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at American Institutes for Research

Panel Presentation 2: Systematic Reviews for a Complex World: New Avenues in Research Synthesis

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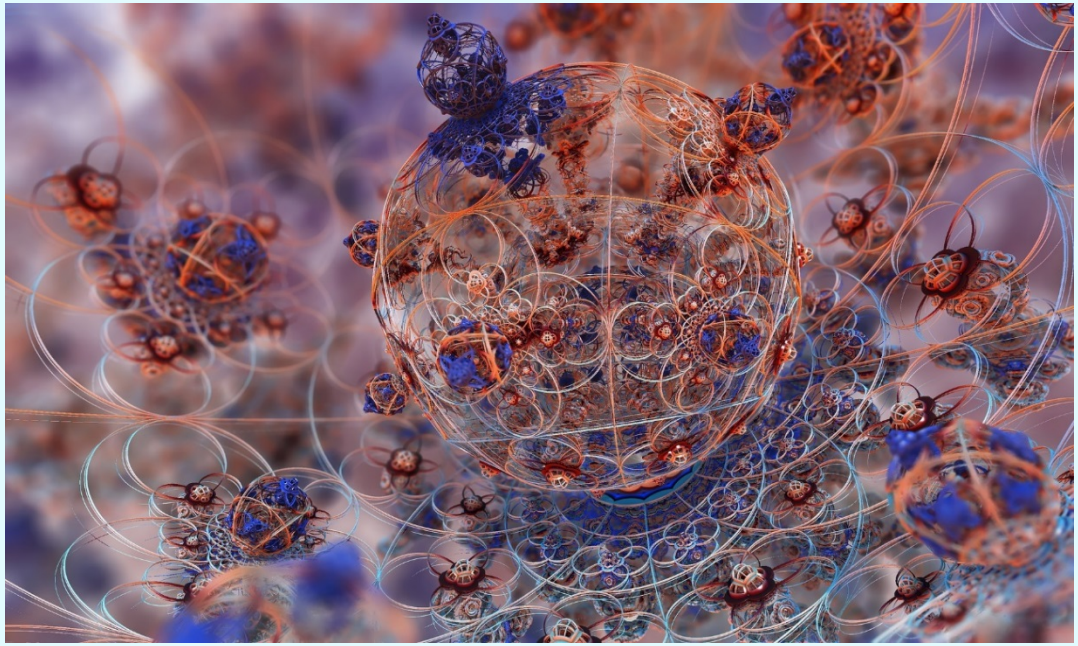
Systematic reviews for a complex world:
New avenues in evidence synthesis



Dr Katy Sutcliffe
Associate Professor
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UCL Institute of Education

EPPI CENTRE

	Effectiveness	Appropriateness	Feasibility
Excellent	• Systematic review • Multi-centre studies	• Systematic review • Multi-centre studies	• Systematic review • Multi-centre studies
Good	• RCT • Observational studies	• RCT • Observational studies • Interpretive studies	• RCT • Observational studies • Interpretive studies
Fair	• Uncontrolled trials with dramatic results • Before and after studies • Non-randomized controlled trials	• Descriptive studies • Focus groups	• Descriptive studies • Action research • Before and after studies • Focus groups
Poor	• Descriptive studies • Case studies • Expert opinion • Studies of poor methodological quality	• Expert opinion • Case studies • Studies of poor methodological quality	• Expert opinion • Case studies • Studies of poor methodological quality

Figure 1 Hierarchy of evidence: ranking of research evidence evaluating health care interventions.

Evans, D. (2003). Hierarchy of evidence: A framework for ranking evidence evaluating healthcare interventions. *Journal of Clinical Nursing, 12*, 77–84. doi:10.1046/j.1365-2702.2003.00662.x

Rigorous vs useful

They [systematic reviews] pick up general principles that are self-evident anyway, or they are so specific that there is little that is transferable. So a systematic review on dance among women over the age of 75 is quite interesting and potentially quite useful, [but] that is not that helpful in helping us think how we spend our limited physical activity budget across a number of different options which might be competing for similar resources.

'Few systematic reviews and meta-analyses are both non-misleading and useful.'

Ioannidis, J. P. (2016). The mass production of redundant, misleading, and conflicted systematic reviews and meta-analyses. *Milbank Quarterly, 94*(3)485–514.

