Meta-Modeling Housing First: A Theory-Based Synthesis Approach

Sebastian Lemire and Christina A. Christie
University of California, Los Angeles

Abstract: *Research synthesis has become an increasingly popular approach for summarizing primary research. In the past two decades, interest in mixed methods reviews has steadily grown, followed, more recently, by an increased attention to theory-based syntheses. This article advances and illustrates a practical application of meta-modeling—a mixed methods, theory-based synthesis approach. The proposed methodology combines meta-analytic and qualitative comparative techniques in developing a program theory—a meta-model—of how and why a program works. As the article illustrates, meta-modeling provides for a structured and transparent synthesis approach for building program theories across existing studies.*

Keywords: *causation coding, Housing First, meta-analysis, meta-modeling, mixed methods, qualitative comparative analysis, theory-based synthesis*

Résumé : *Les synthèses sont de plus en plus populaires pour résumer les travaux de recherche. Au cours des vingt dernières années, on a observé un intérêt croissant pour les méthodes mixtes puis, plus récemment, pour les synthèses basées sur la théorie. Cet article décrit une application pratique de la méta-modélisation – une approche de synthèse basée sur la théorie qui repose sur l'utilisation de méthodes mixtes. La méthodologie proposée combine des techniques de comparaison méta-analytiques et qualitatives visant à élaborer la théorie d'une intervention – un méta-modèle – expliquant le comment et le pourquoi du fonctionnement d'un programme. Comme le montre cet article, la méta-modélisation permet une synthèse des résultats d'études qui est à la fois structurée et transparente et qui permet l'élaboration de théories de programmes.*

Mots clés : *causalité, Housing First, méta-analyse, méta-modélisation, méthodes mixtes, analyse qualitative comparativet, synthèse théorique*

Summarizing existing research has a long and rich tradition in the social sciences. Over the past two decades, interest in mixed methods and theory-based reviews has steadily grown (Bronson & Davis, 2012). As a result, a burgeoning literature showcasing approaches and methods for conducting these kinds of syntheses has emerged (Saini & Shlonsky, 2012). Emphasizing the need to move beyond identifying "what works" (the *sine qua non* of traditional systematic reviews), these new approaches share a commitment to synthesizing a broader range of evidence with

Corresponding author: Sebastian Lemire, Social Research Methods, University of California, Los Angeles, Moore Hall 2005, Los Angeles, CA, 90095-1521, USA; slemire@ucla.edu

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the aim of answering a broader range of questions, including "how" and "why" interventions work (Pawson, 2006). Despite the growing and sustained interest in mixed methods and theory-based synthesis approaches, published applications are still relatively scarce: only a few illustrative examples of mixed methods and theory-based reviews have been published in evaluation journals. Notable examples include two applications of realist syntheses (Pawson, 2002; van der Knaap, Leeuw, Bogaerts, & Nijssen, 2008) and an application of a meta-analysis combined with a narrative review (Scott-Little, Hamann, & Jurs, 2002).

Motivated by the growing interest in explaining how and why programs work on the basis of existing studies, we introduce and present an application of meta-modeling—an operational approach for mixed methods, theory-based syntheses. Meta-modeling structures the integration of findings from different types of studies around the development of a "meta-model"—a visualization of the program components and mechanisms that generate a specific program outcome. Meta-modeling also relies on transparent and systematic procedures for integrating mixed evidence when developing and testing hypotheses about the extent to which and how these program components work (or fail to work). In this way, meta-modeling offers procedural guidance on how and in what way to extract, analyze, and integrate findings from different types of studies.[1]

The remainder of the article is structured as follows. We first situate the meta-modeling approach within the broader landscape of mixed methods and theory-based syntheses approaches, paying particular attention to the EPPI-Centre and realist synthesis approaches. We then provide an outline of the six steps comprising the meta-modeling approach. Advancing toward operational guidance, we then illustrate these six steps in a meta-modeling application on Housing First—a popular and widely implemented housing model for homeless individuals. We conclude with a discussion of the benefits, limitations, and further development of the meta-modeling approach.

THE META-MODELING APPROACH: INTELLECTUAL ROOTS AND PROCEDURAL STEPS

The intellectual roots of meta-modeling

The meta-modeling approach emerges from the growing literature on mixed methods and theory-based synthesis approaches. A comprehensive presentation of the growing range of these approaches is beyond the scope of the present article (see Saini & Shlonsky, 2012, for a masterful review of these). For the present purposes, two distinct and commonly cited approaches to mixed methods reviews are worth considering in more detail: the EPPI-Centre approach and the realist synthesis approach—both of which provide the intellectual foundation for meta-modeling.

