

Speaker Notes: Qualitative Comparative Analysis (QCA) in Implementation Studies

PART 2: CRISP SET ILLUSTRATION

Slide 1: Crisp Set Illustration

Welcome to part 2 of our series on “Qualitative Comparative Analysis.” These presentations are offered to you by The North Carolina Translational and Clinical Sciences Institute, which is the academic home of the Clinical and Translational Science Award at UNC-Chapel Hill. In part 2, we will provide an illustration of crisp-set QCA, using an example from a program evaluation conducted within the Veterans Health Administration (VA).

Slide 2: What was the evaluation purpose?

The purpose of the evaluation was to identify the facility structures, processes, policies, and clinical program features associated with better patient weight loss outcomes in a clinical weight management program within the Veterans Health Administration, also referred to as the VA. The VA contracted with RTI International to conduct this evaluation.

Because QCA depends on in-depth knowledge of cases and draws heavily on expert substantive knowledge, using QCA in this evaluation required a highly collaborative relationship between RTI and National *MOVE!* program staff at the VA. This close collaboration enabled us to capitalize on the strengths and knowledge of each organization while ensuring evaluation integrity. VA provided design feedback and input, offered their knowledge and access to VA data, and discussed evaluation findings. RTI designed the evaluation, developed data collection tools, collected evaluation data, and conducted all analyses.

Slide 3: What is MOVE!?

The VA established the MOVE! Weight Management Program nationally in 2006 to help treat the increasing numbers of overweight and obese veterans seen within their health care facilities. MOVE! uses a comprehensive, evidence-based, tiered approach that incorporates diet, physical activity, and behavioral modification strategies as core clinical program features. The approach is largely based on the National Institutes of Health Evidence Report for the Identification and Treatment of Overweight and Obesity in Adults and recommendations of the US Preventive Services Task Force. It has also been supplemented by other studies, such as the Diabetes Prevention Program. Although program guidance is provided by a National MOVE! Program Office, individual VA facilities organize and adapt the program based on local populations, environments, opportunities, or constraints.

Slide 4: How did we design the evaluation?

This evaluation used a multicase study approach that leveraged existing variation in patient weight loss outcomes that was seen among VA MOVE! Programs. This was entirely focused on organizational-level influences on patient-level outcomes, thus we restricted our evaluation to key clinical program features

used as part of patient treatment, and to key implementation features (i.e., local structure, policies, processes) used to provide care through the program.

Slide 5: MOVE! Clinical Program Flow

At each VA hospital facility, a MOVE! Coordinator, (typically a Registered Dietitian, Nurse, or Psychologist) provides overall program leadership and coordination among the various disciplines that provide care through MOVE! and with affiliated community-outpatient clinics, which may be located very close or at a considerable distance (> 100 miles) from the main VA hospital campus. In addition to the MOVE! Coordinator, each facility has a MOVE! Physician Champion, who in addition to providing direct patient care, advocates for the program and assists with the development of clinical policies or process related to care.

Patients are screened for obesity using body mass index (BMI) in primary care clinics. Primary care staff are responsible for communicating results of BMI screening and weight-related risks to patients. If the patient is interested in weight management, they are referred for treatment within the MOVE! Program. Interested patients are then started with treatment and provided with a core behavioral program to support self-management for diet and physical activity behaviors designed for small to modest amounts of weight loss.

We focused our evaluation efforts on the two middle boxes of the upper row, since these were aspects of the program that the evaluation sponsors believed were most different between facilities based on their experience with program implementation, and as such, might explain differences in program outcomes.

Slide 6: MOVE! Implementation Model

In addition to clinical program features, the evaluation sponsors believed that how a facility was structured or organized to provide MOVE! care might influence its patient outcomes. Therefore, we adapted Weiner, Lewis, and Linnan's 2009 *Model of Implementation Effectiveness* for MOVE! implementation. This conceptual model defined how the MOVE! program structures, policies, and processes logically linked together to contribute patient weight loss outcomes. We decided to focus our efforts on *implementation policies and procedures* and *resource availability* aspects of this model because these were felt to be the most actionable by the evaluation sponsor, based on their experience to date with implementation.

Slide 7: How did we select our cases and outcome?