Why might SRs have limited usefulness?

- Typical caricature of Cochrane reviews:
  - Narrow in scope and range of included methods
  - Aim to answer a single question with a single answer
- But policymakers do not come to us with a single narrow question or aim for a single answer
  - Policy and practice concerns often precede/go **beyond questions of effectiveness** e.g., 'Does it vary according to…?' 'What is the range of possible solutions?' 'What is the extent of the problem?'

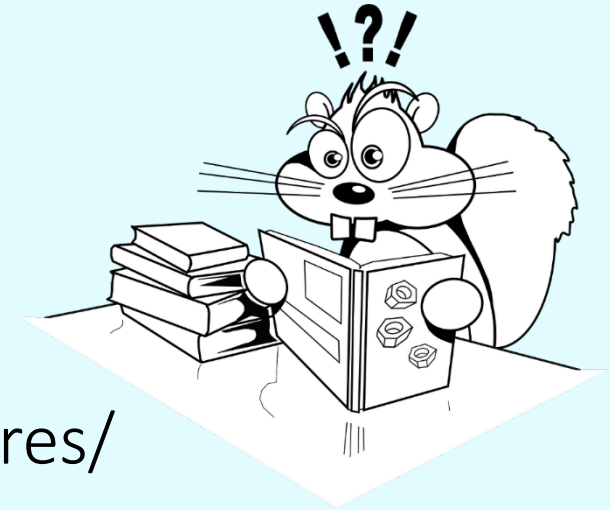
Not just complex questions, but complex interventions

Public health and other interventions may involve multiple, interacting components

Those that involve people can be particularly *complex – impacts affected by nature and beliefs of both provider and recipient*

If SRs are to be *used* they need to be *useful*

SRs with complex questions / interventions can be challenging but *essential* if SRs to be *more than an academic exercise*



e.g., without identifying critical features/ moderators > decision makers left *unsure about exactly what to implement and how*

SRs straightforward?

'When the methods for conducting systematic reviews were originally developed, the process of reviewing the literature was treated as relatively straightforward. Complexity existed, but reviewers often tried to simplify this complexity to group studies and in attempts to make comparative claims. In general, the systematic reviews and primary research included in systematic reviews approached research from a classic reductive philosophic and methodologic stance. Increasingly, people interested in adopting published interventions from reviews have found that this reductive stance eliminates details that are critical for them to understand whether the intervention is feasible and likely to work in their context, with their populations, and at what cost.'

Guise, J. M., Chang, C., Butler, M., Viswanathan, M., & Tugwell, P. (2017). AHRQ series on complex intervention systematic reviews paper 1: An introduction to a series of articles that provide guidance and tools for reviews of complex interventions. *Journal of Clinical Epidemiology 90*, 6–10.

How can we enhance the utility of SRs?

Solutions to these issues are constantly evolving – some avenues of work that we have been pursuing focus in on the detail of interventions

- Guidance for detailed reporting of components of interventions – with TIDieR team
- Methods for identifying *which components* of complex interventions *are critical to success*
  - Intervention Component Analysis
  - Qualitative Comparative Analysis

Enhancing the usability of systematic reviews by improving the consideration and description of interventions

Clinicians, patients, and policymakers cannot implement effective interventions if details of the interventions are not known. Review users should be able to compare the details of the interventions and consider whether – and, if so, how – to implement interventions in their setting.

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use systematic reviews, whenever available, rather than single trials to inform their practice. This article explores the problem and implications of incomplete intervention details

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such as in systematic reviews, with implications for the reproducibility and usability of the systematic review.

Appropriate use of intervention details in the planning, conduct, and reporting of systematic reviews is facilitated by interventions being well described in trials and other evaluative studies. The

Intervention details important for …

- **Planning:** During question formulation and protocol writing, consider dimensions of difference in interventions
- **Data extraction:** Draw on detailed tool – e.g. TIDieR checklist. Request missing info from authors.
- **Analysis:** Use information to inform interpretation of results.
- **Reporting:** Detailed account of intervention characteristics.