The most well-developed and empirically tested approach for mixed methods synthesis is arguably the EPPI-review (Saini & Shlonsky, 2012). Promoted by Harden and Thomas (2005), and labeled according to their affiliation with the

Evidence for Policy and Practice Information and Coordinating Centre (EPPI-Centre) at the University of London, the approach is structured around the parallel development of individual syntheses of qualitative and quantitative evidence, subsequently merged into a combined synthesis (Thomas et al., 2004). The latter combined synthesis takes the form of a thematic triangulation of quantitative and qualitative data. Following Thomas et al., this integration involves the juxtaposition of findings in a matrix, that is, the matching of "barriers, facilitators, and implied recommendations against the actual interventions that had been implemented and evaluated" (p. 1011). As Thomas et al. note, the resultant matrix allows for a better understanding of the experiences of the target groups, which in turn "could lead to the development of more appropriate and effective interventions" (p. 1012).

As an extension of the EPPI-reviews, more recent applications of mixed methods reviews have emphasized the use of logic models as a way to integrate findings across different types of studies (Allmark, Baxter, Goyder, Guillaume, & Crofton-Martin, 2013; Anderson et al., 2011; Baxter, Blank, Woods, Payne, Rimmer, & Goyder, 2014; Baxter, Killoran, Kelly, & Goyder, 2010). These applications utilize thematic coding and analysis techniques, often combined with matrices for structuring and summarizing findings, to develop and refine logic models across existing studies. As described by Baxter et al. (2014, p. 3),

> In our approach, extracted data from the included papers across study designs are combined and treated as textual (qualitative) data. A process of charting, categorizing and thematic synthesis of the extracted quantitative intervention and qualitative data is used in order to identify individual elements of the model.

The resultant logic model is in some applications further verified and refined on the basis of feedback from relevant stakeholders (see Baxter et al., 2014, for an illustrative example).

Another prevalent approach—and one that has gained significant traction in evaluation circles—is that of realist synthesis (Pawson & Boaz, 2004; Pawson, Greenhalgh, Harvey, & Walshe, 2005). Developed in response to traditional systematic reviews, the premise for Pawson's (2006) realist synthesis is the emphasis on understanding how, for whom, and under what circumstances programs work. More specifically, the realist synthesis revolves around the development of context-mechanism-outcome configurations (CMOs)[2] corresponding to the underlying logic of the program under study. In its practical application, the realist modus operandi is to develop an initial CMO configuration on the basis of a subset of findings, qualitative as well as quantitative, and then through iterative rounds of inclusion and synthesis of additional findings, again qualitative as well as quantitative, to refine the initial CMO configuration of the program. The underlying idea is that this step-wise, reiterative synthesis of findings will serve to refute or confirm salient aspects of the CMO, resulting in an increasingly refined understanding of how the program works.

The meta-modeling approach is both informed by and extends beyond the promising and inspiring approaches outlined above. In its purpose, the meta-modeling approach shares much with the realist synthesis approach, among others, in its aim of better understanding how and why programs work (or fail to work). Extending its scope further, the meta-modeling approach also aims to address the extent to which programs generate a specified set of outcome by calculating standardized effect sizes as part of the synthesis (a meta-analytic technique typically associated with more traditional systematic reviews). The position we hold is that the latter provides salient information for a more complete understanding of the extent to which and how programs work.

In its structure, the meta-modeling approach aligns with the EPPI-review in that it emphasizes separate syntheses of quantitative and qualitative evidence, before merging these into a fully integrated mixed-evidence synthesis (Harden & Thomas, 2005). However, in marked contrast with the EPPI-review approach, the qualitative synthesis is intentionally conducted prior to the quantitative synthesis in meta-modeling (see Table 1). As illustrated in the application presented later in this article, this sequential approach allows for hypothetical causal strands about how the programs work to be developed on the basis of qualitative findings, followed by the subsequent testing of these on the basis of quantitative findings. This sequential approach also aligns with a common social scientific principle that the same data should not be used to both *develop* and *test* hypotheses.

Table 1: The six steps of meta-modeling

Step 1: Define the research question
• Define research question in terms of Population, Intervention, Context and Outcome (PICO standard)
Step 2: Search and retrieve relevant studies using explicit search parameters
• Define search terms and inclusion/exclusion criteria
• Conduct search for empirical papers by using multiple avenues
Step 3: Conduct a relevance appraisal of the studies
• Appraise each study abstract for its relevance to the research question
Step 4: Qualitative synthesis (identify causal chains)
• For each study, apply causation coding to identify causal chains
• Summarize the causal chains in a causal chain matrix
Step 5: Quantitative synthesis (compute effect sizes)
• For each study, estimate relevant effect sizes
• Summarize the effect sizes using meta-analytic techniques
Step 6: Develop integrated meta-model
• Apply QCA to identify causal recipe for the intervention
• Develop meta-models

Adapted from Greenhalgh, Robert, Macfarlane, Bate, and Kyriakidou (2004)

Finally, the meta-modeling approach departs from the existing approaches in its emphasis on using structured analytical strategies for the extraction, analysis, and integration of findings from different types of studies. More specifically, and as illustrated in the case example below, meta-modeling applies causation coding, standardized effect-size calculations, and qualitative comparative analysis to ensure a more transparent and systematic synthesis. The end product is a systematic, transparent, and operational approach for mixed methods, theory-based syntheses. Advancing toward operational guidance on the meta-modeling approach, we now turn to an application on Housing First programs.

