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

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• The EPPI-Centre team

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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?

Face coverings at scale

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

Approach for the Monitoring and Evaluation of Wearing Masks

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Outcomes</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implement wearing masks as a community mitigation strategy that prevents spread of COVID-19, and maintain healthy environments and operations</td>
<td>Reduce exposure among individuals</td>
<td>Minimize COVID-19 morbidity and associated mortality</td>
</tr>
<tr>
<td>Strengthen, focus, or relax mitigation strategies based on local context</td>
<td>Reduce transmission</td>
<td>Thrive socially, emotionally, and economically</td>
</tr>
<tr>
<td></td>
<td>Reduce burden on the health care system</td>
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Critical considerations
- Ensure individual and community ability to adopt and sustain wearing masks
- Mitigate adverse effects and impacts on health disparities and social determinants of health
- Foster mental and emotional health and resilience
- Minimize negative physical, mental, and emotional challenges related to wearing masks

The politics of face coverings!

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

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

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

Why do QES in Public Health?

A QES can help understand the
- values and preferences of end-users
- acceptability and feasibility of health and social interventions,
- effects of different interventions on equity

In public health, a QES can explore:
- Health-related behaviours or experiences of illness
- Why and how a policy or intervention works
- Appropriateness or acceptability of interventions
- Barriers and facilitators to implementation of interventions
- Gaps in primary qualitative research evidence, eg gaps about knowledge of the acceptability of intervention
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
Thank you

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