We had 239 VA sites eligible for this evaluation, but twenty-two was determined to be the most VA facilities possible given the resources for the project and based on the ability of the evaluation team to have a robust and thorough understanding of each VA MOVE! Program. We used patient weight loss outcomes aggregated to the facility-level to consider sites for selection. We considered geography and facility type (tertiary medical center vs. community hospital vs. rural hospital vs. community-based outpatient clinics) during the selection process in order to have a representative selection of VA

facilities. Ultimately, we included 11 VA facilities from among those with the largest MOVE! patient weight loss outcomes and 11 VA facilities from among those with the smallest MOVE! patient weight loss outcomes.

Slide 8: What were our data sources?

We used a variety of data sources for this evaluation including the following:

Program Summary Form: VA sites were sent a Program Summary Form to complete. This form asked about the disciplines involved in providing MOVE! care, their level of effort (% FTE) in the program, their role, how their program was organized, and their program reporting structure.

Interview: The MOVE! coordinator was the primary interview participant with other program staff offering information as needed. Interview participants answered questions in a variety of areas related to MOVE! implementation, including staffing, treatment program organization, care plans, clinical processes, oversight, quality improvement, use of information technology, resource availability and challenges with resources. We also asked about the diet, physical activity, and behavioral strategies used as part of treatment at their site.

EMR abstraction: RTI helped VA develop a tool to abstract information from the EMR about behavioral strategies and clinical components documented in patient records as being used in MOVE! treatment. The purpose of the abstraction was to validate information provided by sites in the program summary form and during interviews, and to quantify the use of specific strategies (e.g., specific behavioral techniques such as self-monitoring).

Slide 9: What were our conditions?

Selecting specific features within the three priority areas we previously identified to operationalize as conditions for the QCA analysis was challenging. We created an exhaustive list of possible conditions, which was informed by the literature on clinical weight management programs, organizational theory, and program experience within VA and ended up with 17 conditions. We tried to reduce the number of conditions by assessing whether any of the conditions were correlated (i.e., we conducted bivariate analyses to ensure that each condition represented a unique concept) and by considering whether any composite measures could be developed, but unfortunately, we could not reduce the number. We would like to note that this is not an ideal number of conditions based on the number of cases (N=22) that we had.

A best practice in QCA is to select a number of conditions based on the number of cases. You may recall from the introduction to QCA that this method examines combinations of conditions. Adding conditions to the model increases the possible number of combinations exponentially (i.e., 2^k , where k = the number of conditions). For three conditions, eight possible *combinations* of conditions exist. We were able to use a “bottom up” approach to analysis to manage our problem of having too many conditions, which we describe further in the presentation.

Slide 10: How did we calibrate the measures?

We chose to employ crisp rather than fuzzy sets for calibration. QCA analyses using crisp conditions are more easily interpreted and, thus, provide more actionable information for stakeholders. In addition, many conditions lent themselves to crisp coding, and in this analysis, we were more interested in whether staff used particular program components, rather than the degree to which they were used.

We consulted with National MOVE! Program Office staff and used the key informant interviews to understand how the conditions we selected functioned in practice. For example, programs had different models for providing treatment. Some used a traditional individual consultation model, some use an open-ended support group model, and some used a standard curriculum, with a defined beginning, middle, and end and education and skills content covering the full spectrum of diet, physical activity, and behavior associated with effective weight management. Sites that used the latter model were coded as *fully in* the set of *standard curriculum*. If the site did not use such a model, it was coded as *fully out* of the set.

Slide 11: Abbreviated Truth Table

After calibrating the measures, we constructed a data matrix (known as a truth table). To construct the truth table, we sorted our cases (i.e., VA sites) into the rows of the truth table based on their crisp-set membership scores. Each row within the truth table represents a specific combination of VA MOVE! Program organizational features and the outcome of interest (facility-level patient weight loss outcomes: *higher vs. lower*). Since we had a total of 17 organizational features plus the outcome set, our truth table had 2^{18} rows representing 262,144 logically possible configurations. In our example, there were many more possible truth table rows than the 22 empiric cases within our evaluation. This is a problem known as limited diversity.