META-MODELING THE INNER WORKINGS OF HOUSING FIRST

In its procedural approach, meta-modeling consists of six steps: (1) defining the research question(s), (2) searching for and retrieving candidate studies, (3) conducting a relevance appraisal, (4) synthesizing qualitative findings, (5) synthesizing quantitative findings, and (6) developing an integrated synthesis using Qualitative Comparative Analysis (QCA). The steps are briefly outlined in Table 1 and illustrated in more detail in the case application on Housing First presented in what follows. Before advancing the case application, a brief description of the Housing First program is provided.

The case: Housing First

Housing First (HF) is a widely used approach to addressing homelessness. Currently, HF programs exist in major cities across Canada, the United States, and most European countries (Groton, 2013). The core idea of HF is to provide homeless individuals with immediate housing of their own choice. In support of sustained housing retention, supportive services (e.g., substance use treatment) are made available but not required by HF programs (Tsemberis, 1999). The provision of immediate housing stands in marked contrast to the traditional housing programs that require homeless individuals to progress and graduate through different steps of treatment and/or sobriety before earning their access to permanent housing.

In their implementation, HF programs are guided by five principles: (1) provide immediate, low-barrier access to independent, permanent housing, (2) provide comprehensive case management, (3) provide housing in building blocks with less than 15% of HF tenants, (4) emphasize client choice in regard to supportive services, and (5) support community involvement in the transition from homeless to housed (Tsemberis & Eisenberg, 2000). Underlying these five principles is a philosophy of promoting self-efficacy and independence among homeless individuals as a pathway to sustaining permanent housing.

The HF model is considered by many researchers and practitioners to be "best practice" and is increasingly referred to as "evidence-based" (Pearson, Montgomery, & Locke, 2009). In support of this coveted label, over the past 20 years a diverse body of research has examined the effectiveness of HF programs on

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a number of housing-related outcomes (Groton, 2013). While two systematic reviews have been conducted to determine the effectiveness of HF programs (Leff, Chow, Pepin, Conley, Allen, & Seaman, 2009; Nelson, Aubry, & Lafrance, 2007), a systematic mixed-methods synthesis of the program components and mechanisms by which such programs work has not been undertaken. The present mixed-methods theory-based synthesis of HF programs is the first of its kind.

Meta-modeling Housing First: A worked example

In the following, each of the six steps of the meta-modeling approach is illustrated. The motivation for the meta-modeling application on HF programs—while addressing a gap in the existing literature on HF programs—was primarily methodological: to develop and apply a systematic and transparent approach for mixed methods, theory-based synthesis. Because the novel aspects of meta-modeling—at least in the context of building program theories—primarily pertain to the application of causal coding of qualitative findings and the use of qualitative comparative techniques in developing the meta-model, these steps are covered in more detail.

Step 1: Define the research question. Defining the research question constitutes an important first step of meta-modeling. Informed by the existing literature on HF programs, the research question driving the present systematic review was two-fold:

1. To what extent do HF programs increase independent housing tenure among chronic homeless individuals, as compared with alternative continuum of care housing programs?
2. What are the critical ingredients in HF programs that drive increased housing tenure among chronically homeless individuals?

These questions not only concern whether HF programs promote housing tenure but also demand information about how HF programs promote housing tenure—two equally relevant types of information when trying to understand the extent to which and how programs work. These two questions also fall right between the purviews of traditional systematic reviews (which tend to focus on the first question) and existing mixed methods approaches (which tend to focus on the second question).

Step 2: Search and retrieve studies. The second step in meta-modeling revolves around the search and retrieval of relevant primary studies—the empirical foundation for the subsequent analyses. In the present synthesis, the studies were identified through an electronic literature search using Scopus, PsycINFO, Web of Science, and Sociological Abstracts. The key word "housing first" was used for the search. No restriction was placed on the date or the location of the studies. In addition to the electronic search, manual searches of relevant studies in the most salient journals were carried out. These journals included the *American Journal of Community Psychology*, the *American Journal of Public Health*, the *Journal of*

Community Psychology, *Psychiatric Services*, and *Research on Social Work Practice*. This manual search was motivated by the expected time lag between journal publication (e.g., online first publication) and subsequent inclusion in the databases listed above. Finally, seven identified literature reviews on supported housing were examined for relevant studies. This manual citation search allowed us to reach a point of saturation—a moment where reference lists were no longer providing new, additional studies. The results of the search and retrieval are presented in Figure 1.

