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Defining and Supporting Organizational Readiness in the Interactive Systems Framework for Dissemination and Implementaion

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Abstract

Introduction. In the implementation literature, organizational readiness is associated with an increased likelihood of achieving innovation outcomes. Organizational readiness consists of organizational capacity (general and innovation-specific) and organization motivation. Organizations who wish to get results from their innovations have an interest in making sure that certain factors and subcomponents are in place. However, having awareness that certain capacities and factors that influence motivation are linked to improved innovation outcomes does not necessarily help organizations to get "more ready." There is a need for organizations to know if and how they can effectively put these factors and subcomponents into place. This dissertation set out to synthesize the strength of the evidence on how the Support System can use various techniques and interventions to build organizational readiness for implementing innovations, whether support system activities that specifically target readiness factors and subcomponents as part of an innovation implementation process demonstrate better innovation outcomes than non-targeted support system activities, and whether there were any circumstances under which readiness factors and subcomponents were less responsive to support system activities.

Methods. A broad based research synthesis was used to gather information about what is known about providing support to enhance organizational readiness. To identify relevant articles, the search terms for each *factor or subcomponent of readiness* AND

implementation AND each support strategy (*tools* OR *training* OR *technical assistance* OR *quality assurance* OR *quality improvement*) were entered into PsycInfo and PsychArticles (Behavioral Health), Medline and CINAHL (Health Care), and Science.gov and PAIS International databases (grey literature). 4397 articles were initially identified, with the full text of 297 articles were reviewed and coded following screening. 173 articles were retained and included in the syntheses. A coding form developed for this dissertation had an interrater reliability of $\kappa = 0.76$, with a percent agreement of 89.64.

Results. The information gathered in this synthesis indicated that, 1) there is evidence that support system activities can enhance certain factors and subcomponents of organizational readiness, though the strength of evidence varied between factors and subcomponents, 2) support systems activities that target readiness are more likely to see changes in readiness outcomes than those that do not (log odds =1.13; *SE* = 0.46; *p* = 0.0137; OR = 3.1; 95% CI[1.23,7.48]), 3) support system activities that target readiness are more likely to achieve innovation outcomes than those that do not (log odds = 1.92; SE = 0.84; p = 0.0234; OR = 6.8; 95% CI [1.18,38.83]), and, 4) there are some statistical differences in articles that report changes in readiness versus those that do not.

Conclusion. The findings indicate that there is evidence that organization readiness can be enhanced through the use of targeted support system activities. These findings have implications for service organizations that may be mandated or otherwise pressured to implement policies, program, or process by showing that there is potential to enhance the capabilities of organizations and therefore improve their ability to get positive innovation outcomes. Some next steps for research and practice are proposed.

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Chapter 1: Organizational Readiness for an Innovation

The science of effective practice continues to grow. We are getting better and better at understanding causal models of health disorders and the interventions that can alleviate symptoms and promote health and wellness. There are a variety of different types of innovations that can help us to reach outcomes. An innovation can be any policy, program, process, or technology that is new to a setting (e.g. Hall & Hord, 2011; Rogers, 2003). However, the innovations that result from science are not always effectively implemented among organizations (Durlak & Dupre, 2008; Fixsen, Naoom, Blasé, Friedman, & Wallace, 2005). When we implement innovations with quality, we put them into practice so that they reach their intended outcomes (Meyers, Katz, Chien, Wandersman, Scaccia, et al., 2012).

To create quality in health services, we need to deliberately and comprehensively approach the process of implementation (Wandersman, Duffy, Flaspohler, Noonan, Lubell, et al., 2008). Implementing innovations with quality is especially difficult and complex (Fixsen et al., 2008; Meyers, Durlak, & Wandersman, 2012). An increased emphasis on the factors that enhance implementation can better help organizations put innovations into place. To that end, we often need to consider the conditions that contribute to whether or not an innovation will have its intended impact. These conditions can predict how ready an organization is to implement an innovation.

In the organizational literature there is general agreement that readiness is an essential part of successfully implementing an innovation (e.g. Drzensky, Egold, & Van Dick; Greenhalgh, Robert, MacFarlane, Bate, & Kyriakidou, 2004; Hall & Hord, 2011; Simpson, 2002; Weiner, 2009). Readiness is a considered a necessary precursor to successful organization change (Weiner, Amick, & Lee, 2008) and is often embedded within larger implementation frameworks (Aarons, Hurlburt, & Horwitz, 2011; Damschroder et al., 2009; Greenhalgh et al., 2004; Powell et al., 2012). Beyond the consensus that readiness is an important factor in successful change implementation, however, there has been little agreement about what constitutes readiness as a construct or how to best measure an organization's readiness for a given innovation (Aarons et al., 2011; Damschroder et al., 2009; Greenhalgh et al., 2004; Rafferty, Jimmieson, & Armenakis, 2013; Simpson, 2002; Weiner et al., 2008). In a comprehensive literature review on readiness, Weiner et al. (2008) found that (55%) of the articles had no conceptual definition of readiness, instead deferring to the collective "common sense" of the readers.

One of these common phrases to describe the change process is that someone or something must be ready, willing, and able to change. These are important terms but also indistinct, unclear, and ultimately redundant. The lack of a precise understanding of readiness above colloquial catchphrases is somewhat troubling, as organizational readiness is often discussed in the context of determining whether or not a particular organization will receive a given innovation or support for that innovation (Flaspohler, Meehan, Maras, & Keller, 2012). When readiness is high, it is presumed that there will be greater effort dedicated to the change process and more successful implementation

(Weiner et al., 2008). When it is low, not only will implementation not be successful, organizations may be non-receptive to supportive interventions.

The literature on readiness is vast, complex, and covers multiple organizational and psychological fields and content areas. This dissertation is not a synthesis of those frameworks. Rather, I attempt to frame readiness in terms of implementation and the Support System; that is, how we can address and build the organizational conditions that foster better implementation. This dissertation attempts to refine readiness as it relates to implementation of an innovation. I will present a flexible model for readiness that can be used in assessment, planning, implementation, and evaluation. I will overview some of the preliminary evidence that suggest how we can go about building readiness.

Readiness can be better understood as a continuous and dimensional construct that includes multiple components. This model can be applied to multiple settings, multiple levels, and for multiple innovations. I will overview each of the components of readiness (*motivation*, *innovation-specific capacity*, and *general capacity*) and discuss the implications for enhancing the ability of organizations to put innovations into place. This dissertation approaches readiness not in terms of a summative evaluation framework. Measuring readiness as an outcome would tell us how certain components have changed, perhaps as a result of specific support strategies. However, readiness may be more beneficial if used to inform planning and mid-course changes in implementation strategies.

This dissertation attempts to fill gaps that were identified by Greenhalgh et al. (2004) in their highly influential review paper on how innovations are diffused in organizations. They specify several key questions that are lacking in implementation

literature. These include 1) what steps must be taken to move toward system readiness? and, 2) how can this process be supported and enhanced? I hypothesize that critically examining the components of readiness, monitoring these over time, and taking deliberate steps to build and sustain them may lead to enhanced implementation quality, and ultimately better outcomes.

The Three Components of Readiness.

Organizations are stable systems of people who work together to achieve common goals through a division of labor and hierarchy of ranks and responsibilities (Rogers, 2003). Broadly, *Organizational Readiness* is the extent to which an organization is both willing and able to implement a particular innovation (Drzensky et al., 2012; Rafferty et al., 2013; Weiner et al., 2008; Weiner, 2009). This includes the organization's motivation to implement and the organizational capacities to implement and intentional change (Flaspohler, Duffy, Wandersman, Stillman, & Maras, 2008; Weiner et al., 2008). This definition reflects the colloquial understanding of readiness, as well as Weiner et al.'s (2008) review of the literature indicating that authors generally approach readiness either in terms of psychological beliefs, attitudes, and intentions, or alternatively in terms of structural capabilities.

To unite and extend the concepts of willingness and ability, we operationalize three specific and dynamic components within this construct. *Organizational readiness* consists of an organization's motivation to implement a specific innovation, the general organizational context and capacities, and their specific capacities for a specific innovation (Scaccia, Cook, Lamont, Wandersman, Castellow et al., in press). Simply focusing on the capabilities to put an innovation into place neglects important cognitive

and affective variables. In order to facilitate successful implementation, we must also examine the motivations and perceptions about an innovation.

Organizational readiness for change involves all three of these dimensions. Organizational readiness for a specific innovation (notated as $_i$) can thus be framed in the following manner:

$$Readiness_{it} = (Motivation_i \times Innovation\text{-}Specific\ Capacity_i \times General\ Capacity)_t$$

Or, as a heuristic,

$$R = MC^2$$

Each of the interactive constructs can be measured independently and thus offer a nuanced and actionable understanding of readiness. This heuristic, which is abbreviated as the non-mathematical $R= MC^2$, suggests that an organization can be high in some facets of readiness (e.g., motivation) while low in other domains (e.g., innovation-specific capacity). Readiness can be cross-sectionally assessed at any time during an innovation's lifespan (this is the time *t*). Organizations can be described as more or less ready at any given time during the lifespan of implementation. The components of readiness can also change in a positive or negative direction over time depending on a variety of internal and external influences. This relationship has both qualitative and quantitative utility depending on the precision of the measurement model that is used. For a simple example of the components of readiness on an individual-level, see Appendix A.

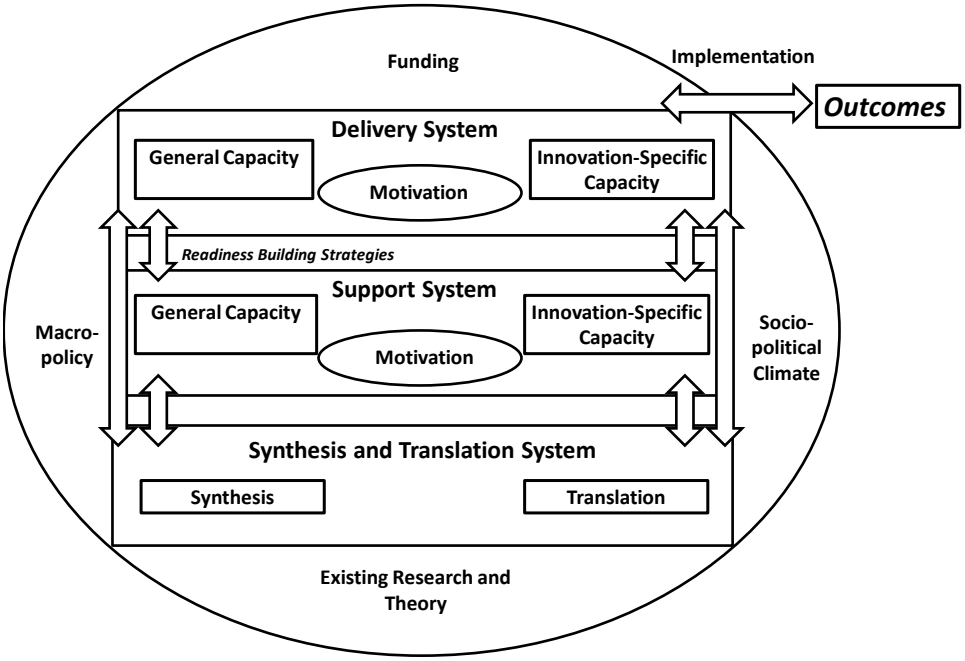
Grounding discussions of Readiness: Accountability and Dissemination Frameworks

When innovations are actively introduced into organizations (as opposed to passively diffused), there is almost always a formal adoption process, following by a planning, evaluation, and sustainability phase (Aarons et al., 2011; Chinman, Imm, & Wandersman, 2004; Greenhalgh et al., 2004). Readiness is often discussed in the context of determining whether or not an organization is capable of putting a particular innovation into practice (Flaspohler et al., 2012). Therefore, readiness is an important construct in dissemination and implementation processes.

Readiness is sometimes contained as minor part within a larger implementation framework (e.g. Aarons et al., 2011; Damschroder et al., 2009; Greenhalgh et al., 2004). I view readiness as part of a comprehensive planning framework that includes needs assessment, goal setting, identification of best or promising practices, planning, and evaluation (Chinman et al., 2004; Powell et al., 2012). This dissertation proposes the readiness is not just a precursor to implementation, but a construct that encompasses the conditions that are necessary to ensure quality implementation through the entirety of the innovation's lifespan (adoption, planning, implementing, and institutionalizing).

We further ground readiness within a conceptual model that articulates how innovations can be supported and implemented. The Interactive Systems Framework for Dissemination and Implementation (ISF, Wandersman et al., 2008) proposes that within a larger system perspective there are bidirectional relationships between providers and support staff that influence how innovations are disseminated and implemented. There are three different systems in the ISF (*Figure 1*). The *Delivery System* is the organization

or community setting that puts an innovation into practice. These are the front-line practitioners or providers. The *Support System* uses various strategies to strengthen the



Delivery System's ability to implement with quality (Wandersman, Chien, & Katz, 2012).

Figure 1.1: Readiness in the Interaction Systems Framework for Dissemination and Implementation

The *Synthesis and Translation System* critically evaluates and condenses the products of research, science, and continuous quality improvement into user-friendly formats that can be easily accessed and understood by practitioners in the Support and Delivery Systems (Rapkin, Weiss, Lounsbury, Thompson, Goodman et al., 2012). This process allows for appropriate innovations to be brought to the attention of organizations and made more accessible for dissemination (Simpson, 2002). Synthesis and Translation processes intentionally and deliberately expose the organization to the innovation

(Simpson, 2002), although this knowledge can be obtained through more passive and informal means (e.g. diffusion; Rogers, 2003)

The ISF has an explicit focus on identifying and building capacity; i.e., knowledge, skills, and abilities that are needed in order to implement innovations. Capacity is the ability of the Delivery System to enact what is required to reach an intended outcome. In the ISF, the Support System helps to increase the ability of the Delivery System to implement innovations by building their capacity. Much work in evaluation and community psychology, especially in Empowerment Evaluation (Fetterman & Wandersman, 2005) focuses on capacity building as a strategy to increases the likelihood that innovations will be put into place. Organizational capacities for behavioral health are informed both internally by the needs and resources of the organization, as well as externally by the demands of both the service recipient and community. Innovations should address and fill the service gaps specified by the needs and resources of the organizations (Flaspohler et al., 2008). Increasing Delivery System capacity may enhance how well an organization implements an innovation (Chinman et al., 2004; Elliott, 2003; Flaspohler et al., 2008).

The concept of *Readiness* was not initially addressed in the ISF (Wandersman et al., 2008). Some models of readiness propose that building organizational capacity (either general or innovation- specific) will build readiness to implement an innovation (Flaspohler et al, 2012; Glisson, 2007). While building capacity is a necessary method for getting an organization ready to implement, it is also insufficient (Wandersman et al., 2008; Weiner, 2009; Weiner, Amick, & Lee, 2008). Thus, a distinction must be made between organizational capacity, organizational resources (e.g. Simpson, 2002), and

organizational readiness (Weiner, 2009). Capacity and Readiness as functional terms are not interchangeable. An organization may have the capacity to implement a specific innovation, but not the motivations to put it into practice. Readiness is reflected in the organizational members' beliefs, attitudes, and intentions regarding the extent to which changes are needed (Armenakis, Harris, & Mossholder, 1993) and the organizational capacity to successfully make those changes. An organization needs to have the "will/desire/drive" to put an innovation into place, the necessary know-how, and the organizational conditions to support it. When the Support System works to build the ability of the Delivery System to implement innovations, they need more holistic readiness-building strategy that includes motivation and capacities *(Figure 1*). Additionally, in order to build readiness in the Delivery System, the Support System must have its own readiness to enact readiness-building strategies.

Readiness and the Appropriate Innovation.

A person or organization cannot be ready for an innovation that is not specified. Innovations can often exist in clusters which include multiple, distinguishable parts that are closely related to one another (Rogers, 2003) and come with a host of conversations, discourses, and texts (Ford, Ford, & D'Amelio, 2008). Readiness for an innovation can be successfully determined only after the innovation that meets the underlying organizational needs is selected. Implementation is also distinct from the initial selection of an innovation (i.e., adoption) (Klein & Knight, 2005; Klein, Conn, & Sorra, 2001; Weiner et al., 2008). An organization may have the willingness to try a new innovation, but it may not have the capacity to implement. Readiness represents an intermediate step between selecting an innovation and putting it into practice.

An innovation should increase organizational control over the intended outcomes (Rogers, 2003). If it is not clear how an innovation will reach the intended outcomes, then this may not be a useful innovation to introduce. Consequently, this dissertation notes that the definition of readiness rests on the critical assumption that an innovation is appropriate for an organization and is grounded in the evidence-base for effective practice (Chinman et al., 2004). Many implementation frameworks that discuss readiness specifically consider the underlying needs and resources of the organization (e.g. Damschroder et al., 2009; Simpson, 2002). This should be determined prior to building readiness (Damschroder & Hagedorn, 2011), not addressed as part of the readiness-building process.

The readiness formula does not imply that an organization should or should not adopt a specific innovation. Rather, it is a way to describe the current conditions with respect to the innovation. We do not make any evaluative statements about which type of innovation is "best" for an organization. If the innovation or change process was chosen without regard to underlying needs or the evidence-base, then is no rational reason that the innovation capacity building process will lead to the intended outcomes (Klein, Conn, & Sorra, 2001). Simply adopting an evidence-based practice does not guarantee effectiveness in an organizational setting (Durlak & Dupre, 2008; Glisson, 2007). The organization may have increased readiness to implement, but the innovation may not have the intended effect, and consequently may not lead to outcomes.

A Need to build Readiness

Readiness for an innovation is often described as a categorical (and sometimes dichotomous) construct with evaluation implications (Flaspohler et al., 2012; Oetting et

al., 1995; SAMHSA, 2010). Pre-defined cut-points or thresholds are used in assessment to determine a "stage" of readiness (e.g. Addiction Technology Transfer Center (ATTC), 2010; Hawkins & Catalano, 2002; Oetting et al., 1995; SAMHSA, 2010). This assessment may be incorporated into a decision-making process, such as whether an organization receives grant funding or particular support services. When readiness is categorical (i.e. ready/not ready), there is an underlying premise that organizations that are not ready will not be able to effectively implement an innovation. Though this categorization may be necessary in certain contexts (e.g., the allocation of limited fiscal resources), there are some functional limitations. Organizations with the largest need for implementation support are often labeled as not being ready for the innovation. The basic assumption is that these "not ready" organizations will be non-responsive to support strategies such as technical assistance (TA), which may result in a waste of resources.

However, we view differences in readiness in organizations as a matter of degree (level of readiness). It is likely that some highly capable organizations are overlooked because of a low level of initial readiness when, in reality, this level of readiness can be augmented with support over time. A dimensional model for readiness that is more multi-faceted is a more actionable construct for measurement and for guiding interventions strategies because it recognizes these differences. As seen in Appendix A, it is not sufficient to assign a global construct of readiness. Rather, we need to pinpoint specific areas *within* readiness that can be enhanced in order to improve implementation. This moves away from the idea of "resistance" to an innovation (Ford et al., 2008) by helping to identify specific components of readiness that can be enhanced.

Support for Readiness. Significant resources are being devoted to innovation support like training and technical assistance (Wandersman et al., 2012). Readiness as defined here can be used to proactively identify potential barriers to change and help to develop strategies to facilitate implementation of a desired innovation (Damschroder & Hagedorn, 2011). This can help to reduce the likelihood of poor implementation (i.e. Type III error; Weiner et al., 2008), and ensure that intended outcomes are reached (Durlak & Dupre, 2008; Meyers et al., 2012b). Proactive support is particularly important for organizations that are mandated to adopt specific innovations (e.g. provisions within the Affordable Care Act like the Community Health Needs Assessment for non-profit hospitals). In many cases, organizations may be unprepared about how to enact mandated changes. Although mandates from regulatory agencies or funders can increase an organization's motivation to adopting an innovation (Beidas et al., 2013; Hall & Hord, 2011; Flaspohler et al., 2008), mandates do not help to build the capacity of an organization (Greenhalgh et al., 2004.) Addressing organizational readiness allows the Support System proactive toward providing support, rather than reactive when addressing resistance.

Therefore, there is a growing need for tailored, proactive, and effective Support System activities that can build and sustain innovation readiness in organizations (Baker et al., 2012; Wensig et al., 2011). Since readiness is a complex, multifaceted construct, readiness building strategies will need to be matched to the conditions of the host organization. By assessing each construct separately using $R= MC^2$, the nuances of readiness in a particular organization for a specific innovation can be better understood.

Organizations that are higher on readiness will not necessarily respond "better" to Support System strategies. Consistent with empowerment evaluation principles (Fetterman & Wandersman, 2005) all organizations likely have the potential to get "more ready" for a particular innovation. Use of $R= MC^2$ helps to identify the level of readiness among the three components and pinpoint specific areas in need of improvement and highlights areas of relative strength that can be used as leverage for improving readiness over time. There are a variety of different strategies available to build readiness, and provided that they are correctly matched to the readiness of the organization, different types of readiness building strategies may lead to the same results (Weiner, 2009). However, this requires that the support strategies be tailored to the components of readiness and target whatever deficits are assessed (Armenakis et al., 1993; Wensig et al., 2012). At this time, there is no synthesis of the research that identifies which support strategies are more effective at enhancing the specific components of readiness.

While $R= MC^2$ is currently non-mathematical (i.e. we have not yet developed scales or a relative scoring system) there are important logical implications. The only way that an organization could be completely lacking readiness is for any one of these factors in $R= MC^2$ to be zero (i.e., any number multiplied by zero equals zero). If this zeroing-out occurs, this is may be when organization may be deemed "not ready." In these cases, there is a critical accountability decision about whether Support System activities should take place under these circumstances since labeling an organization as "not ready" may rule out the organizations that are most in need of help (Rogers, 2003). However, when is organizational readiness too low to be responsive to Support System

activities? This is an unresolved question in the literature on Support System activities and it may be the case that there is no "minimum" amount of readiness.

Synthesizing and Interpreting the Collective Readiness of Individuals in an Organization:

According to Hall and Hord (2010), "to change an organization we must change the individuals within it." Rafferty, Jimmieson, and Armenakis (2013) similarly argue it is impossible to separate organizational readiness from a perspective that incorporates multiple levels. Consequently, $R=MC^2$ may be different at individual, group, and organizational levels. There can be subtle differences between levels of analysis in organizations, with variations seen in the readiness of individuals (Miller & Rollnick, 2013), groups of individuals (Hall & Hord, 2011; Rogers, 2003), and the organization as a whole (Rafferty et al., 2013; Simpson, 2002; Weiner, 2009).

