Common Elements Approaches to Implementation Research and Practice

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Agenda

Common Elements Approaches to Implementation Research and Practice: Methods and Integration with Intervention Science

Thomas Engell[1] · Nicole A. Stadnick[2,3,4] · Gregory A. Aarons[2,3,4] · Miya L. Barnett[5]

- The common elements concept in implementation science

- Common elements 2.0
  - Logic and language
  - Step-by-step guide to conducting CE-reviews
  - Potential results

- Practical implications for dissemination, practice and research

- Limitations

- Recommendations for realizing potentials

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Common Elements Approaches to Implementation Research and Practice: Methods and Integration with Intervention Science

Thomas Engell[1] · Nicole A. Stadnick[2,3,4] · Gregory A. Aarons[2,3,4] · Miya L. Barnett[5]

Paper aims:

▸ Narrative review of the common elements concept

▸ Step-by-step guide to systematic common elements methodology that synthesizes and distills the intervention and implementation science literature together

▸ Recommendations for advancing element-level evidence in implementation science

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Acknowledgements and inspirations

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- Everyone at the common elements meeting in Oslo 2014

- The CE work at Vanderbuilt Peabody Research Institute, Uni of Melbourne and Uni of Washington, Center for Evidence and Implementation

- Arild Bjørndal, Eyvind Elgesem, Robyn Mildon, Patty Leijten, Frances Gardner, John Kjøbli, Maya Boustani, Karianne H. Nilsen, Hege Kornør, Kristine A. Hagen, Aaron Lyon, Bryce McLeod, Kevin Sutherland, Aleisha Clark, Byron Powell, Dennis Embry, Richard Barth, Anthony Biglan, Kimberly Becker, Shannon Dorsey, Laura Murray, Pim Cuijpers, Ann Garland +++

- Erika Crable for this type of slide

Common elements in intervention science

- For reviews of prominent and impactful CE-work in intervention science, see

Common Elements Approaches to
Implementation Research and Practice:
(Engell, Stadnick, Aarons, & Barnett 2023)

Research Strategies to Discern Active
Psychological Therapy Components: A Scoping
Review
(Leitjen, Weisz, & Gardner, 2021)

A chapter with a
literature review
(Engell 2021)

Elements and causality in implementation processes

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- A lot of stuff happening in time and space to implement and sustain something

  - Activities, events, systems, interactions, relationships, qualities and other phenomena

- ***Elements of implementation*:** discrete implementation strategies, implementation determinants, implementation competencies, relationships, values (e.g., Powell et al., 2015; Nilsen & Bernhardsson, 2019; Metz et al., 2021), or any other relevant part of implementation processes

- Elements of implementation may or may not influence implementation mechanisms and outcomes

  - Causes can be linear and non-linear

  - Direct, indirect, interconne~~~~~~~~~~, dispositional, catalyzing

  - Necessary con~~~~~~~~~~necessary but insufficient, sufficient but unnecessary, insufficient but necessary part of an unnecessary but sufficient condition.

- What do these complex messes **tend** to have in common when they "work"?

- **Common elements approaches = Leveraging the evidence-base to distill elements likely to be key/influential in a given process/context/situation**

«Messy and complex?»

…the interesting questions

- When and under what circumstances do certain implementation strategies tend to work, and when do they not?

- Do they work as discrete strategies, or do they need to be interconnected parts of blended or sequential strategies?

- When do specific contextual determinants implicate certain combinations of strategies, and does it depend on the characteristics of the thing being implemented or the competencies of implementation practitioners?

- What are the core elements of effective implementation strategies, and what strategies tend to be adaptable and when?

(Engell, Stadnick, Aarons, & Barnett 2023)
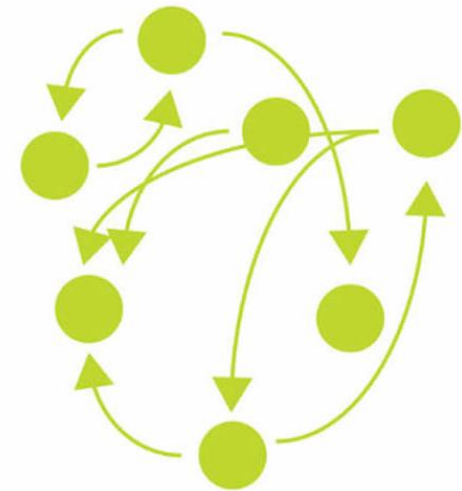
The first main feature of the concept of common elements: **disentaglement**