A total of 346 unique titles and abstracts were initially identified and retrieved. The expansion of the search to include grey literature (i.e., studies not published in peer-reviewed journals) is compatible and even encouraged in the context of meta-modeling. However, for the present purposes of developing and applying a new methodological approach, focusing on published studies was deemed sufficient.

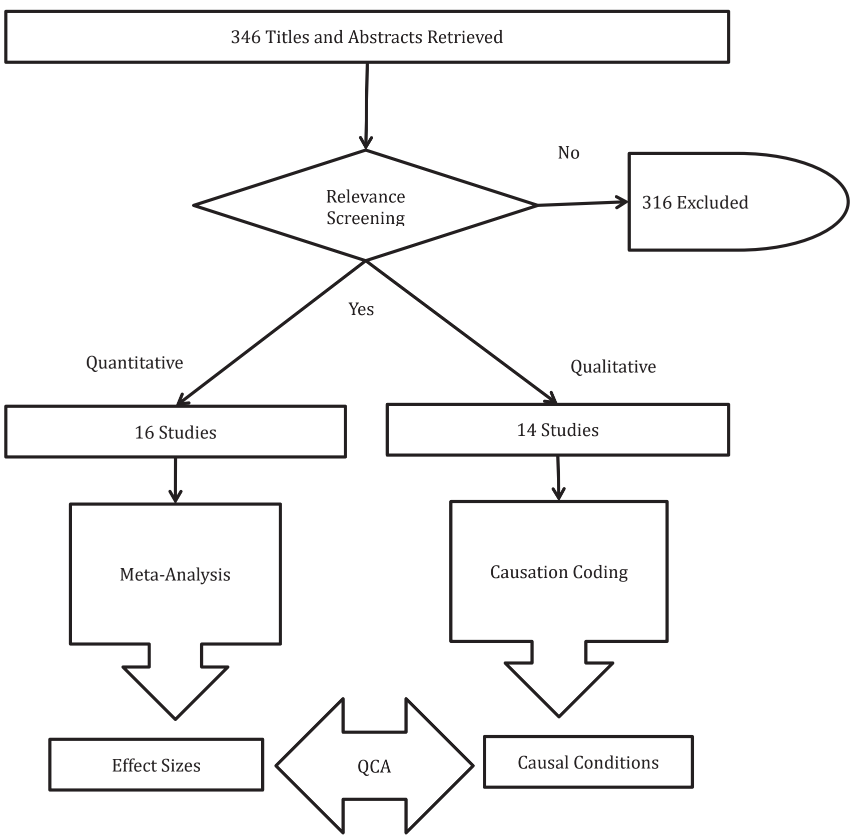

Figure 1: Flowchart of meta-modeling of Housing First

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Step 3: Relevance appraisal. The third step in meta-modeling is a relevance appraisal. In the present synthesis, primary studies for the quantitative synthesis were included if they (1) focused on an HF intervention as treatment, (2) involved a comparison group design, (3) included housing tenure as an outcome measure, and (4) contained sufficient information to compute standardized effect sizes. This includes any experimental study design, including randomized controlled trials as well as quasi-experimental designs (with non-equivalent comparison groups). A total of 16 studies matched these criteria.

For the qualitative synthesis, studies were included if they (1) focused on Housing First intervention as treatment, and (2) provided qualitative data on the experience of individuals in HF programs (sufficient information to support causation coding). While these included a broad range of studies—qualitative as well as mixed methods—only studies that provided rich, detailed descriptions of how and why participants benefited from HF programs were included (e.g., verbatim descriptions or testimonials of the lived experiences of HF program participation). A total of 14 studies satisfied these criteria.

Informed by these relevance criteria, a total of 316 studies were excluded from the synthesis. Collectively, all the excluded studies failed either to provide quantitative data to support effect-size computation or to provide qualitative data to support causation coding.

Step 4: Qualitative synthesis. The first synthesis track in meta-modeling is the qualitative synthesis. The primary aim of this synthesis is to identify candidate "critical ingredients" driving the program's desired outcomes (i.e., housing tenure). Informed by Saldaña's (2013) "causation coding," causally relevant information is identified using causal chain codes. These are codes capturing the causally relevant information in the primary studies, typically from sections of the articles describing how and why the HF program works. More specifically, the coding aims to map out causal chains (CODE1 → CODE2 → CODE3), corresponding to a causal catalyst, an outcome, and a mechanism linking the causal catalyst and outcome. Moderators (e.g., influencing factors) may also be coded and included. As Saldaña reminds us, these causal triplets are often made more complex by involving interactions between multiple causal catalysts, multiple mechanisms and moderators, and multiple outcomes. As such, the causal chains may include subsets of codes: (CODE1A + CODE1B → CODE2A + CODE2B → CODE3 → CODE4).