Individuals within an organization are hypothetically subject to the same readiness formula and considering the individual level may be an important part of an organizational analysis. On the individual level, the concept of readiness is well-developed (DiClemente & Velazquez, 2002; DiClemente, Schlundt, & Gemmel, 2004; Greenhalgh et al., 2004; Miller & Rollnick, 2013). An organization can have people who are high on certain skills, but low on things specific to an innovation, similar to how Rogers (2003) described the characteristics of adopters at different time points (i.e. innovators, early, middle, late, and laggards). While this dissertation addresses the overall readiness of an organization, it is necessarily made up of individuals within the organization. This becomes a specific challenge when considering how to assess, manage, and build the components of organizational readiness. An organization can

influence the individuals within the organization to use an innovation in a number of ways. It can occur as a result of collaboration, unitary decisions (i.e. the group decides on what everyone will do), it can be mandated in a top-down manner, or individuals within the organization can make independent choices whether to use the innovation.

The specific level of analysis (Damschroder & Hagedorn, 2011) must be determined prior to assessment and provision of support system activities. Differences between levels can be handled in two ways. First, either individual or organization-referenced items can be aggregated. Weiner et al (2008) suggest that the appropriate focus of aggregated items should be contingent of the degree of task interdependence. An individual-level aggregate approach is appropriate when the sum of individual capabilities is related to organization performance then. This is particularly relevant for innovation-specific capacities (e.g. the number of behavioral health providers with expertise in Motivational Interviewing.) Motivation is often framed in terms of individual-level shared perceptions of the innovation that influence adoption and implementation processes (Damschroder & Hagedorn, 2011; Weiner et al., 2008).

Secondly, difference between levels can be handled through consensus when the organization-level is targeted. "In such circumstances, what is important is not what I think I can do, or even what I think you can do, but rather what we think we can do together," (Weiner et al., 2008). In these situations, the individual is asked to provide ratings on the organization. This means that people are no longer thinking about the change in terms of themselves, but rather the group/organization's readiness. For example, measures of organizational culture are consensus-based; individuals share their beliefs about how work is collectively done in the organization (Glisson & James, 2002).

Work groups commonly arrive at shared beliefs, meaning, and narrative about change (Rafferty et al., 2013; Rogers, 2003).

Although there is likely to be individual-level variation within groups, it is often necessary to measure some readiness constructs through within-group agreement (Glisson & James, 2002; Rafferty et al., 2013). If within-group agreement on constructs is too low, then the attribute cannot reasonable be said to apply to an organizational level (Klein, Conn, Smith, & Sorra, 2001; Weiner, 2009). In these cases, the constructs of organization readiness do not exist as an emergent, "shared team property," (Weiner, 2009). While it would possible to subdivide people in an organization into categories based on how they vary on the three components of readiness and provide readiness building support strategies tailored to the subgroups, this might be a labor intensive process (and not within the readiness of the Support System).

This dissertation focuses on the evidence for building and sustaining organizational readiness intentionally. In cases where readiness-building strategies are not feasible, then other research traditions, specifically passive diffusion studies (Gladwell, 2001; Greenhalgh et al., 2004; Rogers, 2003) may provide insights on how ideas naturally spread through an environment through social means.

The Systemic Context of Readiness

Readiness is part of a larger implementation framework that exists in a broader systemic context composed of economic, political, and social considerations (Aarons et al., 2011; Damschroder et al., 2009; Wandersman et al., 2008). These factors include regulatory policies, sociopolitical context climate, client/consumer advocacy, the existing research literature, and available funding (Aarons et al., 2011; Wandersman et al., 2008).

While these influence the context in which an innovation will be implemented, they are not directly controlled by organizations. Consequently, they are less easily changed through deliberate actions. Disseminating information through the macro system may require the managing of mass media channels (Armenakis et al., 1993; Powell et al., 2012). Other strategies include working to change accreditation or membership requirements, liabilities laws, and licensure standards (Powell et al., 2012).

Summary

Readiness as a construct needs to be flexible enough to lead to allow for multiple measurement strategies, qualitative and quantitative, and help facilitate supportive interventions from those wishing to implement an innovation. $R = MC^2$ allows a program developer or Support System provider to better delineate the specific factors that makes an organization more or less ready for an innovation or innovation support. I now turn to discussion of the three components of $R= MC^2$ and their various factors or subcomponents. This will provide a fuller description of how organizations can vary on the component of readiness. I will present some preliminary strategies that the Support System can use to help increase and strengthen each factor or subcomponent.

Chapter 2: Motivation for an Innovation

The first part of $R = MC^2$ is the motivation to use a particular innovation ($Motivation_i$). Motivations are beliefs about the innovation and the innovation supports that contribute to innovation use. Motivation is the cognitive and affective perceptions of an innovation that attracts or pushes an organization toward use of an innovation. Many authors refer to motivations as the characteristics of the innovations (Damschroder et al., 2009; Flaspohler et al., 2008; Greenhalgh et al., 2004; Rogers, 2003). Simpson (2002) alternately defines motivations as perceived needs and pressure for change. Hall and Hord (2010) describe the "feelings, preoccupations, thoughts, and considerations give to a particular issue or task." The factors that influence motivation address how organizations feel about for an innovation and how this influences the decision to use and continue using an innovation (Rafferty et al., 2013). In this sense, the traditional concept of "buy in" (e.g. Flaspohler et al., 2008) can be further subdivided into specific, measurable, and ultimately actionable factors.

Factors that influence motivation involve not just the collective perceptions an innovation. Rather, it accounts for whether and how these perceptions contribute to the desire to use the innovation. They contribute to how a person or organization conceptualizes the functional consequences of an innovation. These are collective beliefs that contribute to an implementation effort (i.e. a *shared resolve*; Weiner, 2009). Consequently, building motivation involves creating foster conditions that increase the intent to change (Aarons & Sommerfeld, 2012; Miller & Rollnick, 2013; Rogers, 2003).

When the Support System builds Delivery System motivation, they build awareness that the new innovation can enhance the organization (Greenhalgh et al., 2004), rather than transfer tangible skills.

"Negative" motivations have been commonly framed as resistance (Hall & Hord, 2011; Ford et al., 2008; Weiner et al., 2008). When there are negative perceptions of the innovation (i.e. when motivation is low) this can hinder support for a change (Rafferty et al., 2013). However, resistance to change should not be considered the opposite of readiness. Rather, it is a state of lower readiness, rather than a condition of non-readiness. Identifying areas of resistance provides an opportunity for positive organizational development (Ford et al., 2008). This is consistent with applications of $R= MC^2$ that argue that any level of the components of readiness, even what these components are low, provides information about how to support an implementation process.

There is a substantial research tradition in diffusion studies that look at how an individual perceives and thinks about an innovation. In a review of diffusion studies, Rogers (2003) identified that 49-87 percent of the variance in the adoption rate of an innovation can be explained by five, innovation-specific variables; relative advantage, compatibility, complexity, trialability, and observability. However, Rogers's model has not traditionally been used to facilitate implementation in a prospective way (Damschroder & Hagedorn, 2011). In addition, the perceptions of support for an innovation, the prioritization of the innovation, may be important component of motivation.

The following factors that influence motivation (*Table 2.1*) are not stable/permanent features of an innovation and do predict implementation in and of themselves (Greenhalgh et al., 2004). Rather, these are beliefs about the innovation and innovation support. These are beliefs that may be changed through deliberate Support System activities.

Table 2.1: Ways to address factors that influence Motivation

Aspects of Motivations	Possible ways to Address	Authors
Relative Advantage	Persuasion, incentive management	Armenakis, Harris, and Mossholder, 1993; Rafferty, Jimmieson & Armenakis, 2013; Gladwell, 2001; Weiner, 2009
Compatibility	Translation System	Chinman et al., 2004; Durlak & Dupre, 2008; Fetterman and Wandersman, 2005; Rogers, 2003
Complexity	Core components vs. Adaptation	Fixsen et al., 2005; Meyers, Durlak & Wandersman, 2012; Wandersman et al., 2008
Trialability	Piloting	Rapkin et al., 2012; Rogers, 2003
Observability	Evaluation	Beutler, 2001; Chinman et al., 2004; Rossi, Lipsey, & Freeman, 2004
Priority	Social influences	Armenakis & Harris, 2009; Greenhalgh et al., 2004; Ford, Ford & D'Amelio, 2008

Relative advantage is the degree to which a particular innovation is perceived as being better than the innovations that it is being compared against. This is whether or not the innovation is valued by the organization (Weiner, 2009). When relative advantage is high, then the innovation is more likely to be adopted (Rogers, 2003).

There are many different ways in which the relative advantage of an innovation can be construed. This includes economic profitability, initial and ongoing cost of the innovation, decrease in subjective discomfort, social prestige, efficiency, and immediacy

of reward (Damschroder et al., 2009; Rogers, 2003). Relative advantage is not necessarily an objective measure and whether or not an innovation has value over another is determined through subjective means by the person or organization who wishes to implement it. An innovation may be perceived as better, or alternately the current practice can be perceived as intolerable. Other authors phrase this construct in terms of valance; i.e., the change has value on a cost/benefit ratio for their job and role (Rafferty et al., 2013) and that the overall outcomes will be beneficial (SAMHSA, 2010; Schoenwald & Hoagwood, 2001). The relative advantage of an innovation can also be influenced by the end-consumer demand for the innovation (Powell et al., 2012).

Articulating the relative advantage may be a key component of building tension for a change (Greenhalgh et al., 2004). This involves fostering the idea that change is needed and has benefits over the current conditions (Armenakis et al., 1993; Armenakis & Harris, 2003). Persuasive communication that is *rich,* i.e., tailored to the organization, increases the impact of these messages and can enhance understanding of the innovation's advantages (Armenakis et al., 1993). Additionally, preemptively developing effective responses to common objections can help to address negative motivations (Ford et al., 2008). Management of incentives and disincentives can greatly impact the perceived, positive attributes of an innovation (Hall & Hord, 2011; Powell et al., 2012; Rogers, 2003; Simpson, 2002), though do not necessarily lead to quality implementation (Greenhalgh et al., 2004; Rogers, 2003).

Compatibility is the degree to which an innovation is subjectively perceived at being consistent with the existing values, cultural norms, past experiences with similar innovations, and needs of potential adopters (Rogers, 2003). This is also referred to as

the "innovation-system fit," (Greenhalgh et al., 2004). If an innovation is perceived as more compatible to an organization, it is more likely to be adopted (Greenhalgh et al., 2004). This is because it represents less of a drastic change in behaviors (Rogers, 2003).

Within a strategic planning process like Getting to Outcome ® (GTO, Chinman et al., 2004), compatibility is addressed as part of the innovation-selection process. This narrows down the innovation that is likely to be "best" given the needs, goals, and fit with the organization. Using indigenous knowledge systems to participate in the program planning process can help to build compatibility with an innovation (Durlak & DuPre, 2008; Fetterman & Wandersman, 2005; Greenhalgh et al., 2004; Powell et al., 2012; Rogers, 2003). Furthermore, if an organization can develop ownership over an innovation, this increases the likelihood that it will be seen as relevant (Armenakis et al., 1993; Simpson, 2002). The innovation can also be deliberately packaged and named in a way that increased perceived compatibility (Damschroder et al., 2009; Rogers, 2003). If these steps have not been addressed, then the innovation is not likely to be perceived as compatibility.

Complexity is the degree to which an innovation is perceived as relatively difficult to understand and use (Rogers, 2003). If something is complicated and hard to use, then this can preemptively affect how willing an organization is to adopt it. Implementation of innovations can be an extremely laborious process (Fixsen et al., 2005; Meyers et al., 2012b). If a new innovation is easier to use, then people will be more likely to adopt it. Consequently, as the scale of a change increases (i.e., the complexity), responses to the innovation become more negative (Rafferty et al., 2013). Misperception of complexity can be a significant barrier that prevents initial adoption.

Something may look easy at first glance, but the logistics of learning and routinizing how to use it may be daunting (Hall & Hord, 2011). By not fully appreciating the depth and requirements of quality implementation, this can contribute to increases in perceptions of complexity, which decrease the likelihood of adoption (Rogers, 2003). This can decrease motivation in the early phases of use (Klein & Knight, 2005).

Managing complexity requires effective processes to frame the innovation into user friendly and easily understood components (Wandersman et al., 2008). The more clearly the core components of the innovation are specified, the more readily that a program can be implemented (Fixsen et al., 2005; Greenhalgh et al., 2004). Developing a glossary of implementation terms can help to promote a common understanding of the innovation (Hall & Hord, 2011; Powell et al., 2012). For example, the Affordable Care Act (2010) is 974 pages long, far too in-depth to reasonably expect organizations and providers to parse apart and change policies accordingly. In response, the Department of Health and Human Services has set up a user-friend website explains the changes (http://www.healthcare.gov/law/) and how it affects individuals, families, and employers. This allows the complexity of the law to be distilled in a way that allows the end-user to gain a smoother understanding of the nuances of the innovation.

Additionally, there is a significant need to analyze the tradeoff between adapting an innovation to a setting (i.e. addressing both compatibility and complexity) and maintaining fidelity to the original innovation (Damschroder et al., 2009; Durlak & Dupre, 2008). Enhancing the compatibility and reducing complexity of an innovation requires that the distinction between core and adaptable components be clearly separated (Damschroder & Hagedorn, 2011). Choices that are made in the readiness building

process (i.e. adapting an innovation to reduce complexity) may adversely affect whether or not the innovation does what it is supposed to do.

Trialability is the degree to which an innovation can be tested and experimented with by the organization (Rogers, 2003). When the outcomes of the innovation are uncertain, this allows people to experiment and see the results on a limited basis (Greenhalgh et al., 2004). By facilitating active participation in the implementation of the change, this increases opportunities to form more sophisticated perceptions of the innovation (Armenakis et al., 1993; Fetterman & Wandersman, 2005). If people have the opportunity to try to the innovation prior to formal implementation, this increases the likelihood of use (Rogers, 2003). In this instance, the use of piloting individuals with an organization may be beneficial in building initial motivation (Hall & Hord, 2011).

Observability is the degree to which the outcomes that results from the innovation are visible to others (Rogers, 2003). If people can see what happens when the innovation is used, this can increase the rate of adoption. This source of evaluation data provides tangible feedback about the benefits of a particular innovation (Beutler, 2001; Damschroder et al., 2009). Having sufficient evaluation capacity can increase how observable the innovation is (Labin, Duffy, Meyers, Wandersman, & Lesesne, 2012). Change facilitators in the Support System need to be realistic about the intended outcomes on an innovation in order to cultivate accurate expectations (Ford et al., 2008). Observability is particularly an issue in the case of preventative interventions (Rogers, 2003). This is because there is greater uncertainty about the relationship of the innovation to the outcome (e.g. someone who doesn't get cancer). In these cases, there is less tangible incentive to adopt the innovation and consequently lower motivation to use.

Priority. In addition to the perceived attributes of an innovation, there can be a perceived implementation climate that is specific to an innovation (Beidas et al., 2013; Damschroder et al., 2009). These beliefs are the shared perceptions of the importance of the innovation in the organization. This includes the degree to which an innovation is expected, rewarded, and supported (Klein et al., 2001). Urgency, the amount of time that is available before a change must take place, can also influence the prioritization of an innovation (Armenakis et al., 1993; Damschroder et al., 2009). The urgency of an innovation can be influenced by whether or not there is significant pressure to change (Flaspohler et al., 2008; Lehman et al., 2002). While pressure can be driven internally through social factors (especially when the innovation is home-grown; Damschroder et al., 2009; Rogers, 2003), mandates are often used to influence/direct whether or not there is an expectation that specific innovation should be implemented. As stated before, mandates have a positive influence on increasing motivations, but do not have an impact of the overall capacities of an organization (Beidas et al., 2013; Hall & Hord, 2011).

The motivational climate for a particular innovation can be affected by the influence of key individuals, such as leadership, program champions, or administrative bodies (Aarons & Sommerfeld, 2012; Atkins et al., 2008). This can be fostered by "articulating a compelling and inspiring reason for innovation use, expressing their own fallibility and need for team, members' assistance and input, and communicating to team members that they are essential, valued, and knowledgeable," (Klein & Knight, 2005). There can be specific social pressures to adopt a particular innovation (Armenakis et al., 1993; Gladwell, 2001; Rogers, 2003). Organizational members look to each other for cues regarding ongoing expectations about the innovation (Armenakis et al., 1993). This

is especially true for the “late-adopters,” who are not the initial people to begin use of an innovation (Damschroder et al., 2009; Rogers, 2003). As the number of individuals in an organization develop motivation increases, this can accelerate within-organization motivation (Gladwell, 2002; Rogers, 2003).

Chapter 3: Innovation-Specific Capacities

The second component of $R = MC^2$ is *innovation-specific capacity*. Innovation-specific capacities are the human, technical, and fiscal conditions that are necessary to successfully implement a particular innovation (Flaspohler et al., 2008). At the organizational level, innovation-specific capacities refer to the operational realities that allow or prevent innovation development and implementation. This is the technical domain of the service system (Glisson, 2007). These are the knowledge, skills, abilities, and technological equipment that are needed to put a specific innovation into place (*Table 3.1*). These are also referred to as process-specific capacities, as they relate directly to innovation use (Livet, Courser, & Wandersman, 2008).

Table 3.1: Ways to address subcomponents of Innovation-Specific Capacity

Aspects of Innovation-Specific Capacity	Ways to Address	Authors
Innovation Specific KSA	Vary according to complexity of innovation -identify, provide EBSIS	EBSIS; Wandersman, Chien, & Katz, 2012
Program Champion	Identifying and utilizing connectors, mavens (innovators), and salesmen	Gladwell, 2002; Grant, 2013; Livet, Courser, & Wandersman, 2008; Rogers, 2003
Implementation climate (Supports)	Social influences, leadership	Armenakis et al., 1993; Beidas et al., 2013; Fetterman and Wandersman, 2005; Hall & Hord, 2011; Rogers, 2003; Schoenwald and Hoagwood, 2001

Interorganizational Relationships	Formalized agreements; coalitions building	Powell et al., 2012

Innovation-Specific Knowledge, Skills and Abilities. Each new policy, program, or process has its own set of knowledge, skills, and abilities that are needed in order to implement with quality and reach intended outcomes. The readiness building process for every innovation will be somewhat different. Some innovations may be exceptionally simple (and having few capacities to acquire), while others may be system-wide transformations of complex care arrangements (e.g. Philadelphia Department of Behavioral Health and Intellectual disAbility Services [sic], DBHIDS, 2011). There are several steps involved in the process of building innovation-specific capacity. All components of the innovation need to be thorough specified and standardized. The core components are those that cannot be altered without substantial impact on the integrity of the innovation. These are essential for achieving the intended outcomes of the innovation (Fixsen et al., 2005; Meyers et al., 2012a). However, if organizations are able to adapt certain elements of a program, it will be adopted more easily (Greenhalgh et al., 2004). One possible strategy to manage this balance is to use an innovation configuration map (IC Map; Hall & Hord, 2011). This can help to standardize the measurement of an innovation across settings and track any adaptations.

Innovation champion. A champion is a charismatic individual who put his or her organizational weight behind an innovation (Rogers, 2003). They tend to occupy a key linking position in the organization (i.e. not so senior they are inaccessible, but not so minor they cannot influence change), possess skills in understanding other's motives and

aspirations, and have good interpersonal negotiating skills (Rogers, 2003). By modeling positive emotional responses to a change, champions can influence how people feel about the innovation process (Rafferty et al., 2013). More so than general leadership, champions influence those around them through their expertise, experience, representativeness, and credibility (Armenakis et al., 1993; Dougherty, 2009; Damschroder et al., 2009; Greenhalgh et al., 2004). Champions are actively associated with implementation (Atkins et al., 2008; Damschroder et al., 2009) and their presence is related to both higher levels of use and higher quality of use (Livet et al., 2008).

Gladwell (2001) discussed several types of sub-types of individuals that influence how an innovation can be adopted. *Connectors* are people who have many different types of contacts and therefore can bridge many types of relationships, i.e. having many "weak ties" (Grant, 2013; Greenhalgh et al., 2004). *Mavens* are those who have considerable expertise and interest in a particular innovation. Their characteristics would also be consistent the early adopters of innovators (Rogers, 2003). Implementation leaders, those who are more ready to put an innovation into place, need to have a deeper level of innovation expertise (Meyers et al., 2012b). Finally, *salesmen* possess a special skill at persuading those about the relative advantages of innovation. Ideally, champion(s) involve all three of these types of people in order to facilitate the use of the innovation within the organization.

Implementation Climate Supports. Because there can be separate implementation climate supports for separate innovations, it is included as an innovation-specific capacity (Beidas et al., 2013; Damschroder et al., 2009). This is the extent that the innovation is tangibly supported. Without strong, convincing, informed, and

demonstrable management support for implementation, employees are likely to conclude that the innovation is a passing fad (Klein & Knight, 2005). These supports include whether resources are available for a specific innovation, the number and strategic placement of supporters in the organization (Greenhalgh et al., 2004), and whether there is consistent leadership support for the innovation (Aarons et al., 2011; Aarons & Sommerfeld, 2012; Klein et al., 2001; Weiner et al., 2009). A supportive implementation climate can be a significant predictor of whether the innovation is actually used (Klein & Knight, 2005; Meyers et al., 2012).

Interorganizational Relationships. Flaspohler et al. (2008) define external relationships as a general organizational capacity. I have included this with innovation-specific capacities because the extent to which relationships between organizations are needed will depend on the type and specific components of an innovation. These can refer to relationships between the Support and Delivery System *and* between different Delivery System organizations.

Certain types of innovations (e.g. Systems of Care) require more extensive collaboration and cooperation (Powell et al., 2012), while others (e.g. adopting a new paper stock) require only placing orders with a vendor. Innovations can also spread between organizations (Aarons et al., 2011; Rogers, 2003). Communities of practice that include all relevant stakeholders can help to share and dissemination information about implementation challenges (Aarons et al., 2011; Fetterman & Wandersman, 2005) and threats to ongoing readiness. Interorganizational relationships can be cultivated through coalition building, developing resource sharing agreement, obtaining formal

commitments (such as memorandums of understanding; MOUs), and developing partnerships with academic units (Powell et al., 2012).

