**Webisode 8 - How to determine which interventions work best:**

 **Qualitative Comparative Analysis (QCA) – A method for**

**understanding complex interventions**

Presenters: Katy Sutcliffe and Dylan Kneale (EPPI-Centre, UCL)

EPPI-Centre Evidence Tools, Products, and Projects – A series of webisodes from the Evidence for Policy and Practice Information and Co-ordinating (EPPI) Centre. Hosted by AIR’s Center on Knowledge Translation for Disability and Rehabilitation Research (KTDRR).

**Slide 1: Cover slide**

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**Cover slide template:** dark blue background with white text and gray text. Gray bar at bottom with AIR logo on the left (gray and blue column on left; letters in blue, AIR (R) on the right; words below in blue, American Institutes for Research (R)). To the left of AIR logo, EPPI-Centre logo: A large blue script letter e to the left, with smaller black letters PPI to the right. Below PPI, in a smaller black box, is the word CENTRE in white text.

**Slide 2: Title slide**

How to determine which interventions work best: Qualitative Comparative Analysis (QCA) – A method for understanding complex interventions.

February 2018. Katy Sutcliffe, Dylan Kneale, James Thomas (EPPI-Centre, UCL). **Conflict of Interest statement:** We have no actual or potential conflicts of interest in relation to this presentation.

**Title slide template:** Blue bar at top. On far left, Institute of Education. On the far right, UCL Logo: White image of Main Building with large white letters UCL to the right. In the center background, a photograph of London with title text superimposed over the image. White bar at the bottom: Conflict of interest statement to left and center. On far right, EPPI-Centre logo: A large blue script letter E to the left, with smaller black letters PPI to the right. Below PPI, in a smaller black box, is the word CENTRE in white text.

**Slide 3: What is the challenge in Systematic Reviewing?**

Complex Social interventions

* Intervention complexity: multiple interacting components and multiple potential moderators.
* Further complexity in social interventions: impacts affected by nature and beliefs of both provider and recipient.

Bottom right corner of remaining slides:EPPI-Centre logo: A large blue script letter E to the left, with smaller black letters PPI to the right. Below PPI, in small font, the word CENTRE. A black line on top of PPI and under the script E and CENTRE.

**Slide 4: Why do SRs need to explore complexity?**

Challenging work but essential if SRs on complex interventions to be more than an academic exercise.

Without identifying critical features/moderators > decision-makers left unsure about exactly what to implement and how.

Image on the right: Foresight Obesity System Map. Graphic from <https://www.gov.uk/government/publications/reducing-obesity-obesity-system-map>

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**Slide 5: What is QCA?**

* Aim: to identify mechanisms through which interventions have 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
* 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

**Slide 6: Key set-theoretic relationships (i)**

In the center, a green circle within a larger purple circle. To the left, the words Condition X with an arrow pointing to the larger purple circle. To the right of the circles, the words Outcome Y with an arrow pointing to the smaller green circle.

* Necessity
* Condition (variable) X has to be there for Y to occur
* Condition X is necessary in order for Y to occur

**Slide 7: Key set-theoretic relationships (ii)**

In the center, a purple circle within a larger green circle. To the left, the words Outcome Y with an arrow pointing to the larger green circle. To the right of the circles, the words Condition X with an arrow pointing to the smaller purple circle.

* Sufficiency
* Condition (variable) X can trigger Y to occur
* … but there are other ways in which Y can happen as well
* Condition X is sufficient to produce Y

**Slide 8: Using QCA in different reviews**

Group 1: Mixed methods – use QCA to explore the results of meta-analysis (e.g. highly effective vs not effective)

Group 2: Mixed methods – use QCA to inform the analysis plan for meta-analysis

Group3: Single method – use QCA as sole basis of synthesis (image of a box with an x in it)

**Slide 9: QCA glossary**

A table with two columns and six rows.

Left column: In the world of QCA; Right column: In an ordinary world.

QCA: Conditions; Ordinary: Variables.

QCA: Configuration; Ordinary: A collection/combination of conditions

QCA: Cases; Ordinary: Studies.

QCA: Sufficient condition; Ordinary: Condition is enough to trigger outcome (but other pathways exist).

QCA: Necessary condition; Ordinary: Outcome is only triggered in the presence of condition.

QCA: Truth table; Ordinary: First set of results – logically possible combinations and outcome results.

**Slide 10: Asking Configural Questions**

* What combinations of [insert conditions here] are found among cases that demonstrate [insert outcome here]?

Systematic Review Question Examples:

* What combinations of [behavioral change techniques] are found among interventions that demonstrate [improved medication adherence]?
* What are the [key processes and design features] associated with [successful implementation of school asthma programmes]?
* What are the [key components of quality improvement strategies] to [improve mental health care] for children and adolescents?
* What are the [critical features] of [successful adult weight management programmes]?