An example might serve to illustrate these causal chains. In the present synthesis, several studies describe how a service philosophy of client choice in relation to frequency and duration of supportive services, without any formal requirement of participation, results in a sense of empowerment among the homeless individuals, which in turn generates an incentive among them to actively pursue and participate in supportive services. This in turn supports sustained housing. To illustrate, the causal chain is composed of a process in which "client choice for supportive services" (causal catalyst #1), in combination with "no requirement for participation" (causal catalyst #2), leads to a "sense of empowerment" (mechanism

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#1), which in turn results in the clients "actively pursuing supportive services" (mechanism #2) and "participating in supportive services" (mechanism #3), both of which promote sustained housing (outcome #1). By describing how core activities of the HF programs generate a sequence of attitudinal and behavioral changes, these causal chains shed light on how and why HF programs promote housing tenure.

Echoing Saldaña (2013), one practical point about causation coding is that it is highly interpretive. This is in part because the causal chains are rarely summarized in a neat three-part sequence from causal catalyst(s) to mechanism(s) to outcome(s). In our experience, and as correctly noted by Saldaña, the authors "may tell you the outcome first, followed by what came before or what led up to it, and sometimes explain the multiple causes and outcomes in a reverberative back-and-forth manner" (p. 164). As such, causation coding often involves a high degree of sensitivity to words such as "because," "in effect," "therefore," and "since," which might indicate an underlying causal logic (Saldaña; see also Lemire & Freer, 2015, for a discussion on this).

Another equally important practical guideline is to resist the urge to code causal chains during the first read-through of the studies. Rather, it is advisable to read through all the sampled studies once before initiating the causation coding. In the first read-through, the purpose is simply to make note of the types of causal catalysts mentioned and the general language and terminology used by the authors and participants to define these core program components. On a similar note, we also found it useful to focus on the causal catalysts that cut across multiple studies, suggesting their broader salience and potential importance in explaining how HF programs bring about change. We thus identified four prevalent causal catalysts:

1. *Housing choice and structure*: The provision of immediate access to independent, scattered-site permanent housing with less than 15% other HF program participants in the building.
2. *Supportive services*: The provision of a broad range of supportive services, such as substance-abuse services, employment services, educational services, volunteer services, medical services, social integration, and so forth.
3. *Harm reduction*: The reliance on low-threshold admission, no sobriety/treatment/medication requirements to access or maintain housing, as well as limited staff crossover between housing and supportive services.
4. *Client choice*: The emphasis on client choice of duration, frequency, and intensity of treatment, harm reduction, and no sobriety/treatment/medication requirements.

Each of these causal catalysts represents a core component of HF programs and is thus identifiable as causally relevant across multiple primary studies. Collectively, then, these four identified causal catalysts serve as candidate core components of how and why HF programs promote sustained housing tenure among chronically homeless individuals. More than that, the causal catalysts provide the building blocks for a more in-depth understanding of how these core components connect with the outcome(s) of interest.

As part of this analysis, we found it helpful to organize the identified causal chains for each catalyst in a causal chain matrix (Miles, Huberman, & Saldaña, 2014), providing an overview and facilitating the identification of patterns (see Table 2 below). The matrix summarizes the causal chains identified for each causal catalyst. The matrix specifies the "causal catalyst," the "causal chain" for each catalyst, and a specification of any "influencing factors" inhibiting or enhancing the causal chain. A final column contains a verbatim description of how the mechanism functions, as described in the primary study. This anchoring of each causal chain with the language from the individual studies serves double duty: (1) It provides analytical depth to the causal chains, and (2) it provides a transparent chain-of-evidence that allows other researchers to examine the grounding for the final synthesis and conclusions drawn. This latter point is important for the purpose of methodological transparency.

The testing of these causal catalysts will be the focal point of the final meta-modeling synthesis in step 6. However, before advancing this integration, the quantitative synthesis is to be completed.

Step 5: The quantitative synthesis. The aim of the quantitative synthesis is to examine the overall effectiveness of HF programs through a meta-analysis of the experimental and quasi-experimental studies identified. The effectiveness of HF is considered in terms of housing tenure. In the present review, a total of 16 comparison-group studies, covering the period from 2000 to 2016, were identified. Most of the HF studies used an experimental design with comparable treatment and control groups at baseline (11 studies). The remaining five studies were quasi-experimental studies, of which four used matching or other statistical techniques

Table 2: Causal chain matrix

Causal catalyst	Causal chain	Influencing factor(s)	Explanation
Provision of housing	home + stability → self-efficacy	Permanent housing	"The housing is there for a couple of years so . . . it lends a little stability at least to your life for a short period of time and enables you to get some things done."
	Home → stability → recovery → employment	Permanent housing Access to training Access to jobs	"A place to live and then from there I can start doing my things, like getting better and going out. Getting into a routine. Finding a job, getting the training for something else."

to adjust for baseline differences. One quasi-experiment did not use any statistical adjustment for baseline differences (Tsai, Mares, & Rosenheck, 2010). None of the studies reported large baseline differences between the comparison/control groups, showed high or uneven attrition rates, or indicated any other major implementation issues that potentially could bias the effect-size estimates.