Chapter 4: General Capacity

The third component of $R = MC^2$ is general capacity. General capacities are the skills, characteristics, and the overall functioning that are associated with the ability to implement or improve any innovation (Flaspohler et al., 2008). General capacities include the infrastructure, skills, abilities, context, environment, and processes in which the innovation will be introduced (Greenhalgh et al., 2004). These capacities can be applicable to many different types of innovations and across multiple situations on an organizational level. In many cases, general capacities must be in place if the innovation-specific capacities are to be implemented and sustained over the long term (Fixsen et al., 2005; Greenhalgh et al., 2004; Livet et al., 2008). General capacities are likely to be normally distributed across organizations. An organization that is low in general capacity is likely to be distressed in some manner with dysfunctional elements preventing the organization from operating in a positive and productive manner.

Building general capacities is a system-level intervention, meaning it can apply to many different types of organizational tasks (Fixsen et al., 2005; Glisson, 2007). It can be a lengthy and involved process, especially when addressing more stable features like organizational culture. Some specific strategies linked to this and other capacities are described below (*Table 4.1*).

Table 4.1: Ways to address subcomponents of General Capacity

Aspects of General Capacity	Ways to Address	Authors
Culture	Availability, Responsiveness, Control (ARC)	Glisson, 2007; Glisson & Schoenwald, 2005; Hemmelgarn et al., 2006
Climate	Reshape Vision (Hall & Hord, 2011)	Lehman et al., 2002; Hall & Hord, 2011. Drzensky, Egold, & Van Dick, 2012
Innovativeness	Indirect leadership Support	Aarons & Sommerfeld, 2012; Atkins et al., 2008; Fetterman & Wandersman, 2005; Greenhalgh et al., 2004; Rafferty et al., 2013; Rogers, 2003
Resource Utilization	Expanding incoming resources	Armstrong et al., 2006; Powell et al., 2012; Rogers, 2003; Simpson, 2002
Leadership	Development	McShane & Glinow, 2009; Becan, Knight, & Flynn, 2012; Beidas et al., 2013; Fixsen et al., 2005; Rafferty et al., 2013.
Structure	Revising policies and procedures, developing new teams	Glisson & Schoenwald, 2005; Lehman et al., 2002; Rogers, 2003
Staff Capacity	Attraction, Screening, hiring, attrition.	Flaspohler et al., 2008; McShane & Glinow, 2009; Rafferty et al., 2013

Organizational Culture is the set of expectations about how things are done in an organization (Glisson & James, 2002; Hemmelgarn, Glisson, & James, 2006). This is how an organization or a system functions (Glisson, 2007). Very rigid cultures can be inflexible when efforts made to alter their processes (Glisson, 2007). This can include an organization's identity, or is the extent to which central and enduring characteristics distinguish it from other organizations (Drzensky et al., 2012). A vision statement articulates the underlining philosophy that guides the type and quality of services. A clear organizational vision provides a benchmark for all organizational operations to be

directed and ultimately compared toward (Hall & Hord, 2011). However, having a vision does not ensure that organization change as terms and language may be devoid of any operational meaning (Fixsen et al., 2005).

Part of being culturally competent is thoroughly assessing organizational culture and climate (Fit, Gregory, Orden, Joran, Portnoy, Welsh, et al., 2012). *Cultural competency* refers to the set of academic and interpersonal skills that allow for increased understanding and appreciation of cultural differences within, among, and between groups (Chinman et al., 2004). This is distinct from compatibility. Cultural Competency as a general capacity is the set of skills and expectations that are applied toward any innovation rather than the fit of a particular innovation as judged by the organization that implements it.

Organizational Climate. Organizational climate refers to how employees collectively perceive, appraise and feel about their current working environment (Glisson & James, 2002; Lehman et al., 2002; Hall & Hord, 2006). Climate is an aggregate construct that represents within-group agreement (or disagreement) about the work environment (Glisson & James, 2002). This can include how individuals identify with an organization, measures of job satisfaction, how engaged people are in their work, how functional their interactions with coworkers are, and how stressful they perceive their day-to-day tasks (Damschroder et al., 2009; Glisson, 2007). Climate is fostered when collective perceptions about work environment emerge (Glisson, 2007). Climate is more temporary and transient than culture, responding to various internal and external influences over time (Gregory et al., 2012).

Climate is somewhat an analogue to factors identified in to *Motivation*. As opposed to a specific innovation, these are the shared perceptions that people have toward to the organization a whole. As such, climate as described by Glisson and James (2004) and Glisson (2007) is a general capacity. A positive climate has been positively associated with implementation (Beidas et al., 2013; Glisson, 2007) and service outcomes (Aarons et al., 2011; Glisson, 2007). However, evidence conflicts about whether or not identification with an organization facilitates implementation. When there is a strong organizational identity, individuals may be less likely to adopt and innovation because the strong emotional stake in the well-being of the organization may discourage risk taking (Ford et al., 2008). Organizational identification is positively related to motivation when the perceived benefits (i.e. relative advantage) are in favor to the organization (Drzensky et al., 2012). Some strategies to foster increased identification with an organization and ownership over an organizational change include a developing clear, consistently-articulated narrative of the organization's history, successes, and capabilities (Armenakis et al., 1993).

Perceived Stress is also is a crucial factor for organizations wishing to implement change (Lehman et al., 2002) with large amounts of negative stress linked to poorer job satisfaction (Glisson, 2007). Typically stressors such as role conflict, role overload, ambiguity over tasks and responsibilities, and emotional exhaustion can interfere with daily program operations (Glisson, 2007; Hall & Hord, 2011; White, 2008). When a certain practice or organizational condition is intolerable, a tension for change can emerge (Damschroder et al., 2009; Greenhalgh et al., 2009). When there is this tension, the discrepancy between current conditions and the possible benefits of change can

enhance the relative (dis)advantage of practice as usual (Armenakis et al., 1993). However, as stress is not necessarily linked to readiness for a specific innovation (Hall & Hord, 2011), and it is included as a general capacity.

Organizational Innovativeness. This is how generally receptive an organization is toward change, i.e., whether the organization tries new things and fosters a learning environment (Fetterman & Wandersman, 2005; Hall & Hord, 2006; Rogers, 2003). Innovativeness is separate from motivation for a specific innovation, as it can be applied to many different types of innovations. Some organizations may foster an environment that is open to new innovations while others may be more inflexible and immobile (Damschroder et al., 2009; Greenhalgh et al., 2004; Glisson, 2007; Hall & Hord, 2011; Klein et al., 2001; Rafferty et al., 2013; Rogers, 2003; Rogers, 2003). Innovativeness sets a tone in how an organization reacts to a change by promoting a strong future-orientated perspective (Rafferty et al., 2013). When an organization's culture is receptive to change, this is positively related to the perceived benefits that can results from a change process (Drzensky et al., 2012). This may be influenced by past experiences with the change process, which in some instances may have been negative (Weiner, 2009).

Organizations that have more connections with external organizations are more likely to implement new innovations quickly (Damschroder et al., 2008; Gladwell, 2001; Rogers, 2003). The extent that organizations are externally connected to other organization (i.e. openness) is positively linked to how innovative they are (Rogers, 2003). Glisson (2007) calls these *proficient* organizations. Openness is particularly relevant when facilitating the initial dissemination of innovations.

There is little research on how to directly increase overall organizational innovativeness. Indirectly, establishing innovation workgroups within an organization is associated with positive implementation (Greenhalgh et al., 2004). Innovativeness can be influenced by key individuals or administrative bodies facilitating a learning environment that encourages experimentation and risk taking that is unconstrained by a fear of failure, tolerates mistakes, and fosters teamwork (Aarons & Sommerfeld, 2012; Aarons et al., 2011; Atkins et al., 2008; Klein & Knight, 2005). For example, Many public health systems are very defensive and passive toward innovation due to the need to insulate themselves from criticism, administrative sanctions, and litigation (Glisson & James, 2002).

Resource Utilization. Resources are existing structures, funding, programs, and other activities that are potentially available for programming (Chinman et al., 2004). Resources are not the general capacities. As a general capacity, *resource utilization* is how resources are acquired and used. Large organizations tend to have more "slack," or discretionary/uncommitted resources that can be devoted to innovations (Klein et al., 2001; Rogers, 2003; Lehman et al., 2002). Therefore, how this slack is dedicated is a general capacity. There can also be physical resources such as adequate office space, equipment, and technological capacity (e.g. computer access and integrated clinical data collection systems) that can be dedicated toward different types of innovations (Simpson, 2002; White, 2008.) This can also include the concept of time, i.e. the amount of work hours available or allotted for an organizational change process (Greenhalgh et al., 2004). Because larger organizations tend to have greater slack resources, they tend to be more innovative (Rogers, 2003). Furthermore, the experience and skills that an organization

has at seeking alternative and additional streams of funding is a general capacity (Powell et al., 2012). Examples of this strategy would be applying for grants and/or expanding the number of insurance providers that an organization works (Powell et al., 2012) or developing a strategic financing plan (Armstrong et al., 2006).

Leadership. Quality leadership is motivational, considerate, engaging to staff, and promotes a climate for change (Aarons & Sommerfeld, 2012). Leadership can apply to more than one particular innovation (Fixsen et al., 2005; Flaspohler et al. 2008.) As it relates to an innovation, leaders need to be able to develop, communicate, model, and build commitment toward a strategic vision (McShane & Glinow, 2009). High quality leadership is associated with better staff attitudes toward adopting an innovation (Beidas et al., 2013; Rafferty et al., 2013) increased risk tolerance and positive self-concept (Simpson, 2002) and increased likelihood of implementation (Becan, Knight, & Flynn, 2012). However, tenure increases (specifically among chief executive officers (CEOs)), leaders tend become less likely to introduce fundamental changes into organizations (Rafferty et al., 2013).

Organizational Structure include such factors as organizational architecture, size, specialization, power structures, staff autonomy, staff cohesiveness, communication pathways, and internal decision-making processes that can impact how well an organization functions on a day-to-day basis (Damschroder et al., 2009; Flaspohler et al., 2008; Greenhalgh et al., 2004; Lehman et al., 2002; McShane & Von Glinow, 2009). Typical structural stressors for organizations may include work overload, incivility, low task control, role conflict, ambiguity over tasks and responsibilities, and negative attitudes to work (Glisson & James, 2002; McShane & Von Glinow, 2009; White, 2009).

Methods to address organizational structure issues include revising professional roles and job characteristics (Glisson & Schoenwald, 2005) creating new teams and services sites (Powell et al., 2012), and developing new administrative policies and procedures (Donahue, Allen, Romero, Hill, Vasaeli, et al., 2009).

A structural balance between openness and control must be navigated during implementation processes. Different structural elements may be more important at different points in implementation. Structural flexibility and decentralization are positively associated with the positive motivation toward an innovation (Rafferty et al., 2013) but not necessarily the successful adoption of an innovation (Rogers, 2003). Organizations that are more centralized and have control consolidated in a few individuals tend to show less innovativeness (Rogers, 2003). Rigidity or formalization, the degree to which an organization emphasizes following rules and procedures, is also negatively linked to innovativeness (Rogers, 2003). However, formalization can facilitate implementation of an innovation (Rogers, 2003). Therefore, there is a tradeoff between developing the necessary, formalized organizational structure to implement an innovation and having the general capacity that is receptive to change.

Staff capacities are the general skills, education, and expertise that the staff possesses (Flaspohler et al., 2008; Rogers, 2003). Certain general staff attributes include perceived opportunities for growth and professional development, feelings of efficacy in ability to carry out job duties, the mutual influence that staff have over each other, and staff adaptability to changing work demands (Simpson, 2002). General staff capacity can be built through attracting quality candidates, screening and hiring appropriate candidates, and retention quality employees. The individuals who fit best within the

organization are more likely to be retained and contribute to the organizational climate and culture (Rafferty et al., 2013). Retention is specifically linked positively to the organizational climate and job satisfaction (McShane & Van Glinow, 2009).

Chapter 5: The Dynamics of Readiness

Readiness is typically assessed in the pre-adoption phase of implementation in order to identity barriers to putting the innovation into place (e.g. Chinman et al., 2004; Damschroder et al., 2009; SAMHSA 2010 SAMHSA, 2011; Hawkins & Catalano, 2002). When an organization meets certain criteria, an innovation may be introduced or receive support services (Hawkins & Catalano, 2002; Oetting et al., 1995; SAMHSA, 2010). Once an organization is "ready", then the implementation process can begin and is likely to be successful. For organizations that fall below a readiness threshold, it is assumed that there are likely to be many barriers that will interfere with successful change effort. As a consequence, organizations with the largest need for supportive processes are often labeled as not being ready for the innovation, or alternately, will be non-responsive to supporting strategies like technical assistance (TA). Furthermore, there is an implicit assumption that readiness will be a static condition over the lifespan of the innovation (e.g. SAMHSA, 2010; Simpson, 2009) and will not need to be addressed after implementation.

However, change is not an event; it is process (Hall & Hord, 2011). It is not sufficient just to consider readiness as a precursor to change and then fail to monitor its properties over the course of implementation. For example, key staff may have leave through turnover, a better, more advanced innovation is introduced, or other responsibilities may compete with implementation of the innovation. Neglecting these

variables can have negative consequences on quality of the implementation (Meyers et al., 2012).

Readiness is ongoing, dynamic, and flexible construct. All factors and subcomponents may change over time. Being able to adopt and implement an innovation is an interaction between perceptions of the innovation, the organizations, and the context (Greenhalgh et al., 2004). Any study or assessment must recognize that all three variables are subject to fluctuations over the lifespan of the innovation. Readiness can be assessed prior to implementation, monitored during implemented, measured as an outcome and condition for the sustainability of an innovation, and targeted through tactical CQI changes during the course of implementation (Damschroder & Hagedorn, 2011). Capacity and motivation must be monitored for intended or unintended changes during implementation as these may either positively or negatively influence the impact of the innovation (Damschroder et al., 2009; Meyers et al., 2012b; Rapkin et al., 2012; Stirman et al., 2012). Using one time, cross-sectional methods to study components like motivations (Rogers, 2003) only captures a partial picture.

In the early phases of implementation, putting an innovation into place often results in poorer team performance and/or organizational performance (Klein & Knight, 2005). This "hassle" factor has implications for the readiness of organizations during the early lifespan of an innovation. Given the stressors of implementation, the factors that influence motivation may actually decline during the beginning stages of use. At these beginning stages, addressing concerns that people have can be a way to help disarm early negative motivation toward an innovation (Ford et al., 2008; Hall & Hord, 2011; Rogers, 2003).

The processes that underlie when an innovation is sustained versus discontinued are particularly under-researched (Aarons et al., 2011; Greenhalgh et al., 2004). There can be a variety of reasons by an innovation may be discontinued, including finding a better innovation (Hall & Hord, 2011) or changing needs of the population (Scaccia, Castellow, & Wandersman, in press). While addressing sustainability is often seen in terms of capacity, the ongoing perceptions of the innovation's usefulness also need to be monitored (Chinman et al., 2004; Hall & Hord, 2011). For example, an organization may have high general and innovation-specific capacity, but the front-line staff and administrators responsible for implementation may lack sufficient motivation to continue to implement the innovation because there are other organizational priorities. Maintaining motivation is something that must be continually cultivated over the implementation process if an innovation is likely to have any sustainability (Hall & Hord, 2011; Meyers et al., 2012; Stirman et al., 2012).

At this time our knowledge about what constitutes each of these constructs, including their relative weights and how they are linked to a specific innovation, is still in its infancy. While I have attempted to maintain boundaries between each of these components, these constructs in implementation frameworks can often be indistinct and overlap (Damschroder et al., 2009; Flaspohler et al., 2008). Additionally, the literature on the interactions between components of readiness is sparse. The precise inter-construct dynamics may be dependent, for example, on the expansiveness/scope (Flaspohler et al., 2008) and complexity (Rogers, 2003) of the innovation, so the interrelationships are difficult to predict and generalize.

Currently, the instruments that assess readiness are similarly nebulous, with many researchers developing measures without actually defining readiness as a construct (Drzensky et al., 2012). Weiner, Amick, and Lee (2008) extensively reviewed the change measurement literature and identified 43 instruments for assessing readiness. In these, they noted substantial deficits in terms of both validity and reliability. Only seven instruments had undergone any systematic psychometric testing and they recommended that caution be used when applying these instruments to other settings and innovations. Specifically, they propose the effective instruments would, a) focus on a specific innovation, b) use group referenced items, c) capture change commitment, d) be flexible enough to specify other innovations. For example, the widely used Organizational Readiness for Change (ORC, Lehman et al., 2002) scale does not identify a specific innovation. While it can help to identify general capacities that are present in the organizational environment, it neglects both innovation-specific capacities and motivation related to an innovation. Within the ORC, motivations are defined in terms of needs, training need, and pressures for change (Lehman et al., 2002), which would be considered part of a larger program planning framework, not as a specific implementation-facilitating framework. Because of these measurement deficits, it is difficult to make generalized dimensional statements about how much "more" readiness an organization might have and how much is necessary for implementation quality. Future, more nuanced measurement models will be able to help better distinguish between the levels of readiness profiles and can be used to inform evidence-based support strategies.

Despite the deficiencies in measurement, there is still a need to enhance the components of readiness. Having a specific, deliberate program to increase the innovation use is associated with better implementation (Greenhalgh et al., 2004; Klein & Knight, 2005). Targeted, specific strategies can be used to build readiness through the Evidence-Based System for Innovation Support (EBSIS; *figure 5.1*). EBSIS strategies include developing tools, delivering training, providing technical assistance (TA), and developing quality assurance/quality improvement (QA/QI) systems (Wandersman et al., 2012). Each of these components has its own literature and evidence-base (Wandersman et al., 2012). *Tools* are resources that are designed to organize, summarize, or communicate knowledge. *Training* is a planned, instructional activity intended to facilitate acquisition of knowledge, skills, and attitudes in order to enhance learner performance (Furjanic & Trotman, 2000; Wandersman et al., 2012).

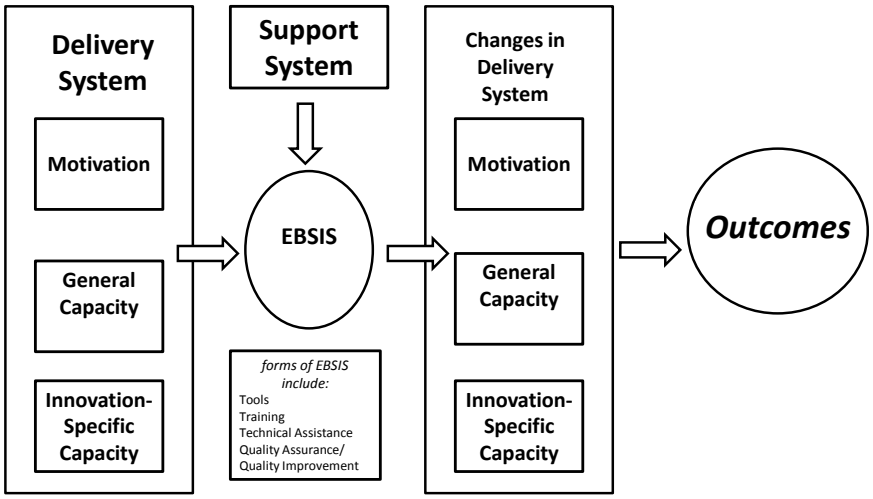


Figure 5.1: Building Readiness through EBSIS

However, training in and of itself is generally insufficient to produce intentional change within an organization (Wandersman et al., 2012). *Technical Assistance* is an individualized support system activity and hands-on approach to capacity-building in organizations and communities, often conducted after training (Chinman et al., 2004; Durlak & Dupre, 2008; Wandersman et al., 2012).

> The goals of technical assistance are to maintain providers' motivation and commitment, improve their skill levels where needed, and support local problem solving efforts. Depending on the situation, technical assistance may include some combination of re-training of initial providers, training of new staff, and providing emotional support. (Durlak & Dupre, 2008)

Quality Assurance/Quality Improvement strategies involve the use of tools and logic to assess (QA) or enhance (QI) quality performance. The capacity to evaluate an innovation is positively linked to implementation quality (Flaspohler et al., 2008; Greenhalgh et al., 2004; Labin et al., 2012). There are a variety of strategies to build evaluation capacity, including developing QA systems and tools, having auditing policies, using reminders, and providing supervision (Powell et al., 2012).

Generally, having positive relationships between the Delivery and Support System will be linked to more positive implementation (Dougherty, 2009; Greenhalgh et al., 2004; Wandersman et al., 2012.) Change agents, the person(s) facilitating the implementation of an innovation, can be a powerful conduit in purposeful dissemination (Armenakis et al., 1993; Glisson & Schoenwald, 2005; Rogers, 2003). Change agents (i.e., the Support System providers of EBSIS) can influence perceptions, attitudes, and

decisions at multiple levels by providing technical information, describing characteristics of the innovation, and facilitating linkages between multiple groups (Gladwell, 2002; Glisson & Schoenwald, 2005; Rogers, 2003). As described by Rogers (2003), this is done by 1) developing the need for a change, 2) establishing an information-exchange relationship, 3) diagnosing the problem (Simpson, 2002), 4) creating an intent to change (i.e. building motivation for the innovation), 5) translating this intent into action, 6) stabilization implementation and prevent discontinuation (Hall & Hord, 2011), and 7) termination (Chinman et al., 2005; Dougherty, 2009). Change agents have better effectiveness when they are homophilous (i.e. they share attributes with and are similar to the potential innovation users), can develop good relationships, can assess community needs, and allow potential users to make independent decisions about using of the innovation (Greenhalgh et al., 2004; Rogers, 2003). Provided that support strategies are delivered with quality, this will lead to enhanced levels of the targeted components, and consequently improved implementation (Klein, Conn, & Sorra, 2001; Powell et al., 2011; Rafferty el al., 2013; Rogers, 2003; Wandersman et al., 2012).

While EBSIS was initially developed for building the capacity for a specific innovation (Wandersman et al., 2012), it can be extended to each component of readiness: motivation, innovation-specific capacities, and general capacities. The EBSIS process can pinpoint specific areas in need of improvement and highlights areas of relative strength that can be used as leverage for improving readiness over time. It can help guide thinking on which dimensions are particularly strong and where the Support System needs to intervene.