Engell et al., 2020
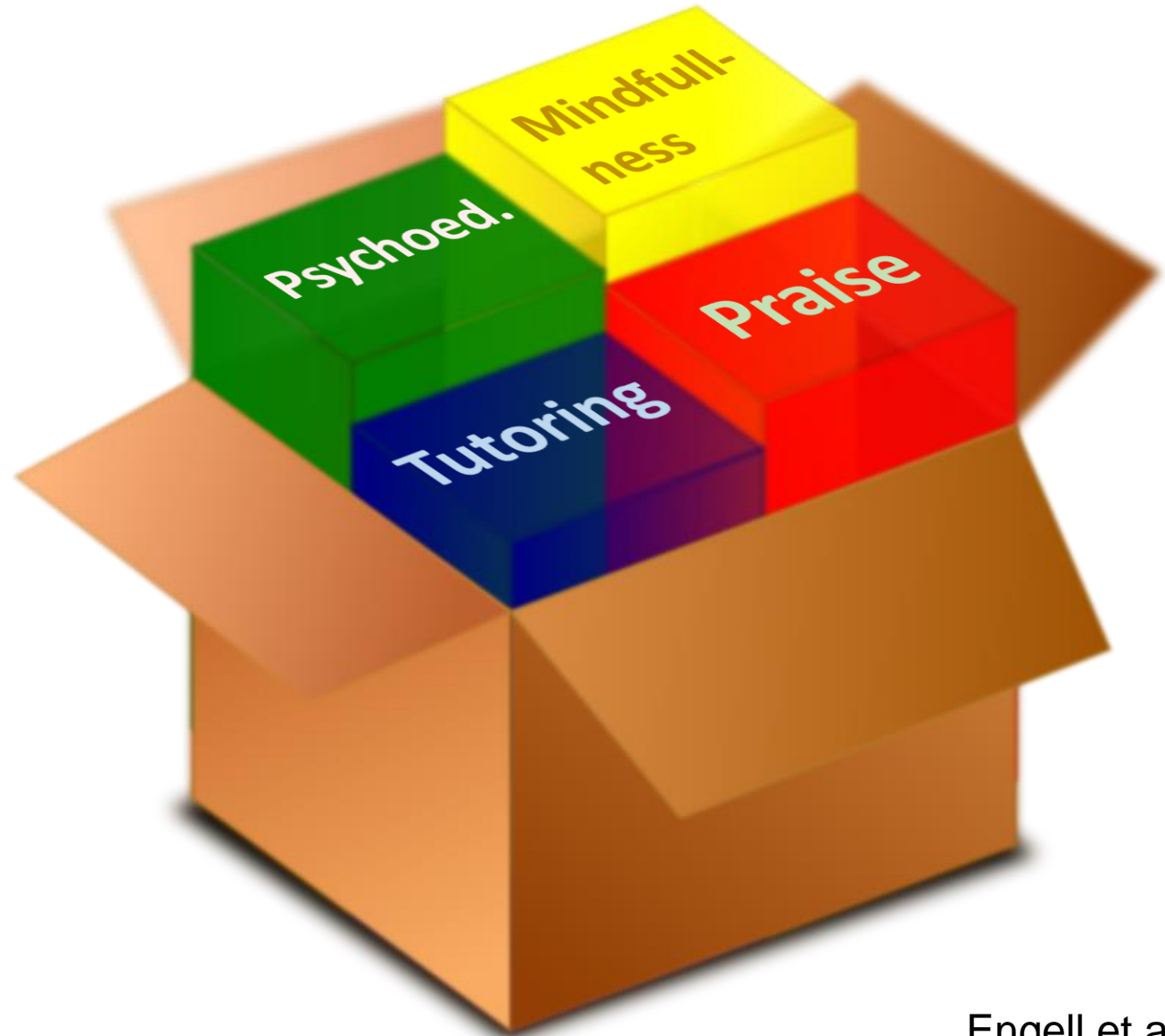
The second main feature: finding **commonalities**

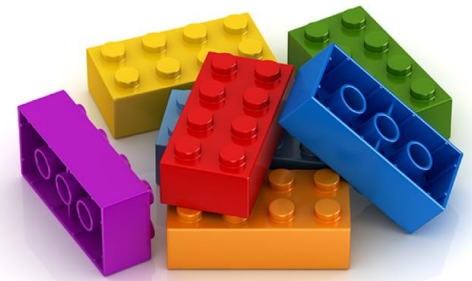**Intervention A**

Intervention B
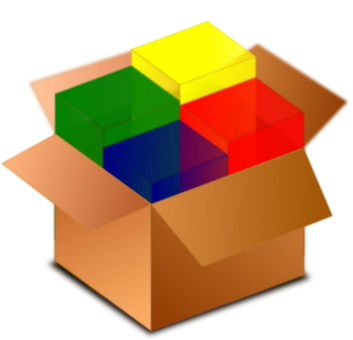
Common elements

Intervention C

Intervention D

Common elements

- Common elements (CE) = "practices or processes frequently shared by a (large) selection of interventions or implementations"

- CE-Methods = disentangle complex interventions/implementations into discrete elements, and then describe or evaluate the relative merits of common elements across the scientific literature

- Depending on theoretical orientation and methods used: assumed to have certain qualities or characteristics
  - active ingredients, essential elements, evidence-informed elements, evidence-based elements, evidence-based kernels

→ Synthesize and distill research to extrapolate "what works"

(Engell et al., 2020; Chorpita & Daleiden, 2005; Embry & Biglan, 2008; Leijten et al., 2021)

Methods for identification and evaluation of common elements

Traditional methods:

Focused on identifying practice elements that are "active ingredients"

- Expert opinions (e.g., Delphi methods; Garland et al., 2008)

- Describing commonalities or counting frequencies (e.g., in systematic reviews; van der Pol et al., 2019; or practice-based observation; Hogue et al., 2019),

- Statistical testing of associations (e.g., meta-regressions on elements; Leijten et al., 2019)

- Combinations of the above

(Leijten et al., 2021)

Recent developments:

More focused on configurations/combinations of different types of elements

- Reviewing combinations of different types of intervention practices, processes, contextual characteristics, and discrete implementation strategies to identify configurations that tend to work (Engell, 2021)

- Testing of relative effects of elements or configurations using component network meta-analyses, and testing conjunctions with client characteristics using individual participant data meta-analyses (Furukawa et al., 2021)

Applications in intervention science

- Direct dissemination and implementation

- «Trim» complex interventions and programs
    - Discard unnecessary elements, add contributing ones
    - More flexible and contextualized implementation (e.g., element-based flexibility for function, Engell et al., 2021)

- "Building blocks" to design or re-design tailored interventions or other models of implementation in practice (Engell et al., 2021; Chorpita et al., 2021)

- Inform experimental studies/fine grained testing of elements and mechanisms
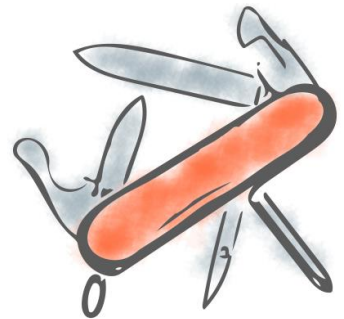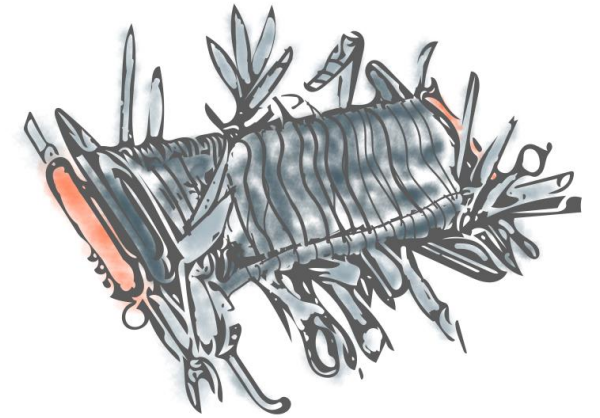
Common elements 2.0

▶ High quality systematic reviews and/or quality assured databases

▶ Synthesis, coding, and integration of intervention and implementation science literature

▶ **Deconstruction**, **commonalities** and **configurations** (network architecture)

- Just as focused on what and how elements and components make up meaningful *"wholes"* as on discrete elements/components (i.e., *"parts"*)

- Aims to add to our understanding of the *how*, *why*, and *when* interventions tend to work, to complement the primacy to the *whether* and *how often*

- Unveil adaptations that tend to be favorable under different circumstances (e.g., Park et al., 2022).