**Slide 11: Example review: Adult weight management programmes (WMPs)**

* Existing SRs show multiple-component WMPs (addressing both diet and exercise) more effective than those addressing diet or exercise alone
* BUT more fine-grained evidence not available
* NICE (2014) meta-regression – “key ingredients that differentiate more effective from less effective interventions remain largely unknown”
* DH commissioned us to try an alternative method
* Built on work of colleagues – Thomas, O’Mara-Eves and Brunton (2014)

**Slide 12: Six stages of QCA**

A table with three columns (Stage, Name, Details) and six rows.

Stage 1. Building ‘data table’; Details: rows = cases, columns = conditions; - to capture whether conditions are present or not in each case.

Stage 2. Constructing ‘truth tables’; Details: Summarizes how many cases within a particular configuration are instances of outcome.

Stage 3. Checking quality of truth tables; Details: Contradictory configurations = identical configurations present in both pos. and neg. cases. Satisfactory Spread = good spread in terms of outcomes and conditions within configurations.

Stage 4. Boolean minimization; Details: Most simplified configurations, i.e. reduced to essential components of configuration.

Stage 5. Consideration of ‘logical remainders’; Details: Consideration of the potential outcome of configurations not present in any interventions.

Stage 6. Interpretation; Details: interpreting findings in the light of theory – ensures that findings are grounded – not “fishing”.

**Slide 13: Stage 1: Data Table (well some of it…)**

A table with 10 columns and 22 rows.

Column 1 identifies studies (top 10 are highlighted yellow: very effective); bottom 10 are highlighted green: not very effective).

Data reported in columns 2-10 are reported as 1 or 0.

Columns 2-4: Practical info, De-emphasise ‘diet’, visual demos.

Columns 5-6: Diet monitoring ‘easy”, Diet monitoring not further stated.

Columns 7-10: Direct provision, focus on fitness gains, tailored to fitness levels, graduated.

Last 3 rows contain totals: Very effective total, Not very effective total, and Total.

Very effective:

Bertz 2012: 1, 0, 1; 0, 1; 1, 1, 1, 1.

DPP 2002: 1, 0, 0; 1, 0; 1, 0, 1, 0.

Foster-Schubert 2012: 0, 0, 0, 0, 1, 1, 0, 1, 1.

Kuller 2012: 1, 0, 0, 0, 1, 0, 0, 0, 1.

Rejeski 2011: 1, 0, 1, 0, 1, 1, 1, 0, 1.

Rock 2010 (CB): 1, 0, 0, 0, 0, 0, 0, 0, 0.

Rock 2010 (TB): 1, 0, 0, 0, 0, 0, 0, 0, 0.

Villareal 2011: 0, 0, 0, 0, 1, 1, 0, 1, 1.

Vissers 2010 (fitness): 0, 0, 0, 0, 0, 1, 0, 0, 1.

Vissers 2010 (vibration): 0, 0, 0, 0, 0, 1, 0, 0, 1.

Not very effective:

Eriksson 2009: 1, 0, 0, 0, 0, 1, 0, 1, 1.

Hersey 2012 (2): 0, 0, 0, 0, 1, 0, 0, 0, 0.

Hersey 2012 (3): 0, 0, 0, 0, 1, 0, 0, 0, 0.

Jolly 2011 (GP): 1, 0, 1, 0, 1, 0, 0, 0, 1.

Jolly 2011 (pharmacist): 1, 0, 1, 0, 1, 0, 0, 0, 1.

Jolly 2011 (SW): 1, 0, 1, 0, 1, 0, 0, 0, 1.

Munsch 2003 (clinic): 0, 0, 0, 0, 1, 0, 0, 0, 1.

Nanchahal 2011: 1, 0, 0, 0, 1, 0, 0, 1, 0.

Patrick 2011: 1, 0, 0, 1, 0, 0, 0, 1, 1.

Vermunt 2011: 1, 0, 0, 0, 1, 0, 0, 0, 0.

Very effective total: 6, 0, 2; 1, 5; 7, 2, 4, 7.

Not very effective total: 7, 0, 2; 1, 8; 1, 0, 3, 6.

Total: 13, 0, 5; 2, 13; 8, 2, 7, 13.

**Slide 14: Stages 2 & 3: Construct Truth Table and examine quality**

Table 3.7: Configurations represented in the provider alliance model

Table consists of six columns and ten rows.

Columns: Direct provision of exercise, Provider relationships, Graduated exit, High intensity; Number of most effective interventions, Number of least effective interventions.