While it is likely necessary that certain component of readiness must be in place in order to ensure the implementation happens with quality (Greenhalgh et al., 2004; Glisson, 2007; Meyers et al., 2012), there is no consensus about what these necessary components might be. There may be variation in the $R=MC^2$ conditions that are needed for different types of innovations. Determining the relationship of these components to implementation outcomes would allow for more specialized Support System strategies as it would provide information about the components that are most influential. Further research and synthesis is also needed to determine what types of tailored strategies are best practice for the specific readiness constructs (Armenakis et al., 1993; Glisson & Schoenwald, 2005; Glisson, 2007; Powell et al., 2012; Wandersman et al., 2012).

Chapter 6: Research Questions, Methods and Data Analysis Plan

In order to determine how to best build the components of $R=MC^2$ using targeted Support System strategies, the following questions will be addressed in this dissertation:

1. How are the subcomponents of readiness defined across content areas?
    a. What, if any, evidence supports the existence of subcomponents of readiness that were not mentioned/addressed in the introduction?
2. What are the best methods to build the factors that influence motivation?
3. What are the best methods to build the innovation-specific subcomponents of readiness?
4. What are the best methods to build the general capacity subcomponents of readiness?
5. Do tailored support system activities (i.e., those that address specific components of readiness) lead to better innovation outcomes than those that do not?

I hypothesize that tailored Support System activities that target specific components of readiness of the Delivery System will show better innovation outcomes.

6. When is organizational readiness too low to be responsive to tailored Support System activities?

I hypothesize that there is no evidence that organizations will be non-responsive to Support Systems activities that are tailored to readiness. Figure 6.1 illustrate the general causal chain that this dissertation plans to investigate.

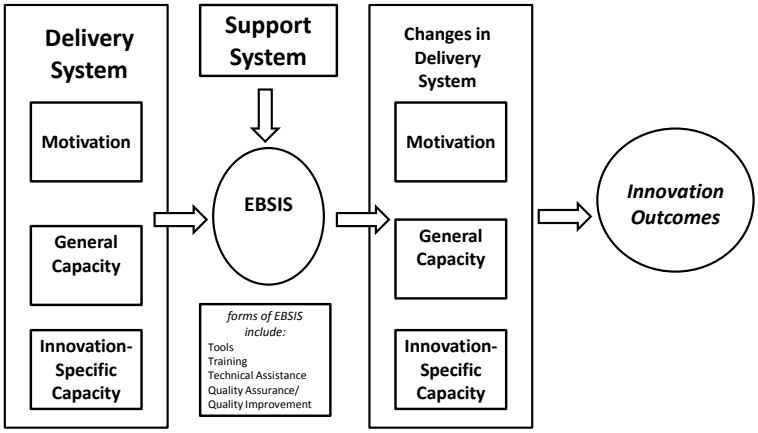


Figure 6.1 Supporting Readiness for an Innovation through EBSIS

Methods

A broad-based research synthesis will be employed to assess the evidence that supports addressing and building readiness as a means to enhance the quality of innovation outcomes. Research synthesis involves techniques that include meta-analysis, but have a broader scope of inclusion criteria (Labin et al., 2012) that includes qualitative findings. Research synthesis is governed by six steps and subsequent decision rules including, 1) defining the research questions, 2) collecting information sources, 3) selecting information sources bases on inclusion/exclusion criteria, 4) extracting and coding data (which includes assessing potential risks of bias), 5) analyzing the data, and 6) presenting the findings. (Labin et al., 2012; Noyles et al., 2011))

Search

Two broad contents areas will be incorporated into this synthesis: behavioral health (e.g. Lehman et al., 2002) and health care/medicine (e.g. Weiner, 2009; Gawande, 2013). These literatures have a tradition of studying how new innovations are

implemented. The following search engines will be used: PsycInfo and PsychArticles (Behavioral Health), Medline and CINAHL (Health Care)[1]. There are no time limits placed upon the search parameters as there is no clear rationale for excluded literature based on publication date.

For the first set of research questions, the search terms are each *factor or subcomponent of readiness* AND *implementation* AND each EBSIS strategy (*tools* OR *training* OR *technical assistance* OR *quality assurance* OR *quality improvement*). A secondary search that uses similar search terms and synonyms may be necessary because different research traditions may use different language to define similar constructs (Greenhalgh et al., 2004). A literature search will not be conducted for the subcomponent of innovation-specific knowledge, skills, and abilities. There is likely too high a degree of specialization for specific innovations to conduct any meaningful or realistic synthesis. However, innovation-specific capacities will be coded and analyzed if they are part of a study and implementation effort.

One major threat in conducting a synthesis is publication bias, or the tendency for positive results to be submitted and accepted for publication over null results (Rosenthal & DiMatteo, 2001; Shadish, Cook, & Campbell, 2002). Furthermore, many technical or evaluation reports may not be submitted to journals, though self-published in other formats. In order to address this "grey literature" (Hammerstørm et al, 2010) a search of the Science.gov and PAIS International database will be used to collect published material in the social sciences that is not otherwise indexed. As a synthesis of all

[1] An initial search included two additional content areas: Business (e.g. Armenakis & Harris, 2009), and education (e.g. Hall & Hord, 2011). Three additional search engines were used to collect information from these content areas; Business Source Complete (Business), ERIC (Education) and Education Source complete (Education). Because the total number of articles returned was quite large (N = 4585), the content search was limited to behavioral health and health care.

available sources is not feasible, a maximum of three articles per subcomponent, selected by relevance, will be included. A diagram of the selection process can be seen in Figure 6.2.

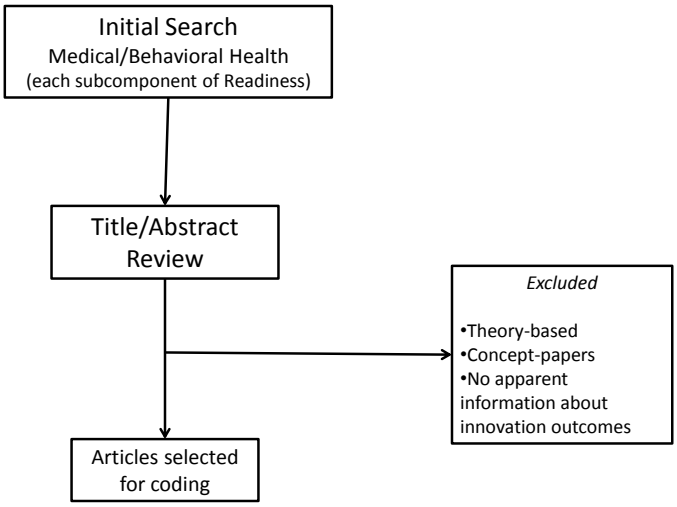


Figure 6.2. Diagram of Study Selection and Exclusion Process

Out of these total numbers of articles, the titles and abstracts will be reviewed for inclusion and exclusion criteria which include relevance to the initial research questions. Only articles that appear to report empirical results will be included in the synthesis; theory or conceptualizations-style papers that do not include any reported evidence will not be utilized. Duplicate results will also be removed.

Coding

After inclusion and exclusion decision rules have been applied, the remaining articles will be reviewed and coded. Descriptive qualitative and quantitative information will be collected via this dissertation's coding form (see Appendix B). Quantitative data will be collected based on indicators in the coding forms that correspond to current knowledge about concepts discussed in the introduction. A guidebook for the coding

form will also be developed (see Appendix C). An initial review of three articles per subcomponent was conducted to assess initial uniformity around their definitions (Appendix D).

Background information will be collected for all articles. This includes authors, the content area, the innovation that is specified, sample size of the study, and the project timeline. The unit of analysis for coding will be an information source; in cases where two or more information sources refer to the same project, the two sources will be counted separately to the extent that each information source provides new and unique information.

Coding form pilot. A pilot of the coding forms will be conducted with 17 cases by a coding team consisting of this author and at least one additional research associate (Gwet, 2010). This will take place after all cases have been initially identified, and will be drawn from that sample. Input from the coding team will be used to resolve inconsistencies or other limitations associated with the use of the coding forms and to inform additions to the coding guidebook. A reliability assessment will be conducted using Cohen's Kappa statistic and percent agreement analyses (Hallgren, 2012). It is expected that there will be iterative refinements made to the coding tools (the form and the guidebook) until reliability reaches an acceptable level (Kappa > .70). The final version of the coding form will be put into an electronic format to ease data collection and analysis.

Data Analysis Plan

To answer question 1) *How are the subcomponents of readiness defined across content areas?,* a uniform definition will be refined for each subcomponent of readiness

and used in the coding guidebook to determine what subcomponents are being examined in each study. Frequency and percentages will be computed for the occurrence with which subcomponents appear in the literature as whole and for each content area. This answer to this question will help to ascertain consensus and recent scholarship around the components of readiness.

To answer questions 2-4), information will be gathered about the types of techniques used to address and build specific subcomponents of readiness. Frequency counts and percentages will be computed to determine which support strategies occur most often when addressing the sub-components of readiness.

Evidence supporting the use of support strategies for each subcomponent of readiness will be qualitatively synthesized and assigned into a category using a version of Greenhalgh et al.'s (2004) modified World Health Organization Health Evidence Network criteria (WHO-HEN) (Øvertveit, 2003) (see table 6.1). This has been adapted to more directly include information about the evaluation design of the study. Coding information for the evaluation design can be found in Appendix C.

Table 6.1 Levels of evidence

Level of evidence	Description	Evaluation Requirement
Strong direct evidence:	Consistent findings in two or more empirical studies of appropriate design and high scientific quality undertaken in health service organizations (include both behavioral health and health care)	Requires participant randomization
Moderate direct evidence	Consistent findings in two or more empirical studies of less appropriate design and/or of acceptable scientific quality undertaken in health service organizations	Requires comparison group
Limited	Only one study of appropriate design and acceptable	Requires

evidence	quality available, or inconsistent findings in several studies.	quantitative measurement
Minimal evidence	At least one study of minimal quality available. This includes practitioner self-reports, single organization case-studies, and other qualitative reports.	
No evidence:	No relevant study found	

The categories in this table will provided a measure of the qualitative strength of the findings. Additionally, when effect sizes are reported or can be computed based on information reported in the article, and if the evaluation model is of high quality (i.e., strong evidence), meta-analysis will be used to synthesize effectiveness findings about the subcomponents of readiness. Meta-analysis allows for combining of descriptive statistics from several studies and the quantitative examination of inconsistencies in the field (Rosenthal & DeMatteo, 2001). Cohen's *d* will be computed, by which changes in means are divided by the pooled standard deviation of the outcome measure (Rosenthal & DeMatteo, 2001). Prior to coding, it is uncertain whether any studies will meet the reporting threshold needed for meta-analysis.

Within-study bias will be assessed by examining evaluation, theory, and implementation failure (Wandersman, 2009). First, threats to internal validity will be assessed using a modified version of the Cochrane Collaboration Risk of Bias scale (Higgins et al., 2011). A second reason why a particular innovation does not have the intended outcomes is that it may not have been appropriate innovation for the underlying need. This was discussed in chapter one and is also known as theory failure (Wandersman, 2009). The coding form will capture information related to the rationale for the innovation. This is particularly important for innovations that are mandated to be implemented. The quality with which the support strategy is implemented may also

affect how the subcomponents of readiness may change. Implementation quality will be measured quantatively by component six of the Quality Implementation Tool (QIT); *Evaluating the Effectiveness of Implementation* (Meyers et al., 2012). This includes an evaluation of *fidelity*, *dosage*, *quality of delivery*, *differentiation*, *reach*, and *adaption* (see Appendix C for definitions).

To answer question 5), *Do tailored support system activities (i.e., those that address specific components of readiness) lead to better innovation outcomes than those that do not?,* evidence supporting the use of tailored support strategies over non-tailored strategies will be quantitatively analyzed using logistic regression.

To answer question 6), *When is organizational readiness too low to be responsive to tailored Support System activities?,* the percentage of articles that explicitly report no change in readiness will be computed. Within these articles, the reasons for support failure will be recorded in terms of the specific readiness subcomponents that were non-responsive to support strategies. This will be qualitatively compared against other possible reasons for failure, including innovation, implementation, and evaluation failure (Wandersman, 2009).

Across all articles, qualitative and illustrative passages that are especially evocative will be gathered.

Reporting the Evidence:

The data that are collected for this dissertation will be presented in a format that is organized according to the plan for data analysis (described above). Quantitative findings about each subcomponents of readiness will be further illuminated using qualitative descriptions that are derived from information sources. Should articles be of

acceptable empirical quality (i.e., strong evidence) and if they report statistics sufficient for meta-analyses, Cohen's d will be reported.

There will be likely great variation in the quality of the reported evidence about how the subcomponents of readiness can be built using support system strategies. By identifying the state of the evidence for these subcomponents, this dissertation hopes to synthesize the state of the evidence for the best strategies to address organizational deficits in the components of readiness. Knowing the effectiveness of various support strategies, with provide increased guidance for the Support System. This also can help to address an additional reason why innovations may fail to meet their outcomes, *support failure*, i.e. inappropriate or inadequate innovation assistance (Wandersman, 2009). This information will allow a more refined, empirically-based model of innovation readiness that can be used by program planners and evaluators to better bring innovations into organizations.

Chapter 7: Results

A total of 4378 potentially relevant articles were identified during the initial screening. From these, 297 were selected for full text review. These 297 were selected because the article abstracts appeared to indicate that a support strategy was provided with the intent of addressing one of the factors or subcomponents of readiness. All statistics were computed in the *R* statistical package (2014).

Reliability Process.

Seventeen articles were picked to be initially coded. The number of articles corresponds to the *N* needed in order to have adequate confidence in the kappa coefficient between two coders (κ , Gwet, 2010). These initial articles met two criteria. First, they were part of the initial title/abstract screening. Second, they were available through the University of South Carolina journal accounts. These articles were picked to represent a diverse range of readiness constructs. There were no other preconditions attached to the initial review.

Coding was completed by the author and one additional coder. The additional coder was conceptually familiar with the items being coded, having worked with the author on several projects related to organizational readiness since 2012. The additional coder did not know the categorization of the articles prior to coding. However, there was still a one-hour training session to review the coding form and glossary. Coders generally could code the presence of an item even if the authors did not use the same precise terminology as the coding manual.

After the first wave of coding, only 11 articles were retained. The κ coefficient on the *Is this article codable?* item was 0.86. Therefore, an additional nine articles (for a total of 26) were selected to be coded in order to reach an *N* of 17 (with the assumption that articles would be retained at the same rate as in the initial coding wave; ~70%). Reasons why articles were not coded included having a fictitious example, did not have any data, and describe a process of support (not provision of support).

Kappa coefficients were computed for each individual item, following procedures detailed by Viera and Garrett (2005). This process helped to identified particular items that were problematic for further review. Items with a κ of ≤0.40 (moderate agreement, Landis & Koch, 1977; Viera & Garrett, 2005) were examined more closely. All discrepancies were reviewed by both coders through a discussion that involved consulting the original articles. A consensus process was used to resolve discrepancies. Where discrepancies were conceptual, particular changes were made to coding form and glossary (Appendices A and B.) These changes and rationale are outlined below:

Background Information. One coder made the decision to code articles that dealt with public health as *other*. An alternative option would have been to code as *health care*. To make a distinction, the category of *public health* was added. No additional *other* items were coded in the remainder of the process. The *technology* item was removed due to lack of distinction and possible redundancy with *intervention* and *process*. A qualitative item, *reason why article is not codable*, was added.

Subcomponents of Readiness. Coding for *compatibility* was refined, as one coder conflated "legitimacy" and "commitment" with *compatibility*. These two items were coded as *priority*.

Readiness outcomes. Two items changed format. The *computation cell* and *type in qualitative outcomes* collected non-categorical data. The *other outcomes* category was deemed redundant, and was removed. These items were not included in the overall κ calculation.

Innovation outcomes. Like above, two items changed format. The *computation cell* and *type in qualitative outcomes* collected non-categorical data. They were removed from the overall κ calculation.

Possible Sources of Within-Study Bias. We discussed several items under *implementation quality*. We clarified the distinction between *fidelity of the innovation* (the innovation is put into place as specified) versus *fidelity of the support strategy* (the support strategy is provided as specified). The *fidelity* item refers to *fidelity of the support strategy*. The item *quality implementation* was dropped due to its qualitative nature and conceptual overlap with *participant responsiveness.*

Following this process, κ was computed at 0.76. As κ may understate interrater agreement and result in a misclassification to a lower rating when there is little or no variability in ratings (Labin et al., 2012), percent agreement was calculated as an additional measure of interrater agreement. Percent agreement was calculated at 89.64. The final codebook and guide can be found in Appendices B and C.

One hundred seventy-three articles met inclusion criteria and were used in the full analysis. The reference list for the articles in the synthesis can be found in Appendix E. *Figure 7.1* is a modified PRISMA diagram (Moher, Liberati, Tetzlaff, Altman, The PRISMA Group, 2009) detailing the selection process, including reasons why particular article were excluded from the primary analyses. There were a number of reasons why

articles were excluded from the analysis: 1) the article described how a support system strategy should be provided, but did not actually provided the support in a setting (*N* = 43), 2) the article described how a factor or subcomponent was linked to innovation outcomes, but not how these factors or subcomponent were changed by the provision of support system activities (*N* = 42), 3) the article described a model of the factor or subcomponent, but not a real-life application of the model (*N* = 24), 4) the article was a review paper that discussed how a factor or subcomponent applied to several settings, but not how the factor or subcomponent was changed, and, 5) the example provided in the article was fictitious or hypothetical (*N* = 2).

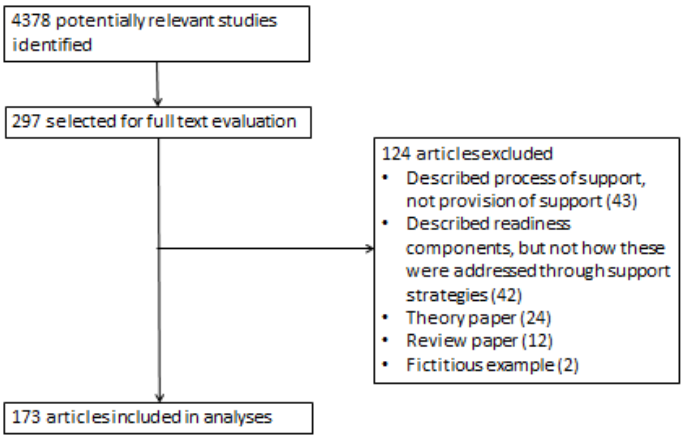


Figure 7.1. Modified PRISMA Diagram of Study Selection and Exclusion Process

Descriptive Characteristics of Included Studies.

Content Area. Health care constituted the largest number of articles (*N* = 112; 65%), followed by public health (*N* = 29; 18%), behavioral health (*N* = 14; 8%), and education (*N* = 11; 6%). Four articles were from the business literature (2%), and three concerned the U.S. Federal Government (1.7%). Articles were published between 1972

and 2013, with 94% being published after the year 2000, although no date restrictions were established on the search parameters *a priori*.

Types of Innovations. Twenty-six (15%) of the articles dealt with the introduction of a policy, 12 (7%) with a promotion intervention (e.g. health promotion), 31 (18%) with a preventative intervention (18%), 21 (12%) with a treatment intervention, 22 (13%) with a non-specified intervention, and 105 (61%) with a process. Some articles involved more than one category of innovation (N = 44; 25%)

Components of Readiness. Eighty-six (50%) articles dealt with factors that influence motivation, 103 (60%) dealt with innovation-specific capacities, and 113 (65%) dealt with general capacities. A majority of articles included more than one component of readiness. Seventy (40%) articles dealt with only one component, 77 (45%) dealt with two of the components, and 26 (15%) dealt with all three. A correlation matrix of how the three components co-occurred can be found in Table 7.1. As the variables are dichotomous, these are phi coeffecients, or rφ.

Table 7.1. Co-occurrence of the three Components of Readiness.

	Motivation	Innovation-Specific Capacities
Innovation-Specific Capacities	0.14	
General Capacities	-0.37***	-0.25***

*p<0.05
**P<0.01
***p<0.001

Motivation. Of the 86 articles that addressed factors that influence motivation, 31 (36%) dealt with relative advantage, 41 (48%) with compatibility, 24 (28%) with complexity, 17 (20%) with trialability, 20 (23%) with observability, and 38 (44%) with priority. Forty-nine (57%) articles dealt with one factor, 19 (22%) with two factors, 14

(16%) with three factors, three (4%) with four factors, and six (7%) with five factors. No article dealt with all six factors identified in the preliminary literature search. A correlation matrix (rφ) for how the factors that influence motivation co-occurred can be found in Table 7.2.

Table 7.2. Co-occurrence of the Factors that Influence Motivation

	Relative Advantage	Compatibility	Complexity	Trialability	Observability
Compatibility	0.27***				
Complexity	0.34***	0.29***			
Trialability	0.40***	0.36***	0.26***		
Observability	0.30***	0.10	0.27***	0.25**	
Priority	0.19*	0.03	-0.01	0.01	0.11

*p<0.05
**P<0.01
***p<0.001

Innovation-specific capacities. Of the 103 articles that addressed innovation-specific capacities, 91 (88%) articles dealt with innovation-specific knowledge, skills, and abilities (though this was not a specified search term, as discussed in the methods section), 30 (29%) with program champions, 39 (38%) with implementation climate supports, and 27 (26%) with interorganizational relationships. Of the articles that dealt with interorganizational relationships, 13 (48%) with relationships between delivery systems, seven (26%) with relationships between delivery and support systems, and seven (26%) with both types of relationships. Sixty-seven (65%) articles dealt with one innovation-specific capacity, 22 (21%) with two capacities, 16 (16%) with three capacities, and 3 (3%) with all four capacities. A correlation matrix (rφ) for how innovation-specific capacities co-occurred can be found in Table 7.3.

Table 7.3. Co-occurrence of Innovation-Specific Capacities

	KSA	Champion	Imp. Climate
Program Champion	0.22**		
Implementation Climate Supports	0.21**	0.45***	
Interorganizational Relationships	0.06	0.10	0.07

*p<0.05
**P<0.01
***p<0.001

General Capacity. Of the 113 articles that addressed general capacity, 45 (39%) articles dealt with organizational culture, 22 (19%) with organizational climate, 8 (6%) with organizational innovativeness, 12 (11%) with resource utilization, 49 (43%) with leadership, 49 (43%) with organizational structure, and 28 (25%) with staff capacity. Sixty-six (58%) articles dealt with one general capacity, 28 (25%) with two, 21 (19%) with three, three article (3%) with four, and three articles (3%) with five. No article dealt with either six or seven general capacities. A correlation matrix (rφ) for how general capacities co-occurred can be found in Table 7.4.