▶ Can be used from pragmatically to advanced

▶ …still limited by the primary studies available and the details and data reported from them
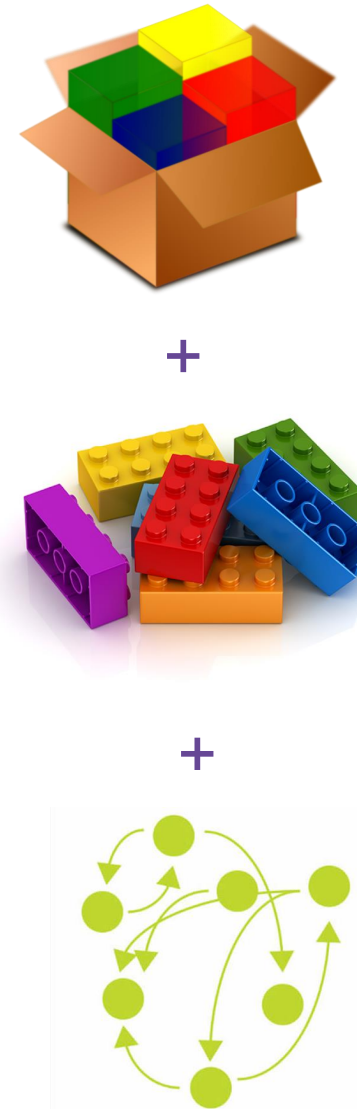
(Engell, Stadnick, Aarons, & Barnett 2023)

Common elements 2.0 logic and language

- Key step: Deconstructing «the thing(s)» and the «stuff we do to get people to do the things» (Curran, 2020)

- The appropriate level of «deconstruction» depends on objectives and/or perspectives on the nature and composition of the things (meronomy/partonomy)
  - Is the thing a sum of one or more active parts/ingredients?(Discrete parts or sets of parts)
  - Is the thing or system as a whole more than the sum of its parts? (Ecological/emergence)
  - Do the things' causal «powers»/contributions tend to be triggered by specific sets of parts/configurations? (dispositional)
  - And others…

- «Atheoretical» foundation to avoid making the methods themselves constrain/lead theory
  - Facilitate the opportunity to synthesize and integrate evidence from different ontological and epistemological views

- <u>Not an attempt to replace any established impsci constructs</u>

Common elements 2.0 logic and language

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Implementation element

Any meaningfully distinguishable *part* of implementation at any level of *discreteness*. An element is a part of a whole that in itself also is a meaningful whole.

- *Example: A provider's self-efficacy towards an intervention may be an element of an implementation mechanism*

Implementation component

Any part or ingredient of an implementation element. A component is not necessarily in itself a meaningful whole. We use the term when a second level of discreteness is needed, or to denote parts that depend on other parts to compose or catalyze a whole.

- *Example: A brainstorm session for implementation barriers as part of a readiness assessment.*

An implementation process

An implementation element

Component A

Component C

Component B

(Engell, Stadnick, Aarons, & Barnett 2023)
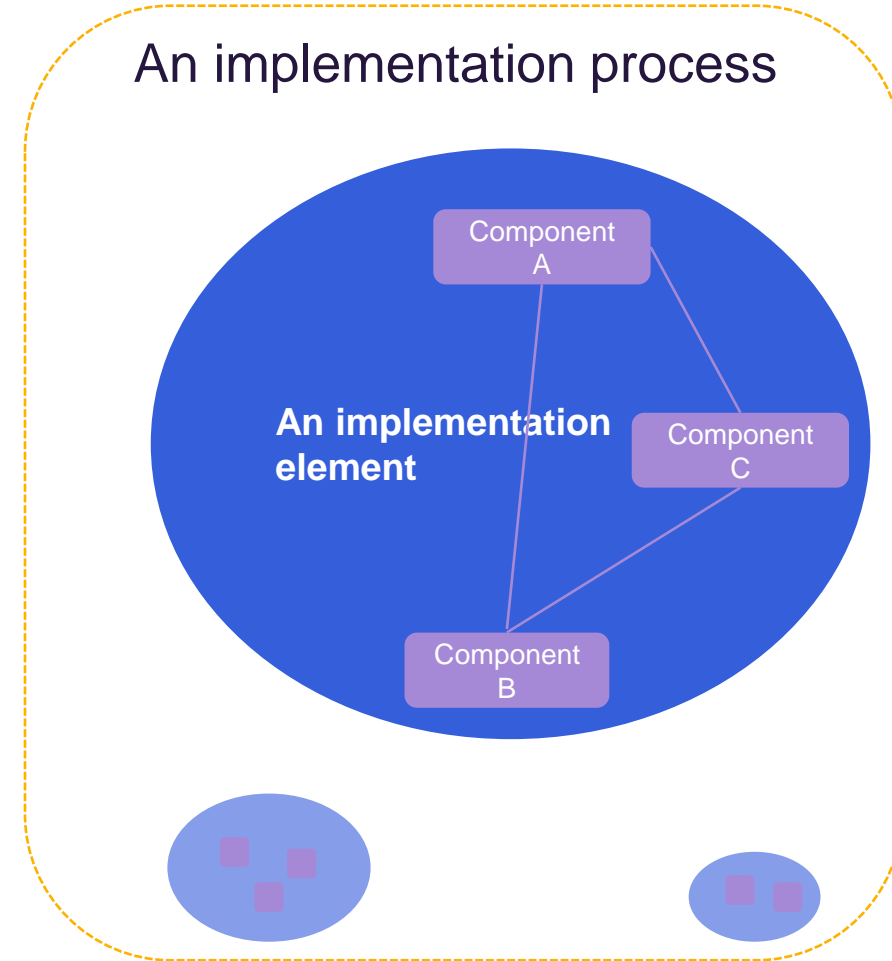
Common elements logic and language