Data in nine rows which contain data indicating Present or Absent in first four columns and total number in last two columns.

Row 1: Present, Present, Present, Present; 5, 0.

Row 2: Present, Present, Absent, Present; 1, 0. Arrow between rows 2-3, “Contradictions?”

Row 3: Present, Present, Absent, Absent; 1, 0.

Row 4: Absent, Present, Present, Present; 3, 0.

Row 5: Present, Absent, Present, Present; 0, 1.

Row 6: Absent, Present, Present, Absent; 0, 1.

Row 7: Absent, Absent, Absent, Present; 0, 5. Arrow at row 7, “Spread?”

Row 8: Absent, Present, Absent, Absent; 0, 1.

Row 9: Absent, Absent, Absent, Absent; 0, 2.

**Slide 15: Stage 4: Boolean minimisation**

A simple example of Boolean minimization. What makes a good restaurant?

L=Locally sourced food; W=Good wine list; M=Michelin star; O=Good restaurant

L \* W \* M + L \* W \* m arrow points to the right to O

L\* W arrow points to the right to O

On the right:Picture of the outside of a restaurant at night. Image Licensed from [Graphics Factory.com](https://www.graphicsfactory.com/)

**Slide 16: Stage 5: Consideration of logical remainders**

Table 3.8: Logical remainders in the provider alliance model

Table consists of six columns and eight rows.

Columns: Provider relationship, Direct provision of exercise, High intensity, Graduated exit; Number of most effective interventions, Number of least effective interventions.

Data in sevenrows which contain data indicating Present or Absent in first four columns and total number in last two columns.

Row 1: Present, Present, Absent, Present; 0, 0.

Row 2: Absent, Present, Absent, Present; 0, 0.

Row 3: Absent, Present, Absent, Present; 0, 0.

Row 4: Absent, Present, Absent, Absent; 0, 0.

Row 5: Present, Absent, Present, Absent; 0, 0.

Row 6: Absent, Absent, Present, Present; 0, 0.

Row 7: Absent, Absent, Absent, Present; 0, 0.

**Slide 17: Stage 6: Interpretation**

Table with four columns: Critical feature, Example view, Most effective interventions (n=10), Least effective interventions (n=10).

Critical feature: Good quality provider relationship

Example View: ‘You feel that somebody’s batting for you’, ‘personality and approach of the advisor is likely to determine the success or failure of the service’

Most effective interventions: All 10 most effective interventions had: Provider-user relationships emphasized AND Characteristics perceived to foster self-regulation.

Least effective interventions: All 10 least effective interventions had: NO emphasis on provider relationships. OR An emphasis on provider relationships BUT NO self-regulation characteristics.

**Slide 18: Stage 6 (cont.): Final Pathways**

Model reflecting supportive provider relationships with multiple configurations within each pathway.

Top row = Blue box on left: Provider relationship emphasised + pink box on right: High intensity + olive green box on right: Graduated exit; Arrow pointing to green circle below right: Highly effective interventions (n=10).

Bottom row = Blue box on left: Provider relationship emphasised + yellow box on right: Direct provision; Arrow pointing to green circle above right: Highly effective interventions (n=10).

**Slide 19: Strengths of QCA**

* Ability to identify critical features where other approaches unsuccessful
* Works particularly well with small number of heterogeneous studies
* Ability to reflect complexity – multiple pathways to effectiveness
* Grounding in theory structures analysis and avoids data dredging
* Grounding in theory ensures not just justification but explanation i.e. not just ‘what works’ but “why it works”

**Slide 20**: **Limitations of QCA**

* Analytical approach is abductive > findings more tentative than from deductive approaches
* Poor intervention reporting is common in trials > may hinder deep understanding
* BUT – QCA is explicit and systematic approach provides useful/usable info for decision-makers where otherwise they have nothing to base decisions on
* Best used in combination with other methods

**Slide 21: Thank you**

QCA methods paper: Thomas J, O’Mara-Eves A, Brunton G. Using qualitative comparative analysis (QCA) in systematic reviews of complex interventions: a worked example. Syst Rev. 2014;3:67.

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Top right: IOE London logo. Leading education and social research. Institute of Education, University of London.

Image on right: London at night - the London Eye on left, bridge over River Thames center, Westminster Palace in background on right.

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**Slide 22**: **Disclaimer**

The contents of this presentation were developed by the EPPI-Centre for grant number 90DP0027 from the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR). NIDILRR is a Center within the Administration for Community Living (ACL), Department of Health and Human Services (HHS). The contents of this presentation do not necessarily represent the policy of NIDILRR, ACL, HHS, and you should not assume endorsement by the Federal Government.

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