Table 7.4. Co-occurrence of General Capacities

	Culture	Climate	Innovativeness	Resource	Leadership	Structure
Climate	0.29***					
Innovativeness	0.18*	0.16*				
Resource Utilization	-.11	-0.10	-0.06			
Leadership	-0.02	0.07	0.11	-0.12		
Structure	0.20**	0.10	0.10	0.13	-0.06	
Staff Capacity	0.06	0.21**	0.13	0.13	0.04	0.03

*p<0.05
**P<0.01
***p<0.001

Use of EBSIS techniques. A correlation matrix for how the EBSIS techniques co-occurred can be found in Table 7.5. As these variables were also dichotomous, these are phi coefficients (rφ).

Table 7.5. Co-occurrence of EBSIS Techniques to Address Readiness

	Tools	Training	TA	QA
Training	0.02			
Technical Assistance	-0.06	0.17*		
Quality Assurance	0.04	-0.02	<0.01	
Quality Improvement	<0.01	-0.38***	-0.17*	0.07

*p<0.05
**P<0.01
***p<0.001

Type of Outcomes Data Reported. *Readiness outcomes* are reported changes in the proposed factor or subcomponents of readiness. Twenty-four (14%) reported both quantitative and qualitative data, while 29 (18%) articles reported solely quantitative data, and 120 (69%) reported solely qualitative data. *Innovation Outcomes* are whether the innovation (policy, program, or process) that was being introduced to the setting had its intended outcomes or not. These were less frequently reported in these studies (*N* = 76; 43%), with 97 (56%) articles reporting no innovation outcome data.

Methodological Characteristics of Included Studies. One hundred fourteen (66%) articles used versions of case study analyses. Of the 49 articles that used comparison groups (28% of total), only eight (16%) had random assignment procedures. Eighty-one (47%) articles had pre-post measurement designs, 57 (33%) solely posttests, 5 (3%) solely pretest, and 30 (17%) had no explicit measurement model. In this dissertation, an indeterminate/non-explicit measurement design generally meant that the changes were reported as part of an ongoing process narrative, and not as part of a traditional results section. Only seven (4%) articles contained no innovation rationale. Table 7.6 shows how these characteristics were distributed in each factor or subcomponent.

Table 7.6. Percent of each Factor that Influences Motivation and the Subcomponents of Innovation-Specific and General Capacities that have the certain Methodological Characteristics

	Factor or Subcomponent	Evaluation Design						Innovation Rationale			
				Measurement Model							
		Case Study	Comparison Groups	Pretest Only	Post-test Only	Pre-Post	Indeter.	None	Included	Mandated	Both
Motivation	*Relative Advantage (N =31)*	20 (65%)	8 (26%)	1 (3%)	13 (42%)	13 (42%)	4 (13%)	1 (3%)	21 (68%)	2 (6%)	6 (19%)
	Compatibility (N =41)	26 (63%)	16 (39%)	3 (7%)	17 (41%)	13 (32%)	8 (20%)	2 (5%)	33 (80%)	2 (5%)	4 (10%)
	Complexity (N=24)	14 (58%)	6 (25%)	2 (8%)	9 (38%)	9 (38%)	4 (17%)	0 (0%)	22 (88%)	1 (4%)	1 (4%)
	Trialability (N=17)	8 (47%)	7 (41%)	1 (6%)	6 (13%)	8 (47%)	2 (12%)	0 (0%)	14 (82%)	1 (6%)	2 (12%)
	Observability (N=20)	11 (55%)	7 (35%)	0 (0%)	7 (35%)	11 (55%)	2 (10%)	0 (0%)	17 (85%)	1 (5%)	2 (10%)
	Priority (N =38)	26 (68%)	9 (24%)	2 (5%)	13 (34%)	21 (55%)	2 (5%)	0 (0%)	28 (74%)	4 (11%)	5 (13%)
Innovation-specific capacity	*Knowledge, Skills, and Abilities (N =91)*	55 (60%)	27 (30%)	3 (3%)	32 (35%)	44 (48%)	12 (13%)	5 (5%)	72 (79%)	4 (4%)	10 (11%)
	Champion (N = 30)	19 (63%)	10 (33%)	1 (3%)	13 (43%)	12 (40%)	4 (13%)	0 (0%)	22 (73%)	4 (13%)	3 (10%

	Factor or Subcomponent		Evaluation Design						Innovation Rationale			
					Measurement Model							
			Case Study	Comparison Groups	Pretest Only	Post-test Only	Pre-Post	Indeter.	None	Included	Mandated	Both
	Implementation Climate Supports (N = 39)		24 (62%)	15 (38%)	0 (0%)	13 (33%)	22 (56%)	4 (10%)	2 (5%)	26 (67%)	4 (10%)	7 (18%)
	Inter-organizational Relationships (N=27)	*Support and Delivery System (n =14)*	11 (79%)	2 (14%)	0 (0%)	6 (43%)	3 (21%)	5 (12%)	1 (7%)	12 (86%)	0 (0%)	1 (7%)
		Between Delivery Systems (n =20)	15 (75%)	5 (25%)	0 (0%)	9 (45%)	4 (20%)	7 (35%)	2 (10%)	18 (90%)	0 (0%)	0 (0%)
General Capacity	*Organizational Culture (N=45)*		37 (82%)	12 (27%)	1 (2%)	10 (22%)	25 (56%)	9 (20%)	2 (4%)	36 (80%)	2 (4%)	5 (11%)
	Organizational Climate (N=22)		14 (64%)	9 (41%)	1 (5%)	5 (23%)	12 (55%)	4 (18%)	0 (0%)	19 (86%)	2 (9%)	1 (5%)
	Organizational Innovativeness (N=8)		4 (50%)	6 (75%)	0 (0%)	3 (38%)	4 (50%)	1 (13%)	0 (0%)	6 (75%)	1 (13%)	1 (13%)
	Resource Utilization (N		9	2 (17%)	0	4	5 (4%)	3	0	10	0 (0%)	2

	Factor or Subcomponent	Evaluation Design						Innovation Rationale			
				Measurement Model							
		Case Study	Comparison Groups	Pretest Only	Post-test Only	Pre-Post	Indeter.	None	Included	Mandated	Both
	=12)	(75%)		(0%)	(33%)		(25%)	(0%)	(83%)		(17%)
	Leadership (N =49)	37 (76%)	15 (31%)	0 (0%)	20 (41%)	21 (43%)	8 (16%)	0 (0%)	43 (88%)	1 (2%)	5 (10%)
	Organizational Structure (N =49)	38 (78%)	11 (22%)	2 (4%)	14 (29%)	25 (51%)	8 (29%)	1 (2%)	40 (82%)	2 (4%)	6 (12%)
	Staff Capacity (N =28)	19 (68%)	10 (36%)	0 (0%)	7 (25%)	18 (34%)	3 (11%)	2 (7%)	21 (75%)	2 (7%)	3 (11%)
Total (N =173)		114 (66%)	49 (28%)	5 (3%)	57 (33%)	81 (47%)	30 (17%)	7 (4%)	141 (83%)	6 (3%)	19 (11%)

Table 7.7 reports how elements of implementation quality (Meyers et al., 2012) were distributed in each factor or subcomponent. One hundred twenty (69%) articles tracked at least one indicator of implementation quality of the support technique that was used. An index score was created for Implementation Quality (IQ) by summing each element of implementation quality (i.e., fidelity, dosage, participant responsiveness, differentiation, reach, adaptation) that was present in a study into a single number. The possible scores on this index ranged from 0 to 6. However, the maximum score obtained was five, obtained by three studies (Ganz et al., 2009; Bonell et al., 2010; Leon et al., 2013), meaning that five of the six elements of implementation quality were present. For all studies included in the analyses, the average implementation quality was 1.28 (1.22), meaning that the average study only reported slightly more than one component of implementation quality. This statistic will also be reported for each subsection.

Table 7.7. Frequency that Elements of Implementation Quality appeared for each Factor that Influences Motivation and Subcomponent of either Innovation-Specific or General Capacity

		Fidelity	Dosage	Participant Responsive-ness	Differ-entiation	Reach	Adaptation	Average IQ (SD)
Motivation	*Relative Advantage (N =31)*	3 (9.6%)	14 (45%)	10 (32%)	3 (10%)	6 (19%)	11 (35%)	1.52 (1.52)
	Compatibility (N =41)	7 (18%)	17 (41%)	13 (32%)	2 (4.9%)	6 (15%)	13 (32%)	1.41 (1.50)
	Complexity (N=24)	3 (13%)	9 (38%)	14 (58%)	2 (8.3%)	2 (8.3%)	10 (42%)	1.67 (1.43)
	Trialability (N=17)	1 (11%)	10 (59%)	6 (35%)	0 (0%)	3 (18%)	3 (18%)	1.35 (0.93)
	Observability (N=20)	0 (0%)	5 (25%)	9 (45%)	2 (10%)	2 (10%)	2 (10%)	1.00 (0.79)
	Priority (N =38)	6 (18%)	16 (42%)	15 (39%)	3 (8.0%)	7 (18%)	11 (29%)	1.53 (1.45)
Innovation-specific capacity	*Knowledge, Skills, and Abilities (N =91)*	9 (10%)	42 (46%)	30 (33%)	3 (3.3%)	17 (19%)	21 (23%)	1.34 (1.22)
	Champion (N = 30)	7 (23%)	13 (43%)	12 (40%)	3 (10%)	8 (27%)	11 (37%)	1.80 (1.61)
	Implementation Climate Supports (N = 39)	7 (18%)	16 (41%)	17 (46%)	5 (19%)	7 (18%)	15 (39%)	1.64 (1.51)
	Inter-organizational Relationships (N=27) *Support and Delivery System (n =14)*	0 (0%)	2 (14%)	5 (36%)	2 (14%)	1 (7.0%)	4 (29%)	1.00 (0.96)

		Between Delivery Systems(n =20)	1 (5.0%)	9 (45%)	8 (40%)	1 (5.0%)	2 (10%)	9 (45%)	1.50 (1.40)
General Capacity	*Organizational Culture (N=45)*		4 (8.9%)	10 (22%)	18 (40%)	3 (7%)	7 (16%)	19 (42%)	1.36 (1.35)
	Organizational Climate (N=22)		1 (4.5%)	8 (36%)	16 (73%)	2 (9.1%)	4 (18%)	6 (27%)	1.68 (1.29)
	Organizational Innovativeness (N=8)		1 (13%)	1 (13%)	4 (50%)	1 (13%)	1 (13%)	2 (25%)	1.25 (1.83)
	Resource Utilization (N =12)		1 (8.3%)	3 (25%)	2 (17%)	0 (0%)	3 (25%)	5 (42%)	1.17 (1.40)
	Leadership (N =49)		2 (4.1%)	25 (51%)	22 (45%)	3 (6%)	9 (18%)	15 (31%)	1.55 (1.31)
	Organizational Structure (N =49)		2 (4.1%)	17 (35%)	15 (31%)	1 (2%)	11 (24%)	18 (37%)	1.33 (1.39)
	Staff Capacity (N =28)		3 (11%)	10 (46%)	15 (54%)	0 (0%)	8 (29%)	9 (61%)	1.61 (1.45)
Total (N =173)			14 (8.1%)	64 (37%)	64 (37%)	6 (3.5%)	27 (16%)	47 (27%)	1.28 (1.22)

Note: N =7 articles dealt with both types of interorganizational relationships

Research questions.

1. How are the subcomponents of readiness defined across content areas? What, if any, evidence supports the existence of subcomponents of readiness that were not mentioned/addressed in the introduction?
2. What are the best methods to build the factors that influence the motivational component of readiness?
3. What are the best methods to build the innovation-specific subcomponents of readiness?
4. What are the best methods to build the general capacity subcomponents of readiness?

This section is structured in the following way. First, the different ways that the factors or subcomponents were discussed will be identified (question 1). For questions 2-4, the evidence for changing the specific factor or subcomponent using certain techniques will be reviewed both quantitatively and qualitatively for each of the proposed factors that influence motivation and subcomponents of innovation-specific capacities and general capacities. Methodological characteristics of the studies are reported for each factor or subcomponent.

At the conclusion of each section, the evidence for changing either a factor or subcomponent is qualitatively synthesized and assigned into a category using a version of Greenhalgh et al.'s (2004) modified World Health Organization Health Evidence Network criteria (WHO-HEN) (Øvertveit, 2003) (see Table 7.8), which was adapted to include information about the support system evaluation design.

Table 7.8: Levels of evidence

Level of evidence	Description	Evaluation requirement
Strong direct evidence:	Consistent findings in two or more empirical studies of appropriate design and high scientific quality undertaken in health service organizations (include both behavioral health and health care)	Requires participant randomization
Moderate direct evidence	Consistent findings in two or more empirical studies of less appropriate design and/or of acceptable scientific quality undertaken in health service organizations	Requires comparison group
Limited evidence	Only one study of appropriate design and acceptable quality available, or inconsistent findings in several studies.	Requires quantitative measurement
Minimal evidence	At least one study of minimal quality available. This includes practitioner self-reports, single organization case-studies, and other qualitative reports	
No evidence:	No relevant study found	

Following this lengthy section, I will then turn to questions five and six:

5. Do tailored support system activities (i.e., those that address specific components of readiness) lead to better innovation outcomes than those that do not?
6. When is organizational readiness too low to be responsive to tailored Support System activities?

Motivation.

This section reviews the evidence for support system strategies for each factor that influences motivation.

Relative Advantage. Definitions of relative advantage were reasonably consistent across articles. These definitions included the value of specified innovation over an alternative innovation (Carlfjord, Lindberg, Bendtsen, Nilsen, & Andersson,

2010; Diker, Cunningham-Sabo, Bachman, Stacey, Waters, et al., 2013; Erwin, Hamilton, Welch, & Hinds, 2006; Foley, Pockey, Helme, Song, Steward, et al., 2012; Gordon, Jones, Goshman, Foley, & Bland, 2000; Leon, Lewin, & Matthews, 2013; Rikli, Huizinga, Schafer, Atwater, Coker et al., 2009; Smith, Murphy, Phillips, Paulsen, Vislosky et al., 2009; Stenger, Montgomery, Briesemeister, 2007), a explication about how the innovation will benefit the employee (Grass & Worsley, 2001; Ramos & Ferreira-Pinto, 2002), and an *a priori* belief in the efficacy of the innovation (Meredith, Yano, Hickey, & Sherman, 2005).

No studies used random assignment procedures to control for influences on relative advantage. No studies attempted to quantitatively measure relative advantage as an independent variable. While some studies included item-level attempts to measure relative advantage (e.g. Hammond, Gresch, & Vitale, 2011; Meredith et al., 2005; Varnell, Haas, Duke, & Hudson, 2007), this information was not disaggregated from global measures of "provider attitudes," and "buy-in," when it was reported. For instance, in a nutritional education study by Diker et al (2013), training and TA led to gains in "motivation to deliver" a cooking intervention at nine months post-training, but they did not report relative advantage as a specific variable.

Twenty studies reported changes in relative advantage qualitatively. Multiple support system activities were used to address relative advantage. Carlfjord et al (2010) used a random assignment design to providing training and TA that specifically targeted relative advantage versus a "common sense" support method. However, the way the authors reported readiness outcomes (i.e. qualitative impressions of relative advantage,

both positive and negative, for both groups) did not allow for distinctions about how the targeted group was distinct from the control group.

Other groups offered incentives when an innovation was used by either individuals (Bassett, Vollman, Brandwene, & Murray, 2013; Mayer et al., 2011; Paarlberg & Perry, 2007) or organizations (Bonnell, Sorhaido, Strange, Wiggins, Allen, et al., 2010). For example, in Paarlberg and Perry (2007) employment interviews indicated that incentives contributed to increased use of the innovation when these incentives were consistent with preexisting employee values. However, in Mohammadi, Mohammadi, Hedge, Zohrabi, and Ameli, (2007) incentives that were given to teams (i.e. the organizational level) for participating in QI projects did not impact changes in qualitative assessment of individual-level relative advantage of a medical process.

In two studies, relative advantage was addressed by removing perceptions of punishments resulting from participating in QI activities in a hospital setting (Bagian, Lee, Gosbee, DeRosier, Stalhandske, et al., 2001; Brush, Balakrishnan, Brough, Hartman, Hines et al., 2005). In both studies, this strategy led to an increase in how often safety violations were reported. This increase was accomplished by also targeting the hospitals' organizational culture, and will be discussed later under the special case of "safety culture." Lekan-Rutledge (2000) provided a list of suggested TA strategies to build relative advantage for an innovation to assist urine voiding in a geriatric population, but did not report whether these strategies were actually used.

Methodological Characteristics of Included Studies. Of the 31 studies that addressed relative advantage, sixty-five percent (N = 20) of the studies were single organization case studies. Thirteen studies had pre-post measurement designs, 13 had

posttest only designs, one study has a pretest only design, and four had indeterminate measurement designs. Only eight studies used comparison groups. Twenty-one studies reported some type of innovation rationale, three studies mandated innovation use, and five studies reported both criteria. The average implementation quality of the support system strategies on relative advantage in these studies was 1.52 (*SD* =1.52).

The evidence reviewed above from the qualitative case studies indicates that relative advantage can be impacted by support system activities. Due to the current lack of quantitative models to measure relative advantage for an innovation, there is currently *minimal* evidence that support techniques can change perceived relative advantage for an innovation.

Compatibility. There was variability in how broadly compatibility was defined. This included adaptability of the innovation (Bonvin, Barral, Kakebeeke, Kriemler, Longchamp, et al., 2013; Carlfjord et al., 2010; Edwards, Moloney, Jacko, & Sainfort, 2008; Foley et al., 2012; Ganz, Yano, Saliba, & Shekelle, 2009; Harshbarger, Simmons, Coelho, Sloop, & Collins, 2006; Leon et al., 2013; Sipilä, Ketola, Tala, & Kumpusalo, 2008; Stevens, Lancer, Smith, Allen, McGhee, 2009), conceptual overlap between the innovation and the organizational mission (Keats, 2009; Vatieri, Gopaul, Brown, & Hostetler, 1994), the time commitment required (Erwin et al., 2006), the relevance, efficiency, and acceptability of the innovation (Lyon, Charlesworth-Attie, Vander Stoep, & McCauley, 2011; Meredith et al., 2005), feasibility of the innovation (Bonnel et al., 2010; Maffli, Schaaf, Jordan, & Güttinger, 2008), the cultural salience of the innovation (Yancey, Lewis, Guinyard, Sloane, Nascimento, et al., 2006), and the overlap with the

organization's current capacities (Shah, Noble, Umulisa, Dushimiyimana, Bukhman, et al., 2008; Welton & Jarr, 1997).

There was no quantitative assessment of the perceived compatibility of an innovation. One study used random assignment procedures to control for influences on compatibility (Bonvin et al., 2013). Thirty-eight studies assessed changes in compatibility qualitatively. Multiple studies used training (N = 27) and technical assistance (N = 16) to address compatibility of an innovation by targeting the fit of the innovation with those who would implement it. This included addressing individual-level values (Diker et al., 2013; Kirsh, Schaub, & Aron, 2009) and organizational culture (Diker et al., 2013; Edmundson, 2012; Kuper, Gold, Callow, Quraishi, King, et al., 2011; Lyon et al., 2011). Diker et al. (2013) illustrated how these individual and organizational levels were addressed by specifically providing training on how a school-based nutritional program complemented the school curriculum and the context of the local community. Post-training, one participant reflected on the innovation, saying, "This is origin, history, geography, the universal connectiveness [sic] of how we get food, historically and currently. I was so happy to see that," (as quoted in Diker et al., 2013). Harshbarger et al (2005) tracked innovation changes that made an already culturally-tailored HIV prevention program more appealing to target populations during implementation. They stressed the importance of TA in maintaining the innovation's implementation quality; "Without TA and training, prevention providers may unintentionally risk altering intervention effectiveness by modifying interventions in ways that either eliminate or change core elements," (Harshbarger et al., 2005).

Two studies used tools (i.e., reference guides) to address compatibility by standardizing and clarifying the innovation (Brown, 2009; Hall & Eccles, 2000). In some studies, compatibility was addressed as part of the innovation selection process before the provision of support systems activities (e.g. Edmundson, 2012; Lyon el al., 2011). Bonnel et al. (2012) and Edwards et al. (2008) gathered formative feedback from innovation users during a pilot period to make incremental changes to increase the innovation's compatibility.

In some studies, addressing compatibility of an innovation negatively impacted implementation outcomes, particularly fidelity (Bonvin et al., 2013; Campanaro, 2008; Flaschberger, Nitsch, & Waldherr, 2012; Hall & Eccles, 2000). A randomized control trial by Bonvin et al. (2013) allowed organizations to determine implementation policies for an innovation in an effort to increase compatibility. However, 1) subsequent poor implementation contributed to null differences between the intervention and control groups, and, 2) compatibility was not quantitatively measured. Similarly, Flaschberger et al (2012) addressed compatibility of a health promotion intervention by allowing a school to determine how participation in the implementation would be structured. This contributed to a low priority to support implementation of the intervention.

Methodological Characteristics of Included Studies. In the literature (N = 41) on support system influences on compatibility, sixty-three percent (N = 26) of the articles were case studies. Thirteen studies had pre-post measurement designs, 17 had posttest only designs, six had a pretest only design, and eight had indeterminate measurement designs. Sixteen studies used comparison groups, with one using random assignment (Bonvin et al., 2013). Thirty-three studies reported some type of innovation rationale and

six studies mandated innovation use. The average implementation quality of the support system strategy in the studies on compatibility was 1.41 (*SD* =1.50).

While there is some *minimal* evidence that support techniques can change compatibility of an innovation, there is conflicting evidence about how appropriate support activities to increase compatibility given the variation in implementation outcomes. Quantitative measurement of compatibility is currently underdeveloped.

Complexity. Complexity was defined as difficulty of use (Carlfjord et al., 2010; Diker et al., 2013), degree of simplicity (Ganz et al., 2009; Lyon et al., 2011; Siddiqi, Young, Cheater, & Harding, 2008), the number of components in an intervention (and the interaction of components) and the actions required from users (Brady, Stott, Norrie, Chalmers, St. George et al. 2011; Herring, Caldwell, & Jackson, 2010), and potential sources of unnecessary variation (Hunter & Segrott, 2010).