Take a look at this abbreviated version of our truth table on this slide, which represents logically possible combinations of features within which our 22 empiric cases fall. This first three columns of this abbreviated version of our truth table show 3 of the 17 organizational features which we evaluated and the rows demonstrate a sample of 6 of the 22 empiric cases. A set membership value of "1" represents the presence of an organizational design feature or outcome, while a set membership value of "0" indicates the absence of an organizational design feature or outcome. So, for example, the first row in the truth table represents a site with larger facility-level patient weight loss outcomes that has a strategy of using a standard curriculum with patients, NOT using a multidisciplinary care team, and NOT having a high level of accountability to facility leadership.

In our example, each VA facility with larger patient weight loss outcomes had a different combination of organizational features and thus represented one truth table row. That is to say, each case was a unique combination of conditions and each case represented a sufficient solution for the outcome. This also means that each of our 11 sufficient solutions had a consistency of 100%. In other examples of crisp-set QCA, empiric cases may share the same pattern of conditions, yet differ on the outcome set. When this occurs, researchers can use several techniques to resolve this contradiction and use measures of consistency to decide how to interpret the findings from that particular row.

Slide 12: Boolean Minimization

Finding 11 unique combinations of conditions to the outcome, is not very helpful, thus, most applications of QCA attempt to identify a more parsimonious solution. After constructing our truth table, we set about to perform truth table analysis and further minimize the initial 11 sufficient solutions down to the most parsimonious number of solutions.

We found two conditions (“use of standard curriculum” and “use of a group-based care delivery format”) that were in all 11 sufficient solutions; thus these conditions are a superset of the outcome set and are considered “necessary” conditions.

We then used Boolean algebra along with a bottom-up approach to QCA to reduce the initial 11 solutions. A bottom-up approach is a strategy for the problem of limited diversity. It involves first looking for single conditions sufficient for the outcome. Finding none, we proceeded to examine pairs of conditions, retaining combinations able to predict the outcome perfectly and preferring those combinations that were able to explain the largest number of sites. When two combinations covered the same number of sites, the we selected the combination that did not introduce a new condition.

We were able to minimize to 4 sufficient solutions as shown in the table on this slide. All of these sufficient solutions include the two necessary conditions shown in column one, plus one of the 4 combinations of conditions depicted in columns 2. Empiric cases can be covered by more than one sufficient solution. Raw and unique coverage for each solution is shown in the two right hand columns of the table. Coverage measures the degree of overlap in the set/sub-set relationship between an outcome and its sufficient solution. For example, the first solution that included the two necessary conditions, plus a combination of high program complexity and high staff involvement was found at 5 of the 11 sites (45% raw coverage) with larger patient weight loss outcomes, and was the only solution covering 3 of those 5 sites (27% unique coverage). The overall solution coverage provides a measure of fit of the combination of all solutions identified. In our example, our parsimonious solution coverage was 100% because the four sufficient solutions we identified covered all 11 facilities with larger weight loss outcomes.

Slide 13: Results as Set-relationships

Results from QCA analyses can be expressed in a variety of ways, for example narrative text or tables with equation-like representation of condition terms connected by symbols representing the words AND, OR, and NOT.

Venn-like diagrams can also be useful for illustrating results and are a visually appealing way to demonstrate superset, set, and subset relationships. On this slide is a Venn-diagram representing our findings from the MOVE! Evaluation. The largest white circle represents the set of 17 VA facilities that had both necessary conditions present. The four, overlapping grey circles represents the subset of 11 facilities with larger patient weight loss outcomes. Each of these facilities fits within one or more of the

four sufficient solutions that were identified through the process of Boolean minimization that occurs as part of the truth table analysis.

Slide 14: Want more information?

You can learn more about how we applied crisp-set qualitative comparative analysis by consulting the article we published in the *American Journal of Preventive Medicine*. The article includes a supplementary online technical appendix that describes set theory and the mathematical operations of crisp-set QCA in more detail and provides additional detail regarding our data sources and calibration process.

The evaluation of the *MOVE!*[™] Weight Management Program was conducted by RTI International under contract to the Department of Veterans Affairs (VA246-P-0317). The views expressed are those of the authors and do not necessarily reflect the position or policy of the Department of Veterans Affairs or the US government.

Slide 15: Thank You!

This concludes Part 2 in this series of presentations. Part 3 is an illustration of Fuzzy Set Qualitative Comparative Analysis. Staff from the TraCs Institute are available for consultations. In order to become a member and request a consultation, please call us at 919-966-6022, email us at nctracs@unc.edu, or visit our website at tracs.unc.edu.

Thank You!