Author (year)	Brief name	Recipient	Why	What (materials)	What (procedures)	Who provided	How	Where	When and how much	Tailoring	Modification of intervention throughout trial	Strategies to improve or maintain intervention fidelity	Extent of intervention fidelity
Altiner (2007)	Complex GP peer led educational intervention	GPs and patients	Focused on communication in a consultation and the mutual discordance between patient expectations and doctor perceived patient expectations, empowering patients to raise the issue in the consultation. By "informing" both sides in the consultation, it is hoped that doctors and patients would openly talk about the issue and thus reduce unnecessary antibiotic prescriptions	Peers used a semistructured dialogue script for outreach visits. Patient materials (leaflet and poster) provided in waiting room primarily focused on the patients' role, doctor-patient "antibiotic misunderstanding,"and brief evidence based information on acute cough and antibiotics	GP peer led outreach visits. Peers were trained to explore GPs' "opposite" motivational background to tackle their beliefs and attitudes. GPs were motivated to explore patient expectations and demands, to elicit anxieties, and to make antibiotic prescribing a subject in the consultation. Patient materials were aimed at empowering patients to raise and clarify issues in the consultation	5 practising GPs and teaching academics in the lead authors' department (2 female, 33 to 63 years old); trained in 3 sessions for outreach visits	Face-to-face outreach visits to GPs	GP clinics during normal working hours	1 outreach visit performed per GP (duration not specified)	Not described	Not described	Not described	51/52 GPs received intervention
Briel (2006)	Brief training programme in patient centred communication	GPs	Focused on teaching GPs how to understand and modify patients' concepts and beliefs about the use of antibiotics for ARIs. GPs were introduced to a model (Prochaska 1992) for identifying patients' attitude and readiness for behaviour change	Evidence-based guidelines for diagnosis and treatment of ARIs (updated, locally adapted and reviewed by local experts) distributed as a booklet	GPs were trained in elements of active listening, to respond to emotional cues, and to tailor information given to patients. Physicians used a model were introduced to a model (Prochaska 1992) to identify patients' attitudes and readiness for behaviour change	Not specified	Seminar in small groups (number not specified) and personal feedback by telephone before the start of the trial. Evidence based guidelines were distributed as a booklet	Not specified	Attendance at one 6 hour seminar and one 2 hour telephone call to give personal feedback before the trial start	Not described	Not described	Not described	Not described
Butler (2012)	Multifaceted flexible blended learning approach for clinicians	GPs and nurse practitioners	Blended learning experience to develop clinicians' sense of the importance about change and their confidence in their ability to achieve change based on social learning theory. Clinicians reflected on practice level antibiotic dispensing and resistance data, reflected on own clinical practice (context bound learning), and were trained in novel communication skills derived from principles of motivational interviewing	Summaries of research evidence and guidelines, web based modules using video rich material presenting novel communication skills, and a web based forum to share experiences and views (see www.stemmingthetide.org for online component)	Intervention consists of 7 components: experiential learning; updated summaries of research evidence and guidelines; web based learning in novel communication skills; practising consulting skills in routine care; facilitator led, practice based seminar on practice level data on antibiotic prescribing and resistance; reflections on own clinical practice; and a web based forum to share experiences and views	A facilitator conducted the face-to-face seminar	Intervention consisted of 7 parts (5 online modules, 1 face-to-face seminar, and 1 facilitator led, practice based seminar)	The face-to-face and facilitator led seminars were presented at the general practice	7 components (5 online, 1 face-to-face, and 1 facilitator led, practice based seminar) A booster module (6 to 8 months after completion of initial training) reinforced these skills	Intervention was flexible so clinicians could access the online components and try out new skills with their patients at their convenience	Not described	Not described	138/139 completed all online training and uploaded descriptions of consultations for the portfolio tasks; 129/139 attended the practice based seminars; 76/139 completed the optional booster session at 6 months; 11/139 entered new threads on the online forum with 81 posts and 1485 viewings of posts and threads
Cals (2009)	Enhanced communication skills training	GPs	Focused on information exchange based on the elicit-provide-elicit framework from counselling in behaviour change—exploring patients' fears and expectations and patients' opinions on antibiotics and outlining the natural duration of cough in lower respiratory tract infections	Pre and post workshop transcripts of simulated patients	Brief context learning based workshop in small groups (5-8 GPs), preceded and followed by practice based consultations with simulated patients. GPs reflected on own transcripts of consultations with simulated patients, which were also peer reviewed by colleagues	Experienced moderator to lead seminars	Brief workshop (5-8 GPs), preceded and followed by practice based consultation with simulated patients	General practice	One 2 hour moderator led small groups workshop, preceded and followed by practice based consultation with simulated patients	Not described	Not described	Not described	66% of patients recruited by GPs allocated to training in enhanced communication skills recalled their GP's use at least 3 of 4 specific communication skills compared with 19% in the no training group