No studies directly measured changes in perceived complexity quantitatively. Brady, Stott, Norrie, Chalmers, St. George, et al. (2011) attempted to quantitatively measure complexity by breaking an oral health intervention down into 25 components and measuring changes in awareness of these components following a staff training. However, this type of measurement model only measures changes in knowledge (as an innovation-specific capacity), not perceived complexity of the intervention. Although Carlfjord et al (2010) used a random assignment procedure, as noted earlier they did not provide sufficient readiness outcome information about how complexity changed following targeted training and TA between conditions.

Twenty-one studies attempted to measure changes in complexity qualitatively. QI was used in six studies to identify the necessary innovation components versus those that

contributed to unwanted variation in outcomes (Hardy, Wertheim, Bohan, Quezada, & Henley, 2013; Vioral & Kennihan, 2012; Young & Wachter, 2009). Vos , Dücker, Wagner, & van Merode (2010) reported that QI did not impact perceived complexity and speculated that not adapting QI strategies for different organizations led to null results. Maffli et al (2008) addressed the perceived complexity of a tool by soliciting user feedback to optimize the tool's organization. Training has a positive impact in reducing complexity when used prior to implementation (Diker et al., 2013; Ganz et al., 2009; Kirsh et al., 2009; Lyon et al., 2011). Lekan-Rutledge (2000) suggested using training and TA to address complexity by simulating use of an innovation but did not provide evidence of the effectiveness of this technique.

Using tools to standardize sources of perceived complexity did not consistently lead to readiness outcomes. Herring et al. (2010) used an adapted checklist to structure and standardize medical rounds, reporting that it useful to manage demands of patients and professionals. Hunter and Segrott (2010) implemented a standardized child birth procedure through the use of a *clinical pathway*. Doctors qualitatively reported that using the pathway did not enhance patient safety because the pathway did not accurately account for the perceived complexity of childbirth (Hunter & Segrott, 2010).

Methodological Characteristics of Included Studies. Of the 24 articles that addressed complexity 58% ($N = 14$) were case studies. Nine studies had pre-post measurement designs, nine had posttest only designs, two had a pretest only design, and four had indeterminate measurement designs. Six studies used comparison groups. Twenty-two studies reported some type of innovation rationale, two studies mandated

use, and one study had both criteria. The average implementation quality of the support system strategy in the studies on complexity was 1.67 (*SD* =1.43).

Qualitative studies indicate the complexity can be impacted by support system activities. However, the lack of stronger evaluation designs and quantitative measurement indicate that there is currently only anecdotal and *minimal* evidence at this time.

Trialability. Trialability was very consistently defined across all studies: the opportunity to test use of the innovation (Carlfjord et al., 2010; Diker et al., 2013; Donald, Dower, & Bush, 2013; Foley et al,.2012; Peltzer, Mataseke, Azwihangwisi, Babor, 2008; Rikli et al., 2009; Schleyer, Teasley, & Bhatnagar, 2005).

There was no quantitative measurement of trialability. No studies directly addressed how to make an innovation "more trialable." The techniques that were used to promote trialability provided different opportunities to test the innovation. Thirteen studies addressed trialability within a training setting (e.g. Diker et al., 2013). Of these, 61%, (*N*= 8) paired training with follow up and ongoing TA (Carlfjord et al., 2010; Donald et al., 2013; Lekan-Rutledge, 2000; Richardson, Bromirski, & Hayden, 2012; Rikli et al., 2009; Shah et al., 2008; Stenger et al., 2007). Three studies addressed trialability through QI by iteratively providing opportunities to test potential improvements to the either the innovation (Edwards, et al., 2008; Welton & Jarr, 2005) or the implementation plan (Rikli et al., 2009)

Methodological Characteristics of Included Studies. In the literature on support systems influences on trialability (*N* = 17), forty-seven percent (*N* = 8) of the articles were case studies. Eight studies had pre-post measurement designs, six had posttest only

designs, one had a pretest only design, and two had indeterminate measurement designs. Seven studies used comparison groups. Fourteen studies reported some type of innovation rationale, one study mandated use, and two studies had both criteria. The average implementation quality of the support system strategy in the studies on trialability was 1.35 (*SD* =0.93).

There is *no* current evidence that trialability can be changed as a result of support system activities. Trialability appears to be a dichotomous variable that is either present or not present. The implications of how this factor is constructed will be addressed in the discussion section.

Observability. Observability was consistently defined across studies. This included ongoing data reporting from the innovation (Bassett, Vollman, Brandwene, & Murray, 2012; Cinquini & Vainieri, 2008; Cox, Wilcock, & Young, 1999; Schwoebel & Creely, 2010; Varughese, Hagerman, & Townsend, 2013; Yi, Wray, Jones, Bass, Nishioka et al., 2013), specifically as the result of a feedback system (Bagian et al., 2001; Carlfjord et al.,2010; Diker et al., 2013; LeKan-Rutledge, 2000; Peltzer et al., 2008; Petruzzi, 2010; Ring, 2010; Yates, Hochman, Sayles, Stockmeier, 2004), perceived effectiveness (Cramm, Strating, Bal, Nieboer, 2013), ongoing organizational visibility (Gordon et al., 2000; Shaha, Brodsky, Leonard, Cimino, McDougal et al., 2005), and the ability to use outcome measurement techniques tied to the innovation (Vos et al., 2010).

No studies used comparison groups to control for influences on observability independently. Cramm et al (2013) measured observability quantitatively using a four-item scale comparing different QI teams across multiple organizations longitudinally. Participating in a QI collaborative lead to improved observability scores on the specific

QI projects even after controlling for the influence of team in a multilevel analysis (N = 208; β = 0.07; SE = 0.02; $p < 0.01$).

Fifteen studies measured changes in observability qualitatively following support system activities. TA was used following training in six studies, specifically by providing observability information to participants and leadership on innovation outcomes (Bassett et al., 2012; Carlfjord et al., 2010; Cinquini & Vainieri, 2008; Lekan-Rutledge, 2000; Peltzer et al., 2008; Varughese et al., 2013). Cinquini & Vainieri (2008) reported that in one site implementing a medical measurement system, "It is highly motivating to be able to measure the output of your own work (especially of teamwork)," Two studies reported no changes in observability following training alone (Diker et al., 2013; Kirsh et al., 2009).

Ten studies addressed observability during QI processes. In five of these case studies, QI results were passively disseminated (e.g. posted on walls so all team members could see) so that participants could note changes that resulted from the QI project (Bagian et al., 2001; Cox et al., 1999; Schwoebel & Creely, 2010; Gordon et al., 2000; Yates et al., 2004). However, when data was presented to users in a confusing manner, it did not impact preserved observability (Ring, 2010). Similarly, a QA-only support strategy was ineffective because end users reported that the data was too complex to interpret and use (Yi et al., 2013).

Methodological Characteristics of Included Studies. Fifty-five percent (N = 11) of the articles were case studies. Eleven studies had pre-post measurement designs, seven had posttest only designs, and two had indeterminate measurement designs. There were no studies with comparison groups. Seventeen studies reported some type of

innovation rationale, one study mandated use, and two studies had both criteria. The average implementation quality of the support system strategy in the studies on observability was 1.00 (*SD* = 0.79).

Due to the presence of quantitative models and multiple case studies, there appears to be *limited* evidence the observability can be impacted by support systems activities. However, these quantitative measurement models are not in wide use at this time.

Priority. Priority was defined as importance of the innovation (Alhatmi, 2011; Bagian et al., 2001; Cox et al., 1999; Ganz et al., 2009; Hall & Eccles, 2000; Leon et al., 2013; Mohammadi et al. 2007; Ring, 2001; Ross & Crumpler, 2007; Yates et al., 2004), in one instance following a seminal event (i.e. an organ transplant with mismatched blood types; Alton, Frush, Brandon, & Mericle, 2006), commitment to implement the innovation (Bassett et al., 2012; Eliopoulus, 2013), perceived organizational status of the innovation (Bohanon, Fenning, Carney, Minnis-Kim, Anderson-Harriss, et al., 2006; Richardson et al., 2012; Stenger et al., 2007; Thomas & Galla, 2012), professed leadership support for the innovation (Donald et al., 2013; Ganz et al., 2009; Hammond et al., 2011; Kennerly, Richter, Good, Compton, & Ballard, 2011; Meredith et al., 2005; Nehlin, Fredricksson, Grönbladh, & Jannson, 2012; Rask, Parmalee, Taylor, Green, Brown et al., 2007; Rikli et al., 2009; Rohrbach, Graham, & Hansen, 1993; Shurman & Lynch, 1994; Shaha et al., 2005), and perceived organizational support (McCormick, Mâsse, Cummings, & Burke, 1999).

A distinction arose between support system activities to raise the priority of an innovation versus activities to set priorities. Setting priorities generally occurred as part

as a needs assessment process (e.g. Alexander, Memiah, Henley, Kaiza-Kangalawe, Shumbusho, et al., 2012; Robinson, Williams, Dickinson, Freeman, & Rumbold, 2012). This dissertation focuses on the activities to enhance the innovation's priority. Articles on priority-setting were not retained for the analyses unless another component of readiness was addressed.

The quantitative measurement of priority was more developed than other factors that influence motivation. In a comparison group study on an educational intervention (Rohrbach et al., 1993), principals were trained on the importance of an intervention. The staff who ultimately implemented the intervention reported greater perceived support and encouragement for the intervention than the comparison group ($t(58) = 2.98$; $p < 0.01$) at the end of the school year[2]. Bohanon et al. (2008) used items within a survey to assess the priority of effective positive behavior supports (innovation). After initial training and TA, priority for the innovation changed positively from baseline ($U = 892.5$, $T = 3238.5$, $p < 0.001$).

Following training in patient safety culture, Thomas & Galla (2013) reported a positive change in mean of 10.9 points on a scale measuring perceived expectations regarding safety behaviors though did not report statistical significance level of this change. McCormick et al. (1999) found no changes in perceived priority of a skin cancer prevention intervention following training for nurses (Friedman two-way ANOVA (Fr) = 2.80, $p = 0.25$) and doctors ($Fr = 2.00$; $p = 0.37$). Although a comparison group was used, there were no differences in changes between either group: nurses (Wilcoxon-

[2] This finding highlights the distinction between priority and the innovation-specific capacity *Implementation Climate Supports*. As discussed in the introduction, priority refers to the perceived status and support of the innovation within an organization, while *Implementation Climate Supports* refers to the actual structures, process, and resources that promote use of the innovation. Priority had significant correlation ($r\varphi = 0.32$, $p < 0.001$) with *Implementation Climate Supports.*

Mann-Whitney (W_x) = 4232.5; z = -0.90; p = 0.37; r = -0.09) or doctors (W_x = 3480.0, z =-1.52; p = 0.13; r = -0.15). This null result was attributed to "too many competing priorities in their practices," (McCormick et al., 1999). Hammond et al. (2011) reported posttest scores only in "intention to support," and "perceived buy-in," following an extended period of QI, and a noted that a longer term follow-up would be needed to determine whether or not these changes in priority would be sustained.

Thirty-four articles reported qualitative changes in priority. Training led to changes in perceived importance in priority in multiple studies (e.g. Alhatmi, 2011; Yates et al., 2011,) especially when leadership was involved in communicating the importance in the innovation (Bagian et al., 2001; Eliopoulus, 2013; Ganz et al., 2009; Gifford, Davies, Tourangeau, & Lefebre, 2011; Mohammadi et al., 2007). In two QI projects, priority was addressed by collectively agreeing on the goals and importance of a project (Cox et al., 1999; Kuper et al., 2011). Conversely, lack of agreement between users negatively impacted priority in one study (Vos et al., 2010).

Mandating participation in support system activities and innovation use was effective in increasing perceived priority of an innovation (Leon et al., 2013; Nehlin et al., 2012; Rask et al., 2007; Vioral & Kennihan, 2012). Priority was significantly correlated with relative advantage ($r\varphi$ = 0.19; $p < 0.05$) and often involved framing the innovation "not only as a requirement, but as a feasible and desirable way of improving [services]" (Leon et al., 2013). Several studies noted that priority was important to an implementation process, but not how it was priority was changed (Ross & Crumpler, 2007; Ring, 2001).

Methodological Characteristics of Included Studies. In the literature of support systems influences on priority (*N* = 38), sixty-eight percent (*N* = 26) of the articles were case studies. Twenty-one studies had pre-post measurement designs, 13 had posttest only designs, two had a pretest only design, and two had indeterminate measurement designs. Nine studies used comparison groups. Twenty-eight studies reported some type of innovation rationale, four studies mandated use, and five studies had both criteria. The average implementation quality of the support system strategy for influencing priority was 1.53 (*SD* = 1.45).

Although there are quantitative models assessing changes in priority following support system activities, the findings are inconsistent. As such, there is currently *limited* evidence that priority can be change.

Motivation Section Summary. Table 7.9 summarizes the evidence for using support system activities to promote change in the factors that influence motivation.

Table 7.9. Summary Evidence Table for Factors that Influence Motivation

	No Evidence	Minimal Evidence	Limited Evidence	Moderate Direct Evidence	Strong Direct Evidence
Relative Advantage		X			
Compatibility		X			
Complexity		X			
Trialability	X				
Observability			X		
Priority			X		

Innovation-Specific Capacity.

This section reviews the evidence for support system strategies changing each subcomponent of innovation-specific capacities.

Knowledge, Skills, and Abilities. *Knowledge, skills, and abilities (KSA*) was not used as a search term due to the potential for wide variability between studies. This is because each innovation has its own set of KSA. Therefore, the majority of the KSA findings reported in this section are from studies that identified KSA in conjunction with other readiness sub-components (N = 88), with five additional studies only focusing on innovation KSA. In all cases, KSA were framed in terms of specific innovation requirements (e.g. Anogianakis & Maglaverra, 2001; Gordon et al., 2010; Harding, Taylor, Leggat, & Wise, 2011; Leitz, 2008; Mayer, 2011; Mohammadi et al., 2007; Varnell et al., 2007; Yates et al., 2004).

KSA were measured quantitatively in only 11 studies (Auon, Shahid, Le, & Packer, 2012; Diker et al., 2013; Donald et al., 2013; Gordon et al., 2010; Green, Malsch, Kothari, Busse, & Brennan, 2012; Harding et al., 2011; Joly, Booth, Shaler, & Mittal, 2012; Kirsh et al., 2009; McCormick et al., 1999; Olson, Muchmore, & Lawrence, 2006; Ten Have, Nap, & Tulleken, 2013). In 91% of these studies (N = 10), positive changes in KSA were reported following training. Only three studies reported follow-up TA (Donald et al., 2013; Green et al., 2012; Joly et al., 2012). The study that did not report changes in KSA (Harding et al., 2011) noted low training dosage and low priority as possible explanation for null effects.

Two studies used randomized control designs (Cleland, Hall, Price, & Lee, 2007; McCormick et al., 1999). McCormick et al. (1999) reported between-group changes in knowledge as the results of training in how to screen for skin cancer (general skin knowledge; $F(1, 78) = 3.96$; $p = 0.051$); skin cancer prevention knowledge ($F(1, 78) = 5.97$; $p = 0.02$)), but not in abilities to screen for skin cancer ($F(1, 78) = 0.75$; $p = 0.39$).

Cleland et al. (2007) reported improvement in innovation outcomes, but not how KSA changed between groups.

Eighty-two articles reported qualitative changes in KSA. However, these reported changes were often vague and implicit, referring to how staff were trained in some particular intervention (e.g. Christianson, Pietz, Taylor, Woolley, & Knutson, 1997; Lietz, 2008; Ross & Crumpler, 2007; Sheth, Operario, Latham, & Sheoran, 2007; Sowden, Hill, Konstantinou, Khanna, Main, et al., 2012; Tachibana & Nelson-Peterson, 2007; Varnell et al., 2007). Training was the primary support strategy, used in 80% of these studies (N = 66). In the remaining studies, QI (Tachibana & Nelson-Peterson, 2007) and TA (Pascaris, Shields, & Wolf, 2008) were used to positively enhance KSA.

Methodological Characteristics of Included Studies. Sixty percent (N = 55) of the articles were case studies. Forty-four studies had pre-post measurement designs, 32 had posttest only designs, three had a pretest only design, and twelve had indeterminate measurement designs. Twenty-six studies used comparison groups, with two (McCormick et al., 1999; Cleland et al., 2007) using a randomized designs. Seventy-two studies reported some type of innovation rationale, four studies mandated use, and ten studies had both criteria. The average implementation quality of the support system strategy in the studies on KSA was 1.53 (SD =1.45).

Within the studies reviewed for this dissertation, there is *limited* evidence that KSA can be influenced by support system activities. However, this review only looked at KSA when it occurred in conjunction with other readiness components, and therefore they may not been the direct focus on the studies that were included.

Champions. Champions were defined as key opinion leaders (Alton et al., 2006; Bassett et al., 2012; Hall & Eccles, 2000; Hammond et al., 2011; Swain, Schubot, Thomas, Baker, Foldy, et al., 2004), a person(s) who models an innovation (Beeri, Dayan, Vigoda-Gadot, & Werner, 2013; Bonuel, Byers, & Gray-Becknell, 2009; Donald et al., 2013; Ellman, Rosenbaum, & Bia, 2007; Sipilä et al., 2008; Yates et al., 2004), innovation-specific project leaders (Ross, O'Tuathail, & Stubberfield, 2005; Yancey et al., 2006), and innovation advisors (Auon et al., 2012),

Only one study (Beeri et al., 2013) measured champions quantitatively by assessing perceptions of leadership specific to the innovation being studied. One year post-training and TA, they found no statistically significant differences in how champions were recognized by fellow staff (Beeri et al., 2013). While some studies controlled for the presence of a champion (e.g. Donald et al., 2013), no studies controlled for influences on champion development. A case study by Foley et al. (2012) qualitatively compared an appointed versus a volunteer champion for a tobacco cessation program. The appointed champion was better able to integrate organizational support (i.e. implementation climate), but the volunteer champion was better able to develop innovation-specific capacity for the innovation. No other studies measured changes in champion behaviors.

This dissertation made no assumptions or hypotheses about the sequence in which the components of readiness had to be in place and introduced. However, the literature on champions often cited them as a necessary precursor for other support activities. The recruitment process for champions varied. Some were selected for training at the beginning of the innovation (Mayer et al., 2011; Rutland et al., 2009) or appointed to oversee implementation (Donald et al., 2013; Kuper et al., 2011; Ouslander, Perloe,

Givens, Kluge, Rask et al., 2007). In two cases, the champions volunteered before implementation began (Auon et al., 2012; Bonuel et al., 2009). In four studies, champions emerged organically, either following a training (Radke et al., 2011; Sables-Baus, & Zuk, 2000; Yates et al., 2006) or during a QI process (Siddiqi et al., 2008; Swain et al., 2004). Beeri et al (2013) found that having a champion in an ethics program significantly and positively predicted implementation climate supports and general organization climate. Finally, Leon et al. (2013) reported that champions were used to address factors that influence motivation among the staff.

Methodological Characteristics of Included Studies. In the literature of support systems influences on champions (N = 30), 63% (N = 19) of the articles were case studies. Twelve studies had pre-post measurement designs, 13 had posttest only designs, one had a pretest-only design, and four had indeterminate measurement designs. Ten studies used comparison groups. Twenty-two studies reported some type of innovation rationale, four studies mandated use, and three studies had both criteria. The average implementation quality of the support system strategy in the studies on champions was 1.80 (SD = 1.61).

At this time, there is *no* evidence that champion development can be impacted or changed by support system activities. However, the presence of a champion is similar to *trialability* in that it is treated as a binary condition within the implementation literature. Implications for this finding will be addressed in the discussion section.

Implementation Climate Supports. Implementation Climate Supports were not as precisely defined as other innovation-specific subcomponents. Descriptions included tangible organizational supports (Cramm et al., 2013; Green et al., 2012; Mayer et al.,

2011; Naylor, Macdonald, Zebedee, Reed & McKay, 2006; Rozenbaum, Brezis, & Porat, 2013; Sables-Baus & Zuk, 2012; Stenger et al., 2007; Talaat, Kandeel, Rasslan, Hajjeh, Hallaj et al., 2006; Thomas & Galla, 2012; Tyler, Taylor-Seehafer & Murphy-Smith, 2004), leadership support dedicated to using the innovation (Donald et al., 2013; Ellman et al., 2007; Gifford et al., 2011; Leon et al., 2013; Lynch & Schurman, 1994; Ouslander et al., 2009; Philliber & Nolte, 2008; Richardson et al., 2012; Wick, Hobson, Bennett, Demski, Maragakis et al., 2012; Yancey et al., 2006), organizational processes that were changed to support the innovation (Bassett et al., 2012; Bonuel et al., 2009; Brady et al., 2011; Douglass & Klerman, 2012), and specific staff dedicated to innovation (Foley et al., 2012; Rask et al., 2007; Rikli et al., 2009).

No studies used randomization to control for influence on implementation climate supports, though some studies randomized implementation climate supports as part of the treatment condition (Carlfjord et al., 2010; Kolko, Baumann, Herschell, Hart, Holden et al., 2012; Naylor et al., 2006; Rask et al., 2007). Implementation climate supports were assessed quantitatively in four studies. Two studies used the Agency for Healthcare Research and Quality's (AHRQ) Hospital Survey on Patient Safety Culture (HSOPSC) tool, but reported their results in dissimilar ways (Mayer et al., 2011; Thomas & Galla, 2012). Training led to improved team supports for a safety intervention at one month follow-up ($t(1,97) = -6.20$; $p < 0.001$) and 12-month follow-up ($t(1,85) = -6.2$; $p < 0.001$) (Mayer et al., 2011). Training also contributed to a positive change in how supervisors promoted a safety intervention in a hospital (+10.9 change in mean on the scale of *Supervision expectation and actions promoting patient safety*). Although the authors

qualitatively labeled this change as an "area of strength," statistical significance was not reported (Thomas & Galla, 2012).

Joly et al. (2012) evaluated a multi-state learning collaborative (MLC) to improve the ability of local public health department to conduct QI projects. The techniques the MLC used to improve QI included training and TA (P. Russo, personal communication, 3/28/14). Public health departments that participated in the MLC did not show a change in implementation climate ($F(1, 404) = 1.71$, $p = 0.192$). However, within the MLC, agencies in the lowest quartile of QI capabilities (scoring the lowest on the assessment tool), showed the greatest change in implementation climate when compared to the other quartiles ($F(14,404)=122.23$; $p <.0001$). In Cramm et al. (2013), QI had a positive impact on organizational supports ($N = 208$; $\beta = 0.04$; $SE = 0.02$; $p < 0.05$) and specific managerial support ($N = 208$, $\beta = 0.13$; SE = 0.02; $p < 0.001$) for a QI project.