Each of the studies was reviewed and information relevant for the estimation of standardized effect sizes (Cohen's *d*) was retrieved, including study sample size, mean housing-tenure statistics for treatment and control/comparison, as well as corresponding standard deviations/standard errors. On the basis of the retrieved information, effect sizes were calculated for each study (Cohen's *d*, the standardized mean difference statistic). Individual effect sizes were calculated using the Practical Meta-Analysis Effect Size Calculator (Lipsey & Wilson, 2001) and adjusted for small sample bias, using the Hedges *g* correction (Hedges & Olkin, 1985). Inverse variance weighting was used when calculating combined effect sizes across the primary studies, whereby each study is weighted by the precision of its respective effect-size estimate (Lipsey & Wilson, 2001). The estimated effect sizes are provided in Figure 2. As shown in the figure, the studies reveal consistently positive effect sizes, favoring the HF programs in comparison with continuum of care programs. More specifically, the combined effect size of 0.97 (95% CI: 0.72–1.22) indicates a markedly stronger effect on housing tenure among participants in HF programs, as compared with participants in continuum of care programs.

The primary purpose of the effect size estimates is, in combination with the causal strands identified in the qualitative synthesis, to comprise the building blocks for the final meta-modeling synthesis.

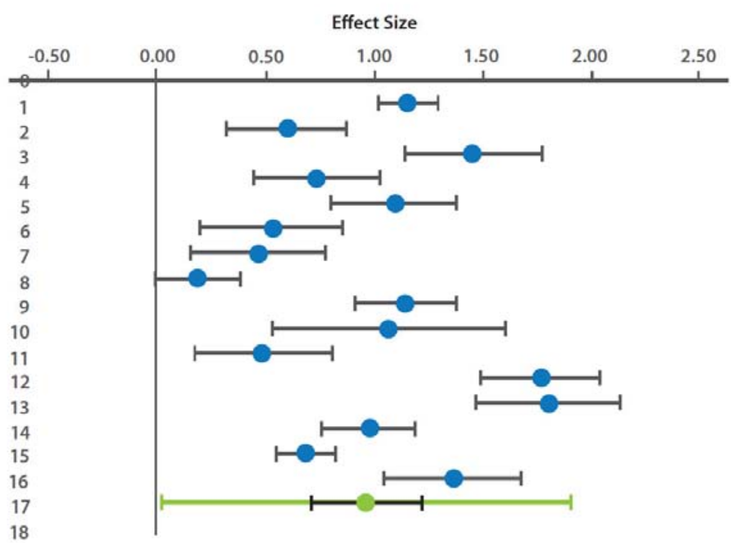

Figure 2: Effect-size estimates for Housing First (housing tenure)

Step 6: Develop the meta-model. The final step in the synthesis is the integration of findings from the qualitative and quantitative syntheses. To integrate the findings from these two syntheses, Qualitative Comparative Analysis (QCA) was applied. Developed by Charles Ragin, QCA is perhaps best described as a set of comparative analytical techniques that aim to identify the sets of causal conditions that trigger a specific outcome (Ragin, 2014; Schneider & Wagemann, 2013). In the present synthesis, QCA allowed us to identify the configuration(s) of the four causal conditions that promote housing tenure. Informed by Rihoux and Ragin (2009), the QCA in the present synthesis involves six steps:

1. gather evidence on core program components and outcomes for each study in the review (extracted from primary studies);
2. develop a matrix with core program components and outcomes (calibration);
3. use QCA software to create a "truth table";
4. minimize solutions;
5. resolve contradictory configurations; and
6. present final interpretation of solutions.

These are the standard steps in QCA, adapted slightly for the purpose of research synthesis. In the first step, the 16 studies in the quantitative synthesis were recoded according to the causal chains identified in the qualitative synthesis. Recall that these causal chains were identified as potential explanations of how and why HF programs promote housing tenure. Recall also that these causal chains involved four primary causal conditions: housing choice and structure, separation of services, service philosophy, and service array. To illustrate, the qualitative synthesis revealed that the provision of immediate access to scattered-site, independent housing is a salient catalyst for sustained housing tenure. As such, the extent to which each of the 16 HF studies involves immediate access to scattered-site, independent housing is relevant to code and test as part of the QCA.