Types of elements and components

Practice elements/components (x) = things people do

Process elements/components (y) = how people do things or how things unfold or emerge

Context elements/components (z) = circumstances in which things are done, unfold or emerge

- *Example: Conducting a readiness assessment (x) in facilitated collaboration (y) at a local community mental health clinic (z) using workshops (y) and a professional facilitator (z), with trust emerging among partners through value-based collaboration (y).*

Elements can be core, evidence-informed, or evidence-based (see paper for definitions and examples)

(Engell, Stadnick, Aarons, & Barnett 2023)

Questions so far?

Next up:

- Step-by-step guide

- Potential results and implications

- Limitations

- Recommendations/needs for realizing potentials

Step-by-step guide to common elements reviews

Step 1 and 2

1. Study selection from systematic reviews or databases

- Define review criteria for studies to code in matrices or databases
- High quality search and selection (e.g., Higgins & Green, 2011

2. Gather material, information and data from included studies

- Papers and supplementary files, reports, manuals, implementation plans, open data etc.

Studies

Systematic review process

Systematic Review

Step-by-step guide to common elements reviews

Step 3: Prepare and pilot coding system

- **Create conceptual framework and system for coding**
  - Define all elements, components, determinants and outcomes of relevance
  - Use existing taxonomies and ontologies when relevant, deviate and report when appropriate
  - Prepare for adding unanticiapted elements during coding to reduce popularity bias (Engell et al., 2020)

- **Prepare matrices or database**
  - Organize data appropriate for algorithms and analyses
  - Our method: **network architecture**

- **Iterative piloting and adjustments**

Step-by-step guide to common elements reviews
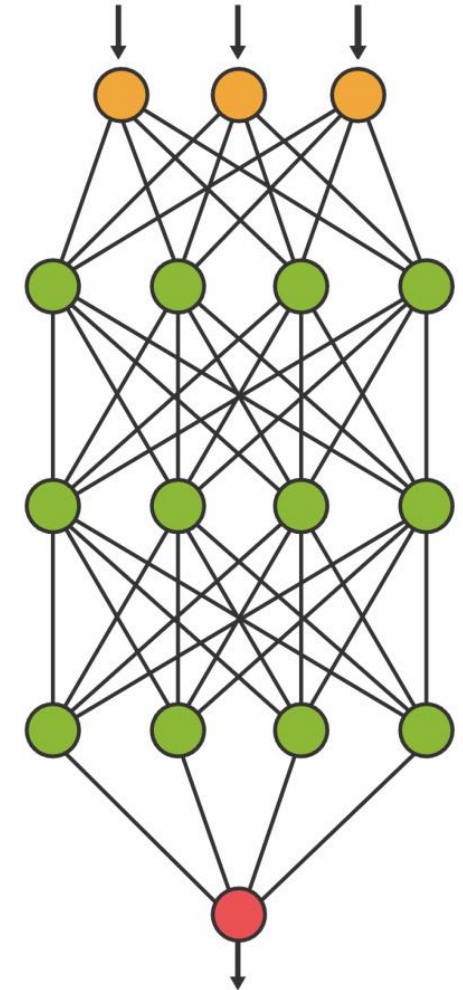
Step 4: Coding iterations

- All relevant study materials coded by two independent coders
  - Conflicts resolved through discussion with supervisor
  - Coding metrics recorded
- Recoding for unanticipated elements included during the coding procedure

Step-by-step guide to common elements reviews

Step 5: Apply algorithms to identify common elements and configurations

- A set of frequency-based algorithms to:
  - Identify common elements and common combinations of elements
  - Identify specific configurations of common elements
  - Account for inclusion in effective interventions/implementations vs in ineffective and with negative effects
  - Formulate hypotheses based on common elements, combinations, and configurations

Step-by-step guide to common elements reviews

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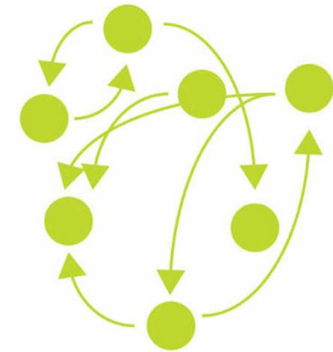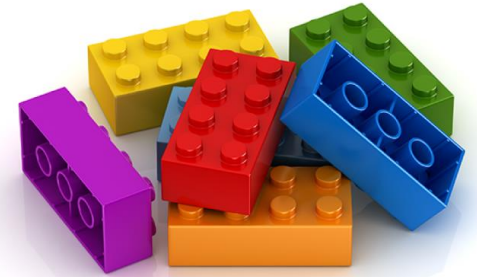
Step 6: Statistical analyses

▶ Several possibilities (see Leijten et al. 2021 for review)

▶ **Three-level meta-regression analyses** (Assink & Wibbelink, 2016)

- Freely available shiny app in R developed by Tore Wentzel-Larsen available here: https://github.com/ToreWentzel-Larsen/threelevel

▶ **Component Network Meta-Analysis** (cNMA). Bayesian or frequentist methods works (Seide et al., 2020; Pompoli et al. 2018)

▶ **Data ecosystems** with machine learning

Include and code all studies regardless of effects if you can
(sort later if needed)

- As a general principle, do not exclude studies/conditions that are less effective, ineffective, or iatrogenic when reviewing common elements

- Exclusion can skew results and increase «**popularity bias**»:
  - "The tendency of some elements to be frequently included in interventions and implementations based on popular opinion reasoning them as important, regardless of (uncertain) effectiveness (Engell et al., 2020)"
  - Just including «winning» studies/conditions can be appropriate depending on aims of review (e.g., describing and testing the literature on effective interventions)