Twenty-three studies measured changes in implementation climate qualitatively. TA was used to facilitate additional innovation supports (Bassett et al., 2012; Bonuel et al., 2009; Carlfjord et al., 2010; Green et al., 2012; Philliber & Nolte, 2008). Cosmetic additions to organizations (e.g. the hanging of posters communicating characteristic on the innovation) were used to build implementation climate support in four studies (Alhatmi, 2011; Bassett et al., 2012; Foley et al., 2012; Yancey et al., 2006). QI was also used to identify specific staff that could be dedicated to support a safety intervention (Alhatmi, 2011).

In several studies, the support systems strategy addressed implementation climate before training (Naylor et al., 2006), TA (Rikli et al., 2009) or QI (Sables-Baus & Zuk, 2012) was provided. In ten studies, leadership was specified as a necessary precondition

for implementation climate supports. Leadership dedicated resources specifically for the innovation in multiple studies (Alton et al., 2006; Bonuel et al., 2009; Douglass & Klerman, 2012; Rikli et al., 2009; Wick et al., 2012). In Gifford et al. (2011) training helped leaders identify specific supports for a diabetes intervention and develop a plan to implement them. Leadership was also used to mandate participation in training and TA (Leon et al., 2013; Rask et al., 2007). In Verschoor et al. (2007), senior leadership used regular walkthroughs (i.e. QA) on the patient floor to non-punitively identify processes inconsistent with a safety initiative.

In Sables-Baus & Zuk (2012) changes in implementation climate were not sufficient to keep the intervention sustained. In Yancey et al., (2006), failure to have adequate implementation climate support for a 13-week health promotion training intervention was cited a reason for implementation failure (i.e., the innovation was not implemented with quality).

Methodological Characteristics of Included Studies. Sixty-two percent (N = 24) of the articles were case studies. Twenty-two studies had pre-post measurement designs, 13 had posttest only designs, and four had indeterminate measurement designs. Fifteen studies used comparison groups. Twenty-three studies reported some type of innovation rationale, three studies mandated use, and seven studies had both criteria. The average implementation quality of the support system strategy for implementation climate supports was 1.64 (SD = 1.51).

Because several studies measured implementation climate supports quantitatively, there is there is currently *limited* evidence that implementation climate can be changed as the result of support system activities.

Interorganizational Relationships. There are two types of interorganizational relationships that were examined in this dissertation, those between the Support and Delivery Systems and those between different organizations within the Delivery System. No studies used random assignment procedures to control for relationship-building supports strategies.

Support/Delivery System Relationships. Relationships between the Support and Delivery System were defined specifically and tangibly (e.g. organizational partnerships built around resources (Olson et al., 2006; Smith et al., 2009; Stevens et al., 2009). No studies measured Support/Delivery System relationships quantitatively. Although 14 articles addressed Support/Delivery system relationships, only five studies reported qualitatively changes in these relationships. In these studies, ongoing TA helped to enhance relationships between the Support and Delivery system (Bassett et al., 2012; Carlfjord et al., 2010; Ross et al., 2005; Pascaris, Shields, & Wolf, 2008; Philliber & Nolte, 2008). In the other nine studies, the relationship was identified as part of the support process, but changes in the relationship were not reported.

Delivery System Relationships. Delivery System relationships were either defined as partnerships maintained between similar organizations working toward similar goals (Donald et al., 2013; Maynard et al., 2012; Watson-Thompson, Woods, Schober, & Schultz, 2013) or in terms of quality of the relationships (e.g. openness and collaboration between agencies; Cambridge & Parkes, 2006).

Only one study measured relationships between Delivery Systems quantitatively (Donald et al., 2013). When comparing targeted TA to a training-only group in order to implement a suicide prevention program, the TA group saw improvements in number of

networks for liaison and support ($F(1, 249) = 5.90$; $p = 0.016$), for information exchange and training ($F(1, 249) = 12.89$; $p < 0.001$), and local planning (F1, 249) = 10.64; p = 0.001). No change was seen in number of organizational links for client referral ($F(1, 249) = 1.36$; $p < 0.245$) or case conferencing ($F(1, 249) = 0.022$; $p < 0.883$).

Qualitative outcomes for strategies to build relationships between delivery systems were addressed in 12 studies. Following a two-day training that targeted Delivery System relationships, Cambridge and Parkes (2006) reported key learning outcomes of:

> increased awareness of shared and linked policies and procedures, an appreciation of respective roles and responsibilities of the workers and different agencies involved, knowledge of the actions required to help achieve more effective inter-agency working and case co-ordination, [and] increased confidence in information sharing between interests and in managing confidentiality.

Learning collaboratives (also called communities of practice) were specifically used to build relationships between Delivery Systems in six studies (Cohen, Shore, & Mazade, 1991; Donald et al., 2013; Erwin et al. 2006; Hayes, Yousefi, Wallington, & Ginzburg, 2010; Linehan, 2010; Maynard et al., 2012). In Maynard et al., (2012) and Smith et al. (2009) "mentor" organizations paired with less developed organizations helped to facilitate enhanced use of QI. Following a two-year period of TA, Pascaris et al. (2008) found that staff reported increased quality of interorganizational relationships in the mental health system.

Methodological Characteristics of Included Studies. Eighty-one percent (N=22) of the articles were case studies. This was the second highest percentage of case studies

among all factors and subcomponents in the analysis. Six studies had pre-post measurement designs, 13 had posttest only designs, and eight had indeterminate measurement designs. Five studies used comparison groups. Twenty-three studies reported some type of innovation rationale, and one study additionally mandated use. The average implementation quality of the support system strategy inthe studies on interorganizational relationships was 1.14 (*SD* = 1.28). The average implementation quality of the support system strategy in the studies on support/delivery system relationships was 1.00 (*SD* = 0.96). The average implementation quality of the support system strategy in the studies on delivery system relationships was 1.50 (*SD* = 1.40).

Given the presence of quantitative comparison designs, there is *limited* evidence that relationships within Delivery System can be enhanced using support system activities. However, there is *minimal* evidence that relationship between the Support and Delivery System can be enhanced through Support System activities.

Innovation-Specific Capacity Section Summary. Table 7.8 summarizes the evidence for using support system activities to promote change in innovation specific capacities

Table 7.10. Summary Evidence Table for Innovation-Specific Capacities

	No Evidence	Minimal Evidence	Limited Evidence	Moderate Direct Evidence	Strong Direct Evidence
Knowledge, Skills, and Abilities			X		
Champion	X				
			X		
Implementation Climate Supports					
Interorgan- Support		X			

izational Relationships	*and Delivery System*	
	Between Delivery Systems	X

General Capacity

This section reviews the evidence for support system strategies for each subcomponent of general capacities.

Organizational Culture. Organizational Culture was defined as a group of people that express and interact through values, beliefs, goals, policies, operations, and uniform expectations on how things are done that are passed down to new members (Alhatmi, 2011; Bonell et al., 2010; Christianson, Pietz, Taylor, Woolley, & Knutson, 1997; Moore & Putnam, 2008; Pronovost, Weast, Rosenstein, Sexton, Holzmueller, et al., 2005; Schwoebal & Creely, 2010; Wallis & Kennedy, 2013). Other related definitions included how things are done in the organization (Beeri et al., 2013; Eliopoulos, 2013; Edmundson, 2012; Fox et al., 2012; Rikli et al., 2009; Swain et al., 200;), the mission and goals of the organization (Mayer et al., 2011; Varkey, Karlapudi, & Hensrud, 2008), organizational values (Chung & Nguyen, 2005; Sables-Baus & Zuk, 2012; Paarlberg & Perry, 2007; Tumerman & Carlson, 2012), a healthy work environment (Herbst, Swengros, & Kinney, 2010), a shared vision (Green et al., 2012) and the "community" of the organization (Naylor et al., 2006).

Safety culture was mentioned in 20 studies. It was specifically defined as all the activities and behaviors in a hospital that are relevant to patient safety (Alton, Mericle, & Brandon, 2006; Alton et al., 2006a; Edwards, Scott, Richardson, Espinoza, Sainfort et al.,

2008; Fudickar, Hörle, Wiltfang, & Bein, 2012; Leonard, Graham, & Bonacum, 2004; Thomas & Galla, 2013; Timmel, Kent, Holzmuetller, Paine, Schulick et al., 2010; Shaha et al., 2005; Verschoor et al., 2007). Safety-culture was split into two constructs for purposes of this dissertation: 1) *Organizational Culture*, or the expectations of how things were done in an organization, and 2) *Organizational Structure*, the organizational processes that allow for activities to take place. Splitting *safety culture* apart in this way allowed for it to be analyzed as two general capacities. Further, it was treated as general capacity because each of these capacities was fundamental to the operations of a hospital and translated across different innovations and conceptually consistent with quality aims for health care as articulated by the Institute of Medicine (2000). This section will focus solely on the first part of this construct and the support system strategies that were shown to influence organizational culture. The structural component of safety culture will be addressed in the section on organizational structure.

No studies used random assignment to control for influences on organizational culture. Though several studies assessed different groups, only one varied the support methods between groups. Using a delayed implementation design for a Comprehensive Unit-Based Safety Protocol (CUSP) that included training and QI in two hospital ICUs, Pronovost et al. (2005) found improvements in staff ratings on organizational expectations for safety. However, statistical significance of the changes was not reported.

Eight additional studies measured changes in organizational culture quantitatively, though using varying degrees of evaluation rigor. In response to a fifteen month QI intervention, Edwards et al. (2008) reported positive changes in safety

expectations using the AHRQ HSOPSC measure from baseline assessment (F = 7.40; p =0.008), degrees of freedom not reported). Green et al. (2012) found changes in one of two Head Start sites on a measure of shared vision (t(30) = -2.44, p <0.05) at the end of the second year of implementation.

Echoing findings discussed earlier, Joly et al., (2012) did not find differences in organizational culture for those who participated in TA and a learning collaborative (F(1, 404) =0.04; p = 0.84), but did find improvement among organizations that were initially rated as low in "QI maturity" (F(1, 404) = 120.07; p <0.001). Following training and TA, Beeri et al. (2013) found changes in expectations about how things "should" be done in an organization (t(108) =7.71; p <0.01), but not in how people behaved in the organization (t(108) =1.19; p =0.22). A TA and QI safety program led to a 6% increase in perceptions of hospital teamwork and 8% increase in perceived hospital safety (N = 28) from pretest measures, both changes reported as significant at p < 0.001 (Timmel et al., 2010). A QI program in an academic hospital (Varkey et al., 2008) led to statistically significant improvements in item-level measures of culture.

Chin, Pun, Ho, & Lau (2002) used QI to influence changes in a comprehensive model of organizational culture. They reported positive changes pre-post changes on a number of dimensions: teamwork (F(1, 198) = 11.45; p < 0.001), participation (F(1, 198) = 373.65; p < 0.001), corporate vision (F(1, 198) = 8.19; p <0.01), communications (F(1, 198) = 141.85; p <0.001), feedback (F(1, 198) = 8.63; p <0.01), and recognition (F(1, 198) = 36.49; p <0.001). Four additional dimensions (continuous improvement, measurement, empowerment, and training and career development) were not statistically significant. Using only posttest frequency count data following training and QI in safety

culture (Alhatmi, 2011), 16% of staff agreed that they had seen an unsafe practice, 38% believed that errors went unreported, and 71% agreed that the unit took time to identify errors. This was interpreted as an increase in safety culture. Mohammadi et al. (2007) reported that training and TA in patient safety led to 70% of respondents saying that the support strategies had a positive impact on culture.

Qualitative changes in organization culture were reported in 17 studies. A tool without any other support strategy was used to reframe an organization's values and mission in Clossey, Mehnert, & Silva (2011). Paarlberg and Perry (2007) used training and tools (in the form of organizational posters) to communicate organizational values throughout the U.S. Department of Defense. Positive changes in organizational philosophy toward service delivery were reported following TA (Pascaris et al., 2008) and following training (Herbst et al., 2010). Eliopoulos (2013) used both training and TA to target organizational culture but did not report any changes. In Hardy et al. (2013), QI was used to shape group efforts to form mission and vision statements for an organization at the beginning of a childhood obesity prevention program.

Alton et al. (2006a) and Shaha et al. (2005) reported that following QI for safety culture, there were qualitative increases in staff ownership over safe patient practices that because routinized. Training in safety culture had similar results (Alhatmi, 2011; Moore & Putman, 2008). QI led to improve expectations for error reporting in three studies (Alhatmi, 2011; Alton et al., 2006b; Verschoor et al., 2007). While QI had a similar focus on culture in Brush et al. (2005), culture was reported to be as a qualitative barrier to error reporting. Anonymous error reporting and blind chart review was used to sidestep, rather than change, perceived organizational mistrust.

Sables-Baus and Zuk (2012) interpreted the mainstreaming of a medical process that was being monitored by QA but without TA support to be evidence of a culture change in a neonatal intensive care unit (NICU). Moore and Putman (2008) similarly inferred a deeper cultural shift when an innovation was unofficially disseminated to staff that did not take part in training. The mainstreaming of an innovation was also reported as culture change in Chung & Nguyen (2005) and Fox et al. (2012).

Methodological Characteristics of Included Studies. Eighty-two percent (N = 37) of the studies on organizational culture were case studies. This was the highest percentage of case studies across all subcomponents and factors. Twenty-five studies had pre-post measurement designs, 10 had posttest only designs, one had a pre-test only design, and nine had indeterminate measurement designs. Twelve studies used comparison groups. Thirty-six studies reported some type of innovation rationale, two studies mandated use, and five studies had both criteria. The average implementation quality of the support system strategy in the studies on organizational culture was 1.36 (SD = 1.35).

Although the measurement of organizational culture is well developed, particularly in the medical field around the issue of safety, only one study of adequate comparative design could be found for this analysis (Pronovost et al., 2005). Because of the lack of strong evaluation models, there is currently *limited* evidence that organizational culture can be changed through support system activities.

Organizational Climate. Organizational Climate was defined as satisfaction with the work environment (Cox et al., 1999; Krugman & Smith, 2003; Leonard et al., 2004; Mohammadi et al., 2007; Varkey et al., 2008; Wallis & Kennedy, 2013), the

psychological impact of the work environment on well-being (Kolko et al., 2012), an organizational atmosphere of trust (Mayer et al., 2011; Williamson & Taylor, 2001), staff stress (Green et al., 2012), staff morale (Anogianakis & Maglaverra, 2000; Williams, Sims, Burkhead, & Ward, 2002), identification with an organization (Beeri et al., 2013), and comprehensively as "distinct areas of work life, consisting of perceived workload, control, reward, community, fairness, values, exhaustion, efficiency, and cynicism," (Cummings, Spiers, Sharlow, Germann, Yurtseven, et al., 2013).

Two studies used comparison groups to study influences on organization climate. Kolko et al. (2008) randomized practitioners into two different support strategies for a CBT intervention: 1) training plus TA or, 2) a training-as-usual condition. Climate was measured with the Organizational Social Climate Questionnaire (Glisson & Schoenwald, 2010). There were no significant differences between groups. At 6-month follow-up, there was a statistically significant decline in climate (β = -8.44, p <0.001) that did not vary between conditions. Williamson & Taylor (2001) measured the impact of a leadership training program on enhancing perceived trust within a nursing unit, finding "a statistically significant difference of 54% in the training group versus 21% in the comparison group." No other statistics were reported.

Seven additional studies measured climate quantitatively. Krugman & Smith (2003) found improvement in staff satisfaction (F(4, 1400) =4.81; p <0.001) over a five year period of implementing a charge nurse training program. Following training and QI over the course of two years, Timmel et al., (2010) reported statistically significant (p < 0.01) percent increases in job satisfaction (65% to 71%) and in perceptions of working conditions (48% to 55%).

Five quantitative studies did not report change in climate. In Mohammadi et al., (2007), only 35% of staff members who responded to a survey rated a hospital QI initiative as having a positive impact on satisfaction. Varkey et al. (2008) reported a non-significant change ($p = 0.60$) in an item level measure of climate two years following a QI process that targeted climate. Cummings et al. (2013) trained leadership on climate and found no significant change in how participants viewed the working environment, with the effects of the training wearing off over time cited as the reason for this null outcome. Wallis and Kennedy (2012) reporting no significant change ($p > 0.09$) in satisfaction with the team environment following training. Training and TA in organizational ethics had no impact on perceived commitment to the organization ($t(108) = -0.15$; *non-significant*) or perceived quality of work life ($t(108) = 1.10$, *non-significant*) (Beeri et al., 2012).

Seven studies reported qualitative outcomes. Green et al. (2012) reported improvements in climate following training and TA in both sites in a comparison study on child behavioral intervention. Leonard et al. (2004) reported improved satisfaction with the work environment following use of a tool to structure nursing communication strategies. Improved satisfaction was also reported following QI in two studies (Cox et al., 1999; Rikli et al. 2009). Training in an intervention to increase empathy led to reported improvements in nursing morale and, "a calmer work environment," (Herbst et al., 2010). Training in an onboard medical software led to reported improvements in maritime ship morale (Anogianakis & Maglaverra, 2000). However, a training and TA program was not successful in addressing climate in one site and was attributed to the

innovation being mandated (no factors that influence motivation were addressed) (Douglass & Klerman, 2012).

Other subcomponents of readiness had a positive impact on climate in five studies. Climate was reported qualitatively improved following efforts of a champion (Rikli et al., 2009), improved organization culture (Herbst et al., 2010) staff capacity (Green et al., 2012; Herbst et al., 2010), and leadership (Krugman & Smith, 2003; Williamson & Taylor, 2001).

Methodological Characteristics of Included Studies. Sixty percent (N = 14) of the articles were case studies. Twelve studies had pre-post measurement designs, five had posttest only designs, one had a pre-test only design, and four had indeterminate measurement designs. Nine studies used comparison groups. Nineteen studies reported some type of innovation rationale, two studies mandated use, and one study had both criteria. The average implementation quality of the support system strategy in the studies on organizational climate was 1.68 (SD = 1.29).

The literature on support system interventions to address organizational climate was more inconsistent than other subcomponents and factors. Because of these inconsistent findings across studies, there is currently *limited* evidence that support systems strategies can promote changes in organizational climate.

Organizational Innovativeness. Innovativeness was defined as general norms about change (Birdi, 2007; Carlfjord et al., 2010; Ganz et al., 2009; Wallis & Kennedy, 2012), organizational risk taking and tolerance of mistakes (Cramm et al., 2013), continuous organizational learning (Edwards, Scott, et al., 2008; Lynch & Schurman, 1994), and being able to apply QI techniques to other projects (Rikli et al., 2009).

Cramm et al. (2008) used a delayed implementation design to measure the impact of QI on innovativeness in several organizations. They found a small, but statistically significant decrease in innovativeness ($t(286) = -2.99$; $p < 0.001$). However, in Edwards, Scott et al. (2008) QI contributed to a significant increase in organizational learning (mean change 3.7 to 3.9; $p < 0.01$) in a community hospital, but not in an academic hospital ($p = 0.34$). Birdi (2007) compared three named workplace creativity training programs. Two of these, Business Beyond The Box (BTBB); ($r = 0.26$, $p < 0.001$) and Divergent Thinking (Lateral thinking; $r = 0.18$, $p < 0.001$) had significant associations with the ability to generate work ideas. BTBB was also positively associated with implementation of ideas at work ($r = 0.24$, $p < 0.01$). A training curriculum in critical thinking, *Six Thinking Hats* had no significant impact on creatively. Cramm et al. (2008) addressed the antecedents of innovativeness, finding that observability ($\beta = 0.07$, $SE = 0.02$; $p < 0.001$), implementation climate ($\beta = 0.04$, $SE = 0.02$; $p < 0.05$), and leadership ($\beta = 0.13$; $SE = 0.02$; $p < 0.001$) predicted innovativeness after controlling for the influence of organization.

Two studies reported changes qualitatively. Following training and TA, staff reported seeing the benefits of continued change in Carlfjord et al. (2010). In Rikli et al. (2009), the use of QI led staff to report that the QI process that was used could be generalized to other projects in a hospital.

Methodological Characteristics of Included Studies. Fifty percent ($N = 4$) of the articles were case studies. Three studies had pre-post measurement designs, three had posttest only designs, and one had an indeterminate measurement design. Six studies were in comparison groups designs. Six studies reported some type of innovation

rationale, one studies mandated use, and one study had both criteria. The average implementation quality of the support system strategy in the studies on organizational innovativeness was 1.25 (*SD* = 1.83).

The literature on organization innovativeness was smaller than any other factor or subcomponent. However, given the presence of quantitative group designs, there appears to be *moderate* evidence that innovativeness can be influenced by support system activities.

Resource Utilization. Resource Utilization was defined as cost-effectiveness in operations (Friedman, Rathod, Farias, Graham, Powell et al., 2010), skills at acquiring reimbursement (Phillips-Angeles, Song, Hannon, Celedonia, Stearns, et al., 2013), fund raising and proposal writing skill (Ramos & Ferreira-Pinto, 2002), the ability to conduct gap analyses to free up resources (Richardson et al., 2012), the ability to dedicate time for the innovation (Varughese et al., 2013), and ability to estimate cost and productivity (Leshikar, Pierce, Salcedo, Bola, & Galante, 2013).

No studies used random assignment to control for influences on the development of resource utilization capacities. Resource utilization was measured quantitatively in three studies. By using QI to review redundancy in a central venous line placement training program, Leshikar et al. (2012) were able to decrease supply costs by 90% and faculty costs by >$12,000. The rate of infections from central venous lines also subsequently dropped. In a similar program, Varughese et al. (2013) used QI *plan-do-study-act* cycles to help free up ten hours per week of nurse practitioner time to dedicate to a specific screening intervention. Training and TA helped staff develop fund-raising and proposal writing skills for AIDS prevention in 285 organizations (Ramos and

Ferreira-Pinto, 2002). However, while the number of organizations that were able to incorporate as non-profits institutions approached significance, (p = 0.062), a non-significant number of organizations were able to acquire additional funding sources (p =0.6502).

Five studies measured changes in resource utilization qualitatively. QI was used to examine areas of process redundancy, and subsequently non-committed resources were reinvested in the building infrastructure (Phillips, 2005; Richardson et al., 2012; Robinson et al., 2012). A training program for a preventative colon health intervention specifically addressed how to receive reimbursement for services (which were implemented in the first six months post-training) (Phillips-Angeles et al., 2013). TA was used to help develop support systems relationships to secure additional grant funding (Stevens et al., 2009).

