon…” Petticrew 2015**
- **The key methodological challenge is: how do we provide methodologically rigorous evidence synthesis which addresses legitimate real-world questions?**

Stepping back to justifying knowledge claims: probabilistic approaches

- **No deep understanding of why something happens**
- **Predictive strength because: a) the same effect has been observed multiple times; b) alternative explanations for causes have been ruled out**
- **Not necessary for the same effect to be observed every time – so long as the effect happens enough**
- **Breaks down when the question involves identifying drivers of variation – there are so many possibilities**
- **Quality assessment involves demonstrating that the effect does follow from the cause regularly, and that alternative explanations have been ruled out**

Adding to the toolkit: mechanistic justifications

Deep understanding of *why* something happens

Predictive strength because the intervention *entails* the outcome (the effect is certain, given the cause)

Disconfirming cases falsify the theory (i.e. our understanding is incomplete) and undermines any claims that the chosen mechanistic claim is substantiated

Done properly, it can be a fragile basis for inferential claims: one disconfirming case disconfirms the entire theory; in reality, it's rare to find 100% outcomes in agreement

So – quality assessment involves demonstrating that the theory has been well tested, and disconfirming cases found and explained

Side-by-side

Probabilistic

- **No need to understand how an intervention works**
- **Predictive strength: same effect observed multiple times; alternative explanations ruled out**
- **No need to predict every individual correctly**

Mechanistic

- **Based on an understanding of how an intervention works**
- **Predictive strength: because we know how the intervention works, we can predict when it will happen**
- **Needs to explain *all* outcomes for all participants**

What we get from integration

- **Ways of overcoming the two different ways of justifying causal claims**
- **When you use theories to explain probabilistic findings, it helps overcome limitations in identifying the right variables in the probabilistic studies**
- **When you use theories to subgroup quantitative studies, it gives you a sound and unbiased basis for subgroup analysis (avoids data dredging)**
- **When both ways of drawing inference 'line up' it gives you greater confidence that you're on to something**

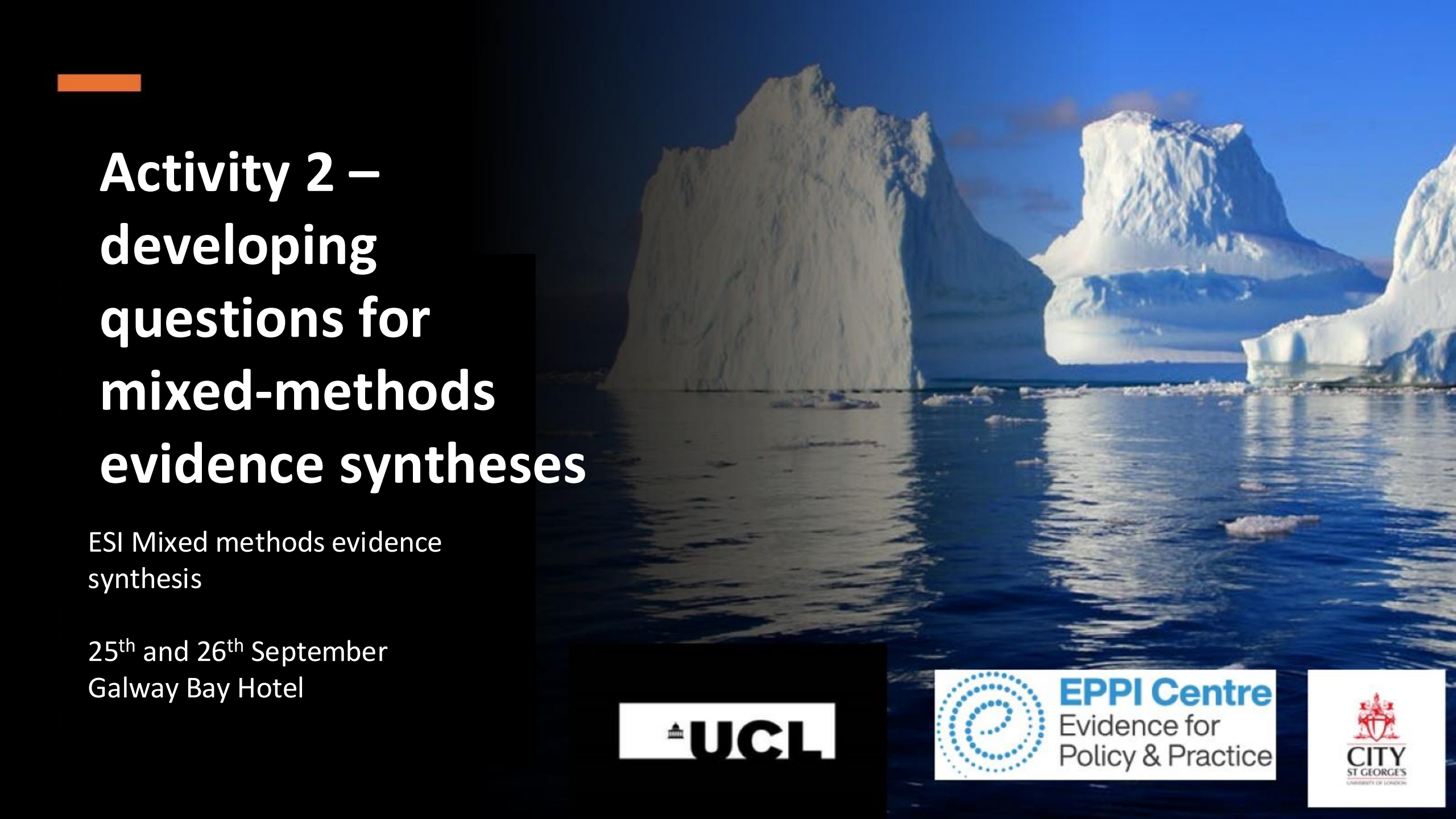
Expanding the range of questions

- **Conventional approaches (these are useful!):**
  - **How often the cause has the effect of interest**
  - **How large is the effect?**
  - **And how consistent?**
- **Mixed methods – often compound – questions**
  - **Effectiveness, feasibility, appropriateness, meaningfulness**
  - **For example:**
    - **Which intervention components are most important?**
    - **For which participants does the intervention work best / worst?**
    - **What factors drive differences between observed outcomes?**

Activity 2 – developing questions for mixed-methods evidence syntheses

ESI Mixed methods evidence synthesis

25th and 26th September
Galway Bay Hotel



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