A note on this assessment and coding is called for. In traditional crisp-set QCA, cases (i.e., the 16 studies in the present synthesis) are coded on a binary scale, whereby a "zero" or a "one" denotes the presence or lack of presence of a given causal condition. However, this type of coding does not reflect the fact that the presence of causal conditions in relation to HF programs is often one of degrees. Accordingly, the extent to which each of the four causal conditions is present in the studies is more appropriately assessed according to four levels: 0 (no presence), .33 (low presence), .67 (high presence), and 1 (full presence).

The results of the coding are provided in Table 3. Each row represents a primary study. The extent to which the four causal conditions are present is noted for each study. For instance, the HF program in the study by Tsai, Mares, and Rosenheck (2010) is characterized by a full adherence to housing choice and structure (1) and a relatively low adherence to supportive services (.33), harm reduction

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Table 3: QCA coding of studies

Study	Housing	Harm reduction	Supportive services	Client choice	Outcome
TSE(2000)	1	.67	1	1	1
GUL(2003)	1	1	1	1	.67
TSE(2003)	1	1	1	1	1
TSE(2004)	1	1	1	1	.67
GRE(2005)	1	1	1	.67	1
SIE(2006)	.67	.67	.67	.67	.67
STE(2007)	1	1	1	1	.67
TSA(2010)	1	.33	.33	.33	0
HAN(2011)	1	.33	.33	.33	1
APP(2012)	1	.33	1	.33	1
MON(2013)	1	.67	1	1	.67
PAL(2013)	1	.67	1	1	1
SOM(2015)	1	.67	1	1	1
STE(2015)	1	.67	1	1	.67
AUB(2016)	1	.67	1	1	.67
BRO(2016)	.67	.67	.67	.67	1.

(.33), and client choice (.33). In addition to these codes of causal conditions, the effect-size estimates are recoded according to the four-level coding scheme.

A couple of important points about this recoding are called for. First and foremost, the coding is intentionally qualitative in the sense that each code represents a qualitative judgment by the researcher. As such, the presence of relevant information (or lack thereof) curbs the confidence in these judgements.

Another important point relates to the importance of not simply using the estimated effect sizes as the outcomes. As noted by Schneider and Wagemann (2013), the outcome scores in QCA should always emerge from a qualitative judgment. For instance, and as demonstrated in the present case, simply relying on the individual effect-size estimates would fail to account for the information provided in the corresponding confidence intervals, which offers important information about the outcome variations for each HF program. As such, these ranges should be taken into consideration when defining the outcome scores for the purpose of QCA.

In the second step of QCA, the values for each study on these codes is arranged in a truth table, displaying the logical configurations of causal conditions that elicit a positive outcome. In the present synthesis, FsQCA (a software developed by Ragin, Drass, & Davey, 2006) was applied to produce the truth table presented in Table 4. In this truth table, each row represents a specific configuration

Table 4: Truth table

Housing	Harm reduction	Supportive services	Client choice	Number	Consistency
1	1	1	1	13 (81%)	0.88
1	0	0	0	2 (93%)	0.67
1	0	1	0	1 (100%)	0.83
				1 (94%)	0.79
				1 (100%)	0.49

of causal conditions (i.e., "causal recipe") that elicits a positive outcome. To illustrate, the first row represents the adherence to all of the four causal conditions—13 (81%) of the studies reflect this combination. Of these, 88% elicit a high outcome (indicated by the internal consistency score).

In the subsequent step, the FsQCA software applies inferential logic (Boolean set algebra) to simplify the truth table into the causal recipes that are sufficient to produce a positive outcome. The results are summarized in Table 5. As the table shows, there appears to be two causal recipes:

1. *~Choice*Services*~Harm*Housing*: Housing First programs with a strong fidelity to immediate housing and supportive services components combined with low fidelity to client choice and harm reduction promote housing tenure;
2. *Choice*Services*Harm*Housing*: Housing First programs with high fidelity to all four program components: provision of immediate housing, supported serviced, harm reduction, and client choice (i.e., the full Housing First model).

In summary, then, these two causal recipes indicate the critical ingredients in HF programs that promote housing tenure among chronically homeless individuals. Moreover, the first QCA solution suggests that the provision of immediate access to independent, scattered-site permanent housing in combination with a broad range of supportive services are sufficient critical ingredients for positive housing tenure.