METHODOLOGY Open Access

Intervention Component Analysis (ICA): a pragmatic approach for identifying the critical features of complex interventions

Katy Sutcliffe*, James Thomas, Gillian Stokes, Kate Hinds and Mukdarut Bangpan

Abstract

Background: In order to enable replication of effective complex interventions, systematic reviews need to provide evidence about their critical features and clear procedural details for their implementation. Currently, few systematic reviews provide sufficient guidance of this sort.

Methods: Through a worked example, this paper reports on a methodological approach, Intervention Component Analysis (ICA), specifically developed to bridge the gap between evidence of effectiveness and practical implementation of interventions. By (a) using an inductive approach to explore the nature of intervention features and (b) making use of trialists' informally reported experience-based evidence, the approach is designed to overcome the deficiencies of poor reporting which often hinders knowledge translation work whilst also avoiding the need to invest significant amounts of time and resources in following up details with authors.

Results: A key strength of the approach is its ability to reveal hidden or overlooked intervention features and barriers and facilitators only identified in practical application of interventions. It is thus especially useful where hypothesised mechanisms in an existing programme theory have failed. A further benefit of the approach is its ability to identify potentially new configurations of components that have not yet been evaluated.

Conclusions: ICA is a formal and rigorous yet relatively streamlined approach to identify key intervention content and implementation processes. ICA addresses a critical need for knowledge translation around complex interventions to support policy decisions and evidence implementation.

Keywords: Systematic reviews, Evidence synthesis, Complex interventions, Knowledge translation, Paediatrics, Medication error, Electronic prescribing

The ICA approach

- 3 stages – (1) describe features, (2) views on strengths of key features, (3) views on implementation
- Two key features of ICA approach
  1) Includes '**informal evidence'** – author description on experience of using EP (informal feedback from users, author observation/hypothesis)
  2) Coded evidence using qualitative approach – to address problem of lack of information/inconsistency in intervention descriptions

Review in which ICA was developed

- DHSC commissioned review on Paediatric Electronic Prescribing (EP)
- EP found to be generally effective for reducing medication errors – but some harmful interventions
- DHSC commissioned further work to answer:-
  - What does successful EP system 'look like'?
  - How should hospitals implement?
  - How can we avoid harms?

ICA Stage 1: Intervention components

ICA enabled bespoke taxonomy:

1. 'Off the peg', 'Customised' or 'Home-grown'
2. Generic ‘adult based’ or **paediatric specific**
3. Included 'front-end' **decision support tools** – intentionally accessed features (dose calculators, order sets, information access)
4. Incorporated 'back-end' support **safety features** – automatically triggered/ system requirements (alerts, mandatory fields, access security)

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Study	Paediatric specific tool	Front end - decision support			Back end - safeguarding features		
		Dose calculation	Order sets	Info access	Alerts	Mandatory fields	Access security
'Off the peg' commercially available packages							
Han (2005)							
Jani (2010)							
King (2003)							
Walsh (2008)							
'Customised' commercially available packages							
Cordero (2004)							
Del Beccaro (2006)							
Holdsworth (2007)							
Kadmon (2009)							
Kazemi (2011)							
Keene (2007)							
Upperman (2005)							
Warrick (2011)							
'Home grown' packages							
Lehmann (2004)							
Lehmann (2006)							
Maat (2013)							
Potts (2004)							
Sowan (2010)*							
Vardi (2007)							
Unidentified package type							
Barnes (2009)							
Sullins (2012)							

ICA Stage 2: Strengths/weaknesses of key features

- 15 authors commented on value of (front end) **decision support** unanimous it is a **key factor in error reduction**
  - 'Similar findings may not be reproducible ... with nominal decision support' (Holdsworth et al., 2007)
- **Fewer studies** commented on **back-end features** – e.g., alerts
- Authors noted **some front-end decision support problems**
  - Han and colleagues (2005) found that automated entry increased order time
  - New errors introduced – e.g., Mis-selection from dropdown list