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Common Elements of Practice, Process and Implementation in Out-of-School-Time Academic Interventions for At-risk Children: a Systematic Review

Thomas Engell[1,2] · Benedicte Kirkøen[1] · Karianne Thune Hammerstrøm[1] · Hege Kornør[3] · Kristine Horseng Ludvigsen[1] · Kristine Amlund Hagen[4]

- ▶ "Structured tutoring" was the nr 1 most common element of effective academic interventions for children at risk

- ▶ When accounting for inclusion in ineffective studies also, structured tutoring did not make the top 5

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Routledge
Taylor & Francis Group

OPEN ACCESS   Check for updates

Common Practice Elements in Treatment Programs for Adolescents with Externalizing and Internalizing Problems: A Meta-Analysis

Line Solheim Kvamme [a], Serap Keles [b], Ragnhild Bang Nes [c,d], Linda Vaskinn [e], Pamela M. Waaler [a,f], Tore Wentzel-Larsen [a], and John Kjøbli [a,g]

- The most common practice elements of "winning" interventions were training in 'behavior regulation' and 'mindfulness awareness'

- When inclusion in less effective and ineffective studies were statistically accounted for, none of them were associated with effects/outcomes

- Accounting for both, 'emotion recognition and differentiation', and 'psychoeducation' identified as more promising/contributing elements

Potentital results from hypothetical example

Unpacking the complexities of external consultation as an implementation strategy, using advanced common elements methods

- Common elements review including above 100 richly reported intervention and implementation studies where external consultation was experimentally tested or used

- We're not there yet, but we can be soon

(Engell, Stadnick, Aarons, & Barnett 2023)
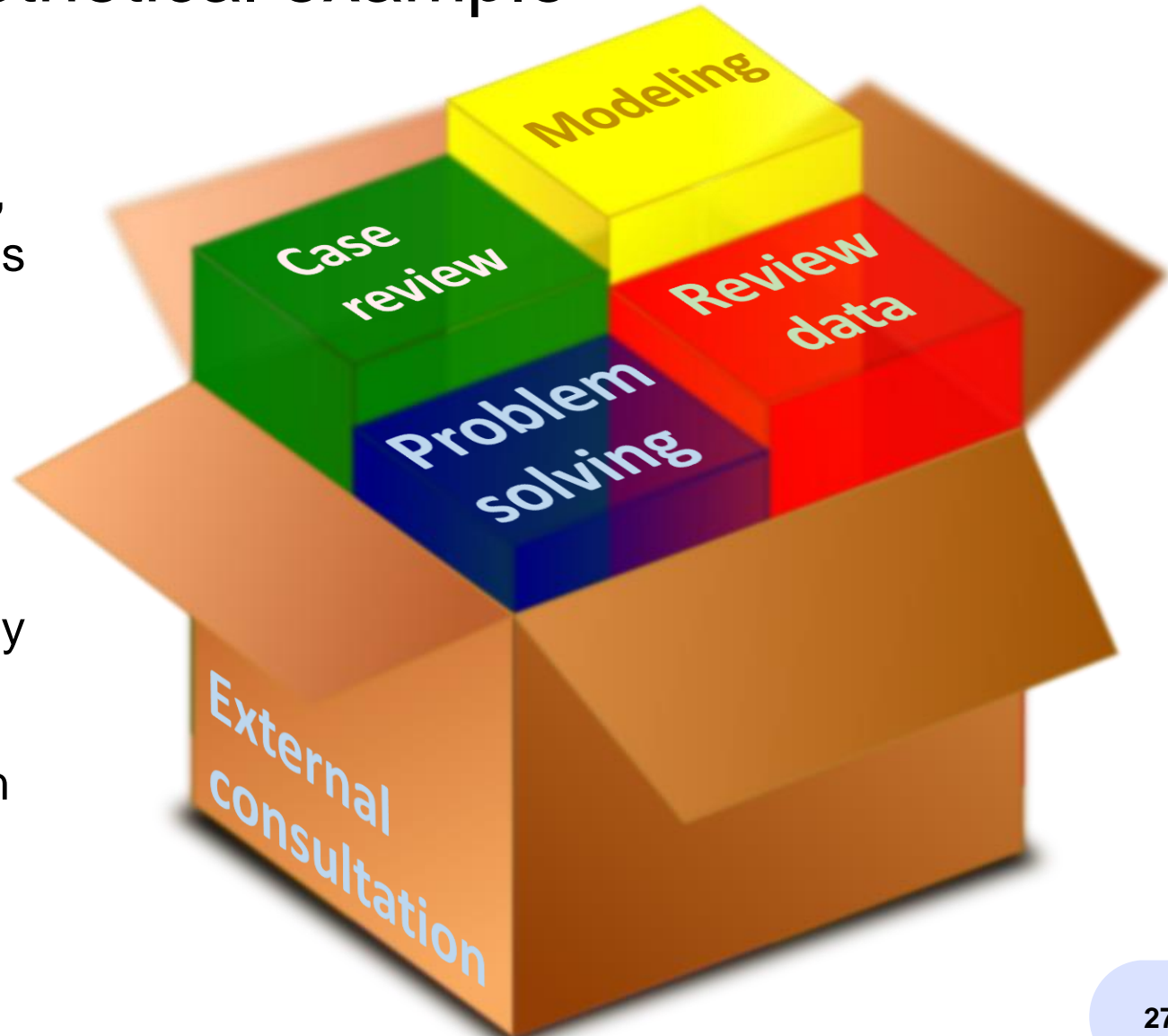
Potential results from CE-review of consultation strategies

1. **A descriptive overview** of the most commonly used consultation elements in implementation processes with successful outcomes, adjusted for use in implementation without successful outcomes. E.g., *this is what tends to work in research*

2. **Sort and extract based on any coded characteristic**
   This is what tends to work given specific constraints and circumstances

   - E.g., for different outcomes, contexts, type of behavioral intervention, type of intervention design, or categories of specific implementation determinants (e.g., high, medium, or low readiness).