Table 5: Causal recipes for Housing First

	Coverage	Unique coverage	Consistency
~CHOICE*SERVICES*~HARM*HOUSING	0.13	0.03	0.83
CHOICE*SERVICES*HARM*HOUSING	0.76	0.66	0.88
Solution Coverage: 0.79			
Solution consistency: 0.88			

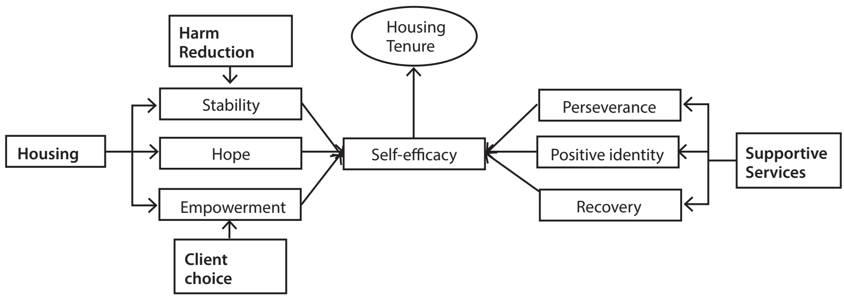

Figure 3: Meta-model for Housing First

In extension of the above findings, these causal recipes are visualized in the development of a final meta-model, that is, a program theory of the causal recipe identified above. To illustrate, the meta-model for the second causal recipe is presented in Figure 3. The meta-model was structured around the critical ingredients identified above and substantiated by the causal chains identified in the qualitative synthesis (Step 4).

DISCUSSION

The intent of this article is to present meta-modeling as an operational and promising approach for theory-based synthesis, an approach for developing program theories across existing studies. As illustrated in the preceding pages, the meta-modeling approach relies on a structured and sequential synthesis process, in which critical program components are first identified within individual studies (as part of the qualitative synthesis) and subsequently verified (with effect sizes from the quantitative synthesis) as part of a final integrated synthesis. Meta-modeling furthermore relies upon established analytical approaches and techniques—causation coding, effect-size calculations, and qualitative comparative analysis—to ensure a methodical and transparent synthesis.

As also indicated in the preceding pages, the meta-modeling approach comes with both benefits and limitations. One benefit of the meta-modeling approach is that it not only allows for the identification of the most salient critical ingredients in HF programs (other synthesis approaches do this also), but it furthermore pushes for a more transparent and systematic integration of qualitative and quantitative findings in identifying and testing these. The use of systematic and transparent procedures for the extraction, analysis, and integration of different types of findings provides for a more systematic and transparent synthesis. The causal chain coding, the summary tables, and the qualitative comparative techniques collectively provide a visible chain of evidence which in turn allows for more verifiable and transparent findings. From a methodological perspective, this is an important benefit.

Another central benefit of the meta-modeling approach is that it relies on a firm division of evidentiary labor, a principle corresponding with a core tenet of scientific investigation: "once data have been used to develop a theory they cannot be used to test it" (Wachter & Straf, 1990, p. xxv). Following this principle, the meta-modeling approach relies on one body of evidence to generate hypotheses (causal strands identified in studies as part of the qualitative synthesis) and another body of evidence to test these hypotheses (effect sizes from studies in the quantitative synthesis). From our perspective, clearly demarcating the evidentiary roles optimizes the advantages of having different types of studies, providing different types of evidence, by having them serve different—yet complementary—purposes within the same integrated synthesis.

No methodological approach is without its limitations. One practical and important limitation concerns the difficulty of distinguishing between the implementation of the primary study and the reporting of the primary study. These two can be very different. Many potentially important aspects of studies are never reported. This lack of reporting on salient aspects of the program studied is particularly problematic in relation to the recoding of the studies in the quantitative synthesis as part of the final integrated qualitative comparative analysis. The best strategy to counter limited program information in the published studies is to seek out additional information from program websites, other publications on the program, authors of the studies, or even fieldwork on the program sites. However, all of these strategies can be time-consuming, even impossible within the time and resource constraints of a commissioned synthesis.

Another limitation pertains to the limited real-world applications of meta-modeling. At the time of this writing, the meta-modeling approach has been applied and refined in only three different contexts (one of which is described in the present article). To be sure, the approach is still in its infancy, a work in progress. To earn a place among the burgeoning array of mixed methods synthesis approaches, it has to be applied across a broad range of contexts and settings and must show comparative methodological and practical advantages in relation to other mixed methods, theory-based approaches. Our modest hope is that the present case application will serve to motivate and further advance the practical application and examination of meta-modeling across different programs, studies, settings, and contexts. Future applications and modifications of the approach are therefore highly encouraged and warmly welcomed.

NOTES

1. Studies included in the synthesis can be obtained by contacting the first author.
2. While there is no definitive consensus on the definition of these terms, "mechanism" generally refers to the underlying social or psychological processes that generate one or more outcomes of interest. The latter typically refers to changes in attitude, knowledge, and/or behaviors. Context usually involves any contextual factors that enable or prevent or in any way influence the mechanism's ability to generate the outcome(s).

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AUTHOR INFORMATION

Sebastian Lemire is a postdoctoral scholar in the Social Research Methodology Division in the Graduate School of Education and Information Studies, University of California, Los Angeles.

Christina A Christie is professor and chair of the Department of Education in the Graduate School of Education and Information Studies, University of California, Los Angeles.