ICA Stage 3: Development and implementation

- Authors' experience-based knowledge on implementation

1. *Customisation essential:* 14/20 authors recommend customising EP systems or warn against use of generic 'off the peg' tools
2. *Engage with a range of stakeholders (SH):* 9 authors describe engaging with SH during development/6 SH involvement enhances EP.
3. *Foster familiarity with EP system:* 13 recommend enhancing user familiarity
4. *Ensure infrastructure is adequate and appropriate:* 6 authors stress importance of appropriate infrastructure.
5. *Iterative implementation:* 14 authors recommend / imply value of iterative or 'suck it and see' approach to development

- Strengths of ICA
  - Vital 'insight' into critical intervention features and implementation
  - Uses wealth of rich 'informal evidence' underutilised in many SRs
- Weaknesses of ICA
  - Informal evidence not equivalent to research data
  - At risk of being partial or biased – self-justifying
- Efforts to mitigate weaknesses
  - Explicitness about extent of data / consistency of opinion across studies
  - Checks to see if emergent themes corroborated by other evidence (other studies/effectiveness data)

Qualitative Comparative Analysis

- Will briefly address as have given a previous webinar on this topic – slides available here: https://ktdrr.org/training/webcasts/webcast51-60/docs/EPPI-8_webisode_Sutcliffe-Kneale_020718.pdf
- QCA is particularly suitable for identifying ingredients of complex interventions as it overcomes some of the challenges that complexity brings for existing synthesis methods

What is QCA?

- **Aim:** To identify mechanisms through which interventions have the impact they do – not 'what works, on average'
- **How:** Identifies combinations of intervention/contextual features that are (or are not) present when an intervention is successful (or not) in obtaining desired outcome
- **Logic:**
  - Case rather than variable oriented – deep holistic understanding of interventions, features and context (much like ICA)
  - Set-theoretic logic – systematic comparison of cases (interventions) within sets (e.g., effective vs ineffective) to identify necessary and sufficient conditions
  - Analysis informed by – or underpinned by – existing theories

What does QCA do that other methods can't?

Complexity means meta-regression likely unsuitable

- Complexity = replications rare
  - *Heterogeneity is unavoidable*
  - *SR datasets often lack necessary numbers of trials for MR, sub-group analyses etc.*
- Complexity = multiple pathways to effectiveness
  - *Complexity means that that different combinations of causal conditions may be capable of generating the same outcome*
  - *MR = correlation-based – association between presence/lack of potential moderators and outcome*

Conclusions

- Systematic reviews are the most robust and rigorous source of evidence – but not always useful.
- Systematic reviewers are seeking ways to make reviews more useful to decision makers AND ways to handle intervention complexity.
- There is a growing range of methods/guidance to enhance review utility by unpacking the nature and complexity of the interventions they examine.

Further reading on using QCA in SRs

Burchett, H. E. D., Sutcliffe, K., Melendez-Torres, G. J., Rees, R. & Thomas, J. (2018). Lifestyle weight management programmes for children: A systematic review using qualitative comparative analysis to identify critical pathways to effectiveness. *Preventive Medicine, 106*, 1–12.

Melendez-Torres, G. J., Sutcliffe, K., Burchett, H. E. D., Rees, R., Richardson, M., & Thomas, J. (2018). Weight management programmes: Re-analysis of a systematic review to identify pathways to effectiveness. *Health Expectations, 21*, 574–84.

Melendez-Torres, G. J., Sutcliffe, K., Burchett, H. E. D., Rees, R., & Thomas, J. (2019). Developing and testing intervention theory by incorporating a views synthesis into a qualitative comparative analysis of intervention effectiveness. *Research Synthesis Methods*.

Sutcliffe, K., Melendez-Torres, G. J., Burchett, H., Richardson, M., Rees, R., & Thomas, J. (2017). The importance of service users' perspectives: A systematic review of qualitative evidence reveals overlooked critical features of weight management programmes. *Health Expectations.* epub ahead of print.

Thomas, J., O'Mara-Eves, A., & Brunton, G. (2014). Using qualitative comparative analysis (QCA) in systematic reviews of complex interventions: a worked example. *Systematic Reviews, 3*(1), 1.

Disclaimer

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