3. **Extract the most commonly successful combinations/configurations** of different types of elements and characteristics.

   - E.g., in context X, for intervention type Y, and population Z, what is the most commonly successful combination of consultation elements and other implementation strategies, how are they most commonly carried out when they work (by whom, dosage, sequence or synchronicity, duration etc.), and what adaptation options are likely useful?

4. **Statistical analyses of effects and associations**, e.g.;

   - Three-level meta-regressions: estimate implementation or intervention effects with and without specific consultation practice elements and test associations between specific consultation practice elements, process elements and context variables

   - Component network meta-analysis: estimates of the relative effectiveness of consultation elements and different combinations

Dissemination of element-level evidence

- Element-level evidence in evidence maps, clearningshouses, libraries/repositiories

    - E.g., evidence gap maps (e.g., Saran et al., 2020)
    - PracticeWise LLC

    → integrating evidence from intervention and implementation science together

- Data ecosystems with ML and AI, «chat bots», search engines etc.

    - The Human Behavior Change Project a pioneering example (Michie et al.)

Ask me what commonly works to address your intervention and/or implementation problem…

..I'll tell you the scientific and practical evidence behind my answers
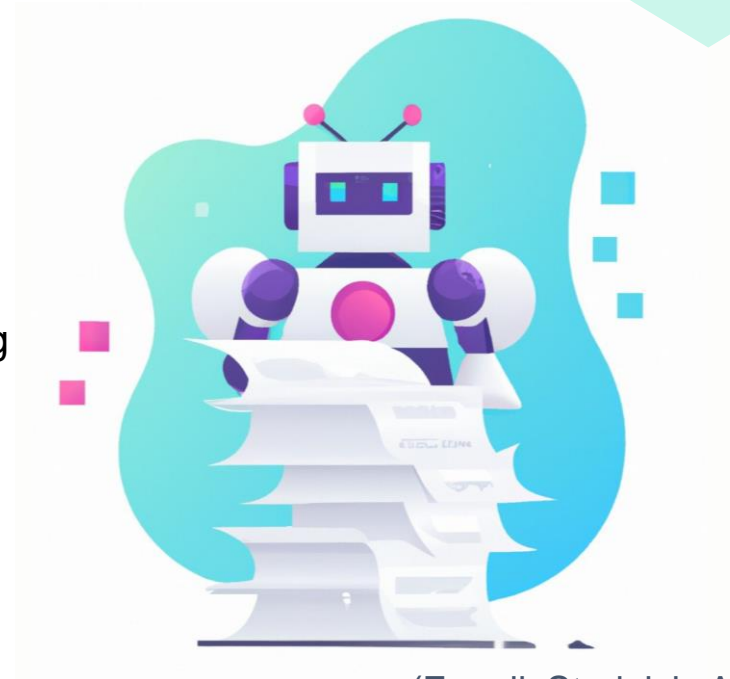
(Engell, Stadnick, Aarons, & Barnett 2023)

Practical applications in implementation practice

- **Evidence-informed «building blocks» for co-designing implementation strategies/processes with partners**

  - Given these circumstances, which elements tend to be combined, what can be adapted, what compencies and releationships is likely required for success etc.

- **Implications for training, education, and capacity buidling**

  - Focusing training on elements that most commonly work, both generically and context-specifically, may efficiently train for breadth and depth in expertise

  - Well-fitted for stepwise and needs-based approaches

- **Building blocks for system, service, and model design**

  - Stimulate innovations while also leveraging the evidence we have

  - E.g., designing or altering systems and implementation models with elements that tend be associated with desired outcomes (e.g., coordinated strategic mental health systems, Chorpita and Daleiden, 2014, 2018)

(Engell, Stadnick, Aarons, & Barnett 2023)

Practical applications for reserach

- Provide overview of element-level evidence

- Identify knowledge gaps

- Generate hypotheses
  - About «core» elements, «active» ingredients, mechanisms, and configurations/networks/systems of elements
  - Inform experimental testing

- Evidence-informed inputs for causal modeling/diagramming

(Engell, Stadnick, Aarons, & Barnett 2023)
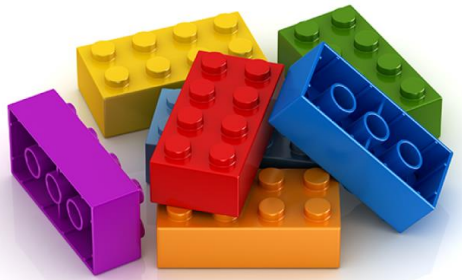
Limitations

- The studies available and the details and data reported from them

  - Especially regarding process and relational/social aspects of interventions/implementation

- Inferring element-level causality when studies tested complex/packaged interventions/implementations

- Popularity bias and publication bias

- For the time being: labor intensive

(Engell, Stadnick, Aarons, & Barnett 2023)

Recommendations for advancing element-level evidence in intervention and implementation science

1. **Track and report element-level details about all relevant intervention and implementation practices, processes, and context characteristics**

   - i.e., capture and report as much information as possible about how important elements and outcomes occur, unfold, and emerge in time and space
     - Likely includes more use of experience sampling (e.g., EMA, audio, geo, and bio-feedback with devices and wearables) and mixing with methods studying subjective experiences (e.g., phenomenology)
   - Use supplementary files to report details!
   - Use current reporting standards and taxonomies when appropriate – add to them and/or deviate when necessary and explain why

2. **Publish as many details about unsuccessful intervention and implementation as for successful**

   - The file drawer-problem an unethical waste of opportunity for scientific learning
   - Use open journals such as arXiv if peer-reviewed journals reject our paper

Recommendations for advancing element-level evidence in intervention and implementation science

3. **Make data available when ethically appropriate**

   - Plan early – at design and planning of study if possible

   - Individual participant data when possible and appropriate

4. **Test hypotheses derived from common elements reviews experimentally**

   - Test common elements-concept as a theory, and gain causal knowledge about elements and mechanisms

     - Different experimental designs (factorial trials, dismantling trials, SMARTs, micro trials, natural experiements)

     - Complement/mix with designs fit for studying processes, mechanisms, dynamics, subjectives experience and narratives from multiple perspectives (e.g., realist evaluation, system dynamics modeling, SCEDs, CCMs, phenomenology)
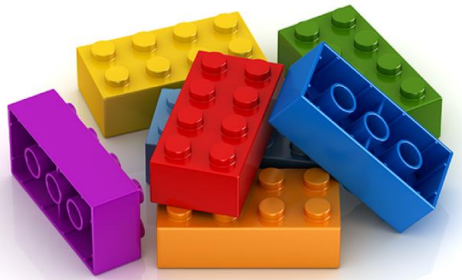
In conclusion

- Advanced common elements approaches can:

  - help synthesize and distill evidence into practical implications

  - generate evidence-informed hypotheses about key elements, processes, and mechanisms in interventions and implementation

  - facilitate evidence-informed tailoring of intervention and implementation strategies to contexts

- Four recommendations for getting there:

  1. Track and report element-level details about practices, processes, and context

  2. Also publish "failures"

  3. Make data available

  4. Test hypotheses derived from common elements reviews from different causal perspectives

(Engell, Stadnick, Aarons, & Barnett 2023)

All references used in this talk in the reference list here (open access) →

https://doi.org/10.1007/s43477-023-00077-4

Global Implementation Research and Applications

GIS Global Implementation Society   Springer

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springer.com/journal/43477
Global forum for everyone who is interested in implementation science and practice

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NIMP

Nasjonalt nettverk for implementeringsforskning

Norwegian Network for Implementation Research (NIMP): https://www.nimp.no/

Similarities between intervention and implementation science

«Inhereted» paradigms, assumptions and constructs from intervention science?

Intervention science

- Complex programs and interventions →

- Practice elements and techniques →

- Common factors/therapist skills→

- Intervention principles and processes of change→

Implementation science

- Blended and multifaceted imp.strategies

- Discrete imp.strategies

- Implementation competencies/relational skills

- Implementation drivers and processess

Similar and connected science-to-practice gaps, and calls for similar solutions (e.g., improving pragmatism and usability, contextual alignment, advancing dissemination and training)

(Engell, Stadnick, Aarons, & Barnett 2023)

Common elements logic and language

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Core elements

Core elements are indispensable parts of a whole, for instance, a particular practice element in an implementation strategy. Without the practice element, the implementation strategy would be incomplete or something else.

- *Example: A core element of audit and feedback would be providing feedback*

Common elements

Meaningful parts of wholes that are frequently shared by wholes. Common implementation elements can be practices or processes frequently shared among implementation strategies used in a selection of implementation studies.

- Example: Role-play, modeling, and video review are common elements of consultation and supervision in CBT

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(Engell, Stadnick, Aarons, & Barnett 2023)

Common elements logic and language

Evidence-informed common elements

Meaningful parts frequently shared by empirically supported wholes (i.e., evidence-based interventions or evidence-based implementation strategies). Degree of 'evidence-informedness' may depend on for instance frequency and intensity in studies effectively improving a specific outcome accounted for frequency and intensity in ineffective or harmful studies for the same outcome.

- *Example: quality monitoring and ongoing consultation are evidence-informed common elements for implementing reading interventions outside of school hours for children at risk for academic problems (Engell et al., 2020)*

Evidence-based elements

Elements consistently demonstrating causal contribution to outcomes in experimental testing (causality can be inferred on the level of elements, not complex packages of them).

- *Do we have examples in implementation science?*

(Engell, Stadnick, Aarons, & Barnett 2023)

FACTORS AND ELEMENTS IN MECHANISMS OF CHANGE
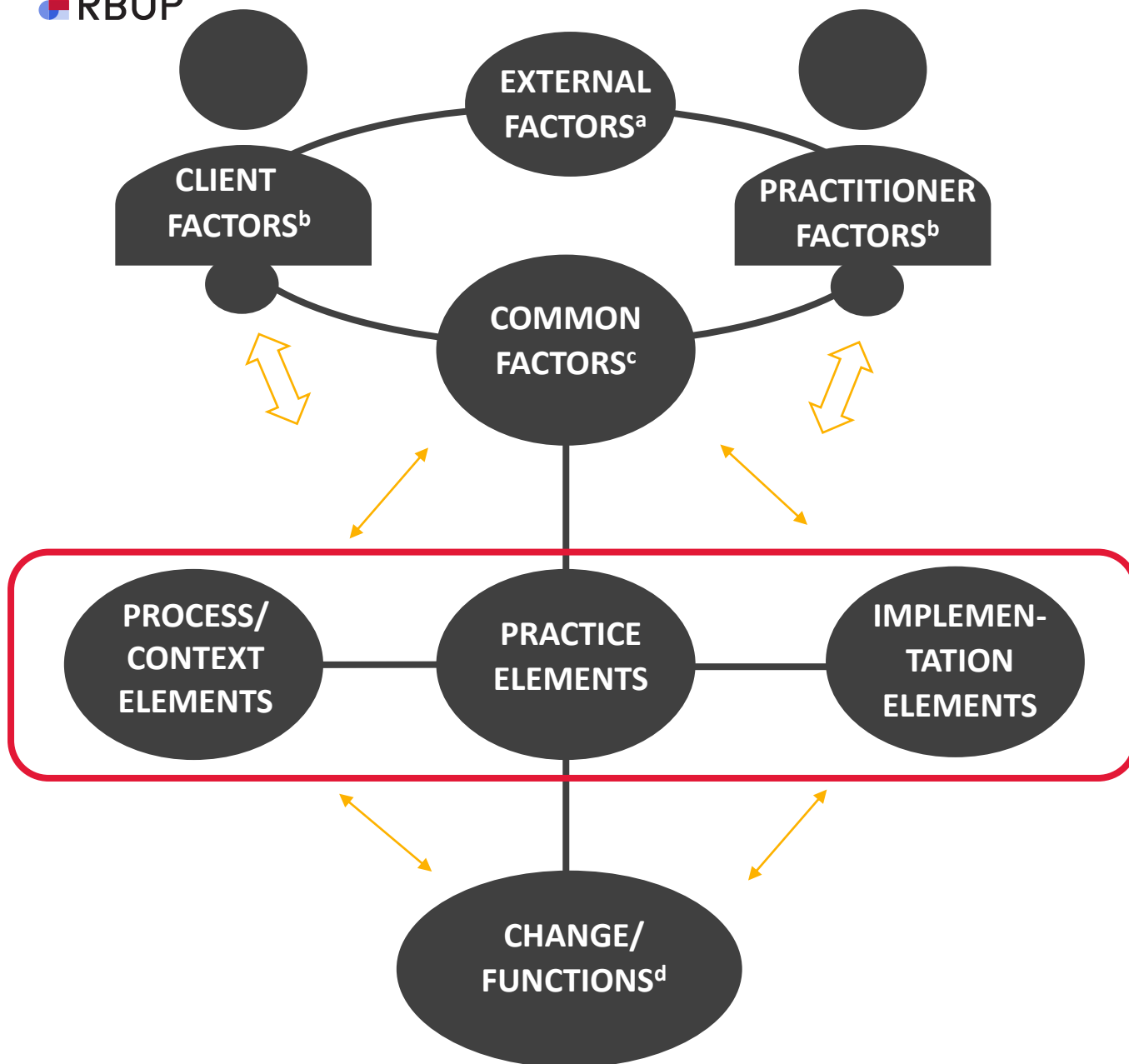
[a] **External factors** can be social norms, culture, and government policies

[b] **Client- and practitioner factors** can be personality, genomics, values, motivation, and competence

[c] **Common factors** can be therapeutic alliance, allegiance, and epistemic trust

[d] **Functions** refer to proximal changes that cause, catalyze, or potentiate change in a medial target outcome (such as motivation, engagement, or altered behavior).

Engell et al., 2020

Common practice elements *Definitions*	Frequency counts						Elements used in combinations with common practice elements		
	Reading (29 studies)		Math (8 studies)		GPA (6 studies)		Process elements (FV[d])	Implementation elements (FV)	Practice elements (FV)
	+	÷	+	÷	+	÷			
Positive reinforcement *Use of positive responses (1) or incentives (2) to welcomed behaviors or performances*	**11** FV[a]=10 (n = 771[c])	**1**	**4** FV=4 (n = 331)		**2** FV=1 (n = 100)	**1**	• Delivered by caregiver (13) • 1on1 delivery (12) • Use of rewards or incentives (11) • Regular support to deliverer (11) • Delivered at home (11) • Multi-element (9)	• Quality monitoring (11) • Provide ongoing consultation (9) • Distribute educational materials (7) • Remind practitioners (5) • Conduct educational meetings (5) • Involve end-users (4)	• Parental school involvement at home (10) • Homework support (8) • Correction and feedback (7) • Monitor performance (7) • Structured tutoring (7)
Training in parental school involvement at home *Training or guidance in any form of engagement by caregivers to support a child academically at home*	**10** FV=10 (n = 1194)		**2** FV=2 (n = 177)		**3** FV=3 (n = 56)		• Received by caregiver (14) • Delivered by professional (13) • Regularly support to receiver (12) • Use of organizational material (11) • Use of educational material (10)	• Quality monitoring (13) • Distribute educational materials (12) • Provide ongoing consultation (8) • Remind practitioners (5) • Clinical supervision (4) • Conduct ongoing training (4)	• Homework support (11) • Psychoeducation (10) • Use of positive reinforcement (9) • Use of incentives/rewards (8) • Structured tutoring (8)

[a] Frequency count value (FV) = frequency of the practice elements' inclusion in effective interventions (+1) accounted for inclusion in ineffective interventions (-1)

[c] Total amount of participants in the studies where the practice element was used in an intervention

[d] The frequency count value of process elements used in combination with the practice element in effective interventions (+1) accounted for in ineffective interventions (-1)

Engell et al., 2020

Configurations (common elements sorted by)				Consultation practice element	Consultation process elements			Commonly combined with	Common determinants	
Intervention context	Population	Intervention type	Outcome measure		Format	Intensity[d]	Duration[e]		Barrier	Facilitator
Community based clinics / Community-based frontline services or mental health clinics	Indicated or identified mental health difficulties / Children age 6-12	Group and individual psychosocial interventions / Transdiagnostic mental health prevention and treatment	Quality of life or internalizing or externalizing difficulties / Client level primary intervention outcomes	Case review +58[a], ÷18[b] (40[c])	Agency visit +42, ÷11 (31)	High (9) Medium (14) Low (8)	Long (16) Medium (14) Short (1)	Performance feedback +38, ÷6 (32)	Limited capacity (24)	Observed benefit of intervention (23)
				Case review definition / Structured evaluation of individual clinical cases with consultant	Practice observation +16, ÷2 (14)	High (4) Medium (6) Low (4)	Long (5) Medium (9) Short (0)	Client outcome feedback +17, ÷5 (12)	Low EBP usability (12)	Proactive imp.leadership (17)
					Telephone +24, ÷11 (13)	High (3) Medium (9) Low (1)	Long (8) Medium (9) Short (÷4)	Flexible intervention structure +14, ÷6 (8)	Poor implementation climate (7)	Reduced caseloads (10)
					Video conferencing +13, ÷6 (7)	High (2) Medium (3) Low (2)	Long (5) Medium (4) Short (÷2)	Learning collaboratives +12, ÷4 (8)	Technical issues with measurement feedback system (6)	Intervention mandated (8)
					Peer consultation +4, ÷6 (÷2)	High (1) Medium (2) Low (÷4)	Long (4) Medium (÷2) Short (÷3)	Train-the-trainer models +10, ÷4 (6)		EBP specific consultation (6)

Examples of common elements work in implementation science

Reviewed in the paper:

- Tugendrajch et al., 2021
- Albers et al., 2021
- Brown et al., 2019
- Engell, Kirkøen et al., 2020
- Chorpita et al., 2018

More?

Recent and ongoing work:

- Kristian Rognstad: process and implementation elements in measurement feedback interventions
- Maya Boustani, Stacy Frazier, Leslie Rith-Najarian: common elements used to implementat problem solving strategies
  - Great work on coding system for cultural adaptations