Methodological Characteristics of Included Studies. Seventy-five percent (N = 9) of the articles were case studies. Five studies had pre-post measurement designs, four had posttest only designs, and three had indeterminate measurement designs. Two studies were found within comparison groups designs. Ten studies reported some type of innovation rationale with two studies mandating innovation use. The average implementation quality of the support system strategy in the studies on resource allocation was 1.17 (SD = 1.40).

Given that there is some quantitative evaluation on how to enhance resource allocation capacities, there is currently *limited* evidence that resource allocation can be influence by support system activities.

Leadership. Leadership was defined in terms of attributes that ideal leadership should possess and behaviors they should demonstrate. This included management skills (Austin, Regan, Samples, Schwartz, & Carnochan, 2011; Cohen et al., 1991; Gagliano, Ferris, Colton, Dubitzky, Hefferman et al., 2010; Kuo, Thyne, Chen, West, & Kamei, 2010; Matovu, Wanyenze, Mawemuko, Wamuyu-Maina, Bazeyo et al., 2011; Omoike, Stratton, Brooks, Ohlson, & Storfjell, 2011; Ten Have, Nap, & Tulleken, 2013), relationship skills (Cummings et al., 2013; Grass & Worsley, 2001; Lew, Martinez, Soto, & Baezconde-Garbanati, 2011; Tumerman & Hedberg Carlson, 2012; Wallis & Kennedy, 2012) , communication skills (Ten Have et al., 2013) and community-building skills (Austin et al., 2011; Gagliano et al., 2010; Kuo et al. 2010; Lew, Martinez, Soto, & Baezconde-Garbanati, 2011; Matovu et al., 2011).

Additionally, six studies defined leadership as the capacity to engage others within an organization to use an innovation (Alleyne & Jumaa, 2007; Bonuel et al., 2009; Cramm et al., 2013; Mohammadi et al., 2007; Shekleton, Preston, & Good, 2010; Wick et al., 2012). Three studies used a specific leadership development framework, the Kouzes and Posner model, which includes five key domains: ability to challenge the process, inspire a shared vision, enable others to act, model the way, and encourage the heart (Crofts, 2006; Cummings et al., 2013; Krugman & Smith, 2003). However, these three studies did not report changes in leadership in similar ways.

There were no studies that used random assignment to control for influences on leadership development. Leadership was measured quantitatively in six studies. Charge nurse training (Krugman & Smith, 2003), led to posttest improvements in three of the Kouzes and Posner dimensions; challenging the process ($t(56) = -3.18$, $p = 0.002$),

inspiring a shared vision ($t(56) = -2.26$, $p = 0.02$) and modeling ($t(56) = -3.18$, $p = 0.002$). They reported declines in two dimensions: enabling others to act ($t(56) = 2.25$, $p = 0.01$) and encouraging the heart ($t(56) = 2.35$, $p = 0.01$). However, this study was weakened by a poor respondent rate and turnover, with only 28% of the total number of nurses returning measures. Cummings et al. (2013) used training to develop leadership using the same Kouzes and Posner framework, but only found positive changes in two scales (inspiring a shared vision and challenging the process) a specific type of leader (those in operational roles). Furthermore, these changes were not sustained at follow-up. Although Cummings et al. (2012) used quantitative measurements, they did not provide sufficient information (i.e. no information about variances) to perform a meta-analysis of these two studies.

Fielden et al. (2009) compared two types of individual-level TA for nursing leadership development: mentoring (non-directive, sharing wisdom and encourage professional development) versus coaching (directive problem solving). Mentees outperformed coaching recipients on a measure of leadership development that included statistically significant gains in: effectiveness of management style ($t(12)=-3.83$, $p = 0.002$), negotiation skills ($t(13)=-2.51$, $p = 0.026$), networking with professional contacts ($t(13)=-2.83$, $p = 0.014$), self-confidence ($t(13)=-2.28$, $p = 0.04$), leadership skills and capabilities ($t(12)=-3.41$, $p = 0.005$), ability to be open and direct others ($t(11)=-2.83$, $p = 0.014$), ability to problem solve ($t(12)=-2.74$, $p = 0.018$), perceived leadership ability ($t(11)=-2.80$, $p = 0.017$), and ability to negotiate ($t(11)=-5.75$, $p = 0.0004$). Coaching recipients saw statistically significant gains only in effectiveness of management style ($t(13)=-6.50$, $p < 0.001$) and ability to negotiate ($t(11)=-3.89$, $p = 0.002$). Cleary et al.

(2005) and Grass and Worsley (2001) reported quantitative gains in leadership skills, but provided insufficient information to determine statistical significance. Using a pre-test/posttest design, a training and TA program to build organizational capacity (including leadership) for an early childhood promotion intervention did not lead to statistically significant changes on perceived effectiveness of leadership at the end of the second year of implementation (Green et al., 2012).

Six additional studies measured leadership develop qualitatively. TA helped leadership improve capacity to deliver quality services (Alleyne & Jumaa, 2007) and self-assessed personal leadership competencies (Law & Aquilina, 2013). Training and TA helped to build capacity to take on more leadership responsibilities in Austin et al. (2011) and Matovu et al. (2011). Training led to improved individual ability to foster collaborations in Cohen et al. (1991). Using a thematic content analysis, Carr, Lhussar, Reynolds, Hunter, & Hannaway, (2009) reported that participants in public health leadership development training that was followed by TA gained:

> An increased capacity for self-reflection, an energizing effect, an increased political astuteness and confidence as leaders, enhanced strategic thinking abilities, greater awareness of health improvement tools and an enhanced evidence base for practice.

TA helped prioritize leadership-development, but not actually change leadership behaviors in substance abuse prevention coalitions ($t(6)=0.55$, $p < 0.05$) (Watson-Thompson et al., 2013). In eleven studies, leadership was mentioned as a necessary precondition for further readiness development, particularly in terms of priority and implementation climate supports (e.g. Cramm et al., 2013; Ellman et al., 2007; Ganz et

al., 2009; Gifford et al., 2011) and organizational climate (Cummings et al., 2012; Tumerman & Hedberg Carlson, 2012). This will be expounded upon in the discussion.

Methodological Characteristics of Included Studies. Seventy-six percent (N = 37) of the articles were case studies. Twenty-one studies had pre-post measurement designs, twenty had posttest only designs, and eight had indeterminate measurement designs. Fifteen studies were found within comparison groups designs. Forty-three studies reported some type of innovation rationale, one study mandated innovation use, with five studies mandating innovation use. The average implementation quality of the support system strategy in the studies on leadership was 1.55 (SD = 1.31)

Although there is some evidence from quantitative comparison studies, inconsistent findings indicated that there is currently *limited* evidence that leadership can be enhanced through the use of support systems strategies.

Organizational Structure. Organizational structure was defined as the communication and workflow process (Cox et al., 1999; Cramm et al., Edwards et al., 2008; Hall & Eccles, 2000; Hunter et al., 2010; Krugman & Smith, 2003; Leonard et al., 2004; Mayer et al., 2011; Moore & Putman, 2008; Rasmussen, Kondrup, Staun, Ladefoged, Lindorff, et al., 2006; Richardson et al., 2012; Ross et al., 2005; Siddiqi et al., 2008; Sipilä et al., 2008; Varkey et al., 2008), the ease in which processes take place (Alhatmi, 2011), how the organizational system is organized (Brown et al., 2003; Grass & Worsley, 2001), the processes and people involved in care (Herring et al., 2011; Lehman, Hudson, Appley, Sheehan, & Slevin, 2011; Leon et al., 2013; Pronovost et al, 2005; Vioral & Kennihan, 2012), degree of teamwork (Lamb, Green, Benn, Brown, Vincent, et al., 2013; Lekan-Rutledge, 2000), job requirements (Nelson, Batalden, Plume,

& Mohr, 1996), degree of autonomy in practice (Christianson et al., 1997), shared leadership (Perry, 2000), and implementation teams (Talaat et al., 2006).

This section will also continue the discussion of *safety culture*, focusing on the structural components that promote patient safety in health care settings. Again, I have included this within general capacities because these processes are fundamental to the operation of these facilities. Twenty articles addressed the structural component of safety culture (e.g. Alton et al., 2006a, 2006b; Verschoor et al., 2007; Wick et al., 2012).

No studies used random assignment to control for influences on structure. Twenty studies measured organizational structure quantitatively. Five studies used the AHRQ HSOPSC (discussed earlier) to measure changes following a support system intervention using a pre-post design (Edwards et al., 2008; Kennerly et al., 2009; Mayer et al., 2011; Schwoebel & Creely, 2010; Thomas & Galla, 2013). Relevant to organizational structure, the HSOPSC measures perceptions of teamwork, communication openness, feedback, and hospital transitions. Mayer et al. (2011) reported statistically significant changes in two hospital intensive care units (ICUs, pediatric (PICU) and surgical (SICU). Changes were reported following QI in the *median* values in two dimensions: communication openness (PICU; $F(2,95) = 22.99$, $p < 0.01$); (SICU; $F(2,88) = 16.28$, $p < 0.01$), and improvements in the median values for teamwork in the SICU ($F(2,89) = 0.41$, $p = 0.04$) but not the PICU. In Edwards et al. (2008), *mean* scores on the HSOPSC were reported following QI. Positive changes were only seen in feedback ($F(2,428) = 9.688$, $p < 0.001$), whereas negative findings were seen in hospital transitions, ($F(2,428) = 13.25$, $p < 0.001$). Thomas and Galla (2013) only reported posttest percent change in HSOPSC scales following training, with "significant

changes" in communication openness, feedback, teamwork (qualitatively labeled as an area of strength), and hospital transitions. The number of respondents was not was reported. Kennerly et al (2009) reported posttest-only data following QI on the number of staff who *strongly agree* there was increased communication and cooperation around patient safety. Finally, Schwoebal and Creely (2010) reported a targeted safety QI initially helped to improve scores in teamwork and communication, but only reported raw percentages, did not provide information about how this percentage should be interpreted, and did not report statistical significance of the changes between hospitals studied.

Lamb et al. (2013) reported the cumulative impact that training ($F(1,430) = 5.051$, $p < 0.05$), top down QI ($F(1,477) = 48.756$, $p < 0.05$); staff-driven QI ($F(1,592) = 20.679$, $p < 0.05$), then tools ($F(1,619) = 69.174$; $p < 0.05$) had on improving communication (change in mean 29.6 to 38.3) and quality of teamwork (37.8 to 43.0) in making care-based decisions. Training and QI increased awareness of necessary communication strategies for safety by 48% ($p < 0.05$) in one ICU (Pronovost et al., 2005). Similar findings were found following training in Moore & Putnam (2008), who found that staff members were two to four times more likely to report medical errors. At follow-up, an organizational-level survey showed that staff that had not been trained were also increasing their error reporting behaviors. Varughese et al. (2013) reported that QI helped reduce redundancy in a screening process which ultimately allowed nurse practitioners to more efficiently complete work tasks. Lehman et al. (2010) reported that QI led to the elimination of 57 mid-level positions and consequently improved overall organizational operations. TA in Ramos & Ferreira-Pinto (2002) led to a decreased average number of people on leadership boards (13.8-10.5, $p = 0.69$), which they

interpreted as evidence of structural streamlining. TA was unsuccessful in helping coalitions who prioritized developed operating structures make changes to their daily operations ($t(6)=1.37$, $p = 0.22$) (Watson-Thompson et al., 2013)

Changes in organizational structure were addressed qualitatively in twenty-five studies. Inter and intra-departmental communications in hospitals were improved through the use of QI (Fudickar et al., 2012; Maynard et al., 2012; Rikli et al., 2009; Varkey et al., 2008), TA (Williams et al., 2002), and tools (Herring et al., 2011). Tools were used in two studies to reframe the decision-making structures in organizations (Clossey et al., 2011; Leonard et al., 2004). QI also led to new patient safety reporting policies in Alton et al. (2006b). Jensen, Johannsson, and Löfström (2013) reported that a failure to attend to structure as part of QI contributed to null outcomes when using QI to implement a public health policy. Lekan-Rutledge (2001) also reported minimal structural changes following TA for a urine-voiding intervention.

Staff roles were reorganized and restructured in several studies using TA (Brown et al., 2003; Winslow, Fickley, Knight, Richards, Rossen et al., 2011), training (Christianson et al., 1997; Sipilä et al., 2008) and QI (Richardson et al., 2012). Training helped to centralize operations of medical partners who used a nuclear medicine department (Grass & Worsely, 2001), though the reported techniques that facilitated this centralization were poorly specified. A steering committee was formed in Perry (2000) to structurally support the implementation of a health process improvement innovation. Similar governance structures were formed in Talaat et al. (2006) for a patient safety initiative.

Methodological Characteristics of Included Studies. Seventy-eight percent (*N* = 38) of the articles were case studies. Twenty-five studies had pre-post measurement designs, fourteen had posttest only designs, two had pretest only designs and eight had indeterminate measurement designs. Eleven studies used comparison group designs. Forty studies reported some type of innovation rationale, two studies mandated innovation use, with six studies met both criteria, and one study had no innovation rationale. The average implementation quality of the support system strategy in the studies on organizational structure was 1.33 (*SD* = 1.39).

There are substantial measurement models supporting the use of support system methods to positively influence changes in organization structure, and multiple studies that used comparison groups to track changes in organizational structure (e.g. Mayer et al., 2011; Pronovost et al., 2005). Currently, there is *moderate* evidence that support system strategies can be used to influence changes in organizational structure.

Staff Capacity. There were many different job types within the articles included in these analyses, and therefore staff capacity was defined diversely. This included the ability to conduct QA processes (Bouchet, Francisco, & Øvretveit, 2002), teacher's abilities to respond opportunistically and flexibly to student needs (Campanaro, 2007), adequate career development (Fielden et al., 2009), ability to use best practices to support socio-emotional learning (Green et al., 2012), engagement in QI projects (Hayes et al., 2010; Schwoebel & Creely, 2009), skills at connecting with patients (Herbst et al., 2010), ability to retain qualified staff (Hillman & Foster, 2011; Williams et al., 2002), ability to do facilitation, advocacy, collaboration, and culture/community competency (Lew et al., 2011), skills to respond to client needs (Lietz, 2008), technical and project management

skills (needs assessment, evaluation design) (Philliber & Nolte, 2008; Ramos & Ferreira-Pinto, 2002; Watson-Thompson et al., 2013), and skills in medication procedures (Rozenbaum et al. 2012). Each of these tasks was considered an essential and fundamental part of the profession within the article, and are therefore included in general capacities instead of innovation-specific capacities.

No study used random assignment to control for influences on the development of general staff capacity. Fielden et al. (2009) compared mentee versus coaching TA relationships for career development skills. Both groups showed significant increases: mentee ($t(11)=-3.64$; $p = 0.004$), and coaching ($t(12) = -3.40$; $p =0.005$)).

Three studies measured changes in staff capacity through retention rates in nursing departments. Williams et al (2002) compared a nursing development program versus nursing units that did not implement this strategy. This led to significant reduction in turnover ($t(2)=-3.707$; $p =0.002$). Hillman and Foster (2010) reported on an extensive screening and nurse development process that consisted of matching and ongoing professional development TA to reduce nursing turning. However, they only reported post-training retention rates. Winslow et al. (2011) set up a tiered TA nursing development program that had nurse move up through higher "levels" indicative of greater clinical skills. They reported that <1% of staff in the top levels left the organization, indicating considerable stability among nurses who were assessed as having the greatest capacity.

Lietz (2008) used training to develop group supervision skills for critical thinking in case evaluation. Those who participated in training reported an increase in ability to use critical thinking ($t(236)=-5.05$, $p < 0.01$). Following training and TA, Ramos &

Ferreira-Pinto (2009) reported an increase in organizations (N = 235) that were able to conduct needs assessments (p = 0.065) saying, "these changes were assumed to indicate an increase in capacity." Following a TA prioritization process, Watson-Thompson et al. (2013) found increases in staff capacity in the ability to: analyze information ($t(6)=2.44$; p <0.05), implement effective interventions ($t(6)=2.44$; p <0.05), and use evaluation skills ($t(6)=2.42$; p <0.05).

Six studies reported changes in staff capacity qualitatively. Olson et al. (2006) reported ongoing QI contributed to the development of a community of practice for diabetes care. Schwoebal & Creely (2010) promoted further use of QI for a safety culture by actively recruiting and selecting team members with interest in "reporting, analysis, [and] feedback." Improvements in a child care staff's ability to communicate and interact with families were qualitatively assessed via staff interviews following training (Douglass & Klerman, 2012). Extensive training helped to reduce turnover for providers delivering teen pregnancy prevention interventions (Philliber & Nolte, 2008). In Sipilä et al. (2008), an ongoing TA and QI program for inter-professional care coordination led to, "common treatment practices—'house rules'….increased evidence-based knowledge of important volume diseases, new skills and tools for patient education and self-measurement." A QI program for preventative services was unable to forestall attrition of key members and consequently program sustainability was in jeopardy in Tyler et al. (2004).

Methodological Characteristics of Included Studies. Sixty-eight percent (N = 19) of the articles were case studies. Eighteen studies had pre-post measurement designs, seven had posttest only designs, and three had indeterminate measurement designs. Ten

studies used comparison group designs. Twenty-one studies reported some type of innovation rationale, two studies mandated innovation use, with three studies having both criteria. Two studies presented no innovation-rationale. The average implementation quality of the support system strategy in the studies on staff capacity was 1.61 (*SD* = 1.45).

Due to the presence of quantitative models and use of comparison groups, there is currently *moderate* direct evidence that general staff capacity can be built with support system activities.

Section Summary. Table 7.11 summarizes the evidence for using support system activities to promote change in general capacities.

Table 7.11. Summary Evidence Table for General Capacities

	No Evidence	Minimal Evidence	Limited Evidence	Moderate Direct Evidence	Strong Direct Evidence
Organizational Culture			X		
Organizational Climate			X		
Organizational Innovativeness				X	
Resource Utilization			X		
Leadership			X		
Organizational Structure				X	
Staff Capacity				X	

Question 5: Do tailored support system activities (i.e., those that address specific components of readiness) lead to better innovation outcomes than those that do not?

Among the 85 articles that reported innovation outcomes, 71 (83%) specifically targeted one of the components of readiness. Tailored support systems activities were coded categorically as "targeted" or "not targeted." *Innovation outcomes* refers to whether or not the innovation that was implemented in the article has its intended

outcome (i.e. the innovation was effective). Innovation outcomes were coded as "met intended outcomes," (i.e. the results of the innovation were as predicted) and "did not meet intended outcomes." Logistic regression was used to answer this question since the outcome variable, innovation outcomes, was categorical.

Support system activities that specifically targeted a component of readiness, had a log odds of 1.92 (SE = 0.84; p = 0.0234). This is equal to an odds ratio of 6.8 with a 95% confidence interval [1.18,38.83], meaning that support systems that target a subcomponent of readiness are almost seven times likelier to have innovation outcomes than those that do not specifically target a subcomponent of readiness. The Wald test (a two-degree of freedom chi-square in which the second degree of freedom is the covariance) indicated that the effect of targeted support system activities was significant (X^2 (2, 85) = 6.2, p = 0.044). Table 7.12 contains the OR for each specific support system technique. While only QI was statistically significant, *tools* approached significance.

Table 7.12. Summary Evidence Table for EBSIS technique leading to innovation to outcomes

	OR	95% CI	P value
Tools	0.23	[0.04-1.01]	0.06
Training	1.65	[0.18-12.44]	0.63
Technical Assistance	1.81	[0.36-12.34]	0.58
Quality Assurance	>100	[<.001- NA]	0.99
Quality Improvement	10.94	[1.47-243.76]	0.05

*No OR significant at p <0.05

Question 6: When is organizational readiness too low to be responsive to tailored Support System activities?

For this question, I examined whether there were any systematic difference between articles that reported changes in readiness outcomes verses those that did not

report changes. *Readiness outcomes* refer to whether or not a factor or subcomponent of readiness changes in response to support systems activities. The purpose was to see whether there were certain conditions in which readiness outcomes were less likely. Thirty-one articles (18%) did not report changes in the components of readiness. Readiness outcomes were coded as "met intended outcomes," (i.e. the subcomponent or factor changed in a positive direction) and "did not meet intended outcomes. Table 7.13 reports the frequencies for each factor or subcomponent.

Table 7.13. Factors and Subcomponents of Readiness in Studies that Reported Changes in Readiness Outcome versus Those that Did Not Report Changes.

Readiness Component			Reported Change	No Reported Change
Motivation	Relative Advantage (N =31)		26 (84%)	5 (16%)
	Compatibility (N =41)		31 (76%)	10 (24%)
	Complexity (N=24)		18 (75%)	6 (25%)
	Trialability (N=17)		12 (71%)	5 (29%)
	Observability (N=20)		14 (70%)	6 (30%)
	Priority (N =38)		31 (82%)	7 (18%)
Innovation-Specific Capacities	Knowledge, Skills, and Abilities (N =91)		74 (81%)	17 (19%)
	Champion (N = 30)		30 (100%)	0 (0%)
	Implementation Climate Supports (N = 39)		35 (90%)	4 (10%)
	Inter-organizational Relationships (N=27)	Support/Delivery (N=8)	6 (75%)	2 (25%)
		Delivery System (N =12)	12 (100%)	0 (0%)
		Both (N=7)	6 (86%)	1 (14%)
General Capacities	Organizational Culture (N=45)		42 (98%)	3 (2%)
	Organizational Climate (N = 24)		22 (96%)	2 (4%)
	Organizational Innovativeness (N =8)		6 (75%)	2 (25%)
	Resource Utilization (N =12)		11 (92%)	2 (8%)
	Leadership (N = 49)		38 (64%)	11 (36%)
	Organizational Structure (N = 49)		44 (90%)	5 (10%)
	Staff Capacity (N = 28)		21 (75%)	7 (25%)
Total (N			142 (82%)	31 (18%)

=173)

Support system activities that specifically targeted a component of readiness had a log odds of 1.13 (*SE* = 0.46; *p* = 0.0137). This is equal to an odds ratio of 3.1 with a 95% confidence interval [1.23,7.48], meaning that support systems that targeted a factor or subcomponent of readiness are about three times likelier to have readiness outcomes than those that do not specifically target a factor or subcomponent of readiness. The Wald test indicated that the effect of targeted support system activities on changes in readiness was significant (X^2 (2, 173) = 58.7, p < 0.001).

Statistical differences between the frequencies in the article characteristics between articles that reported versus did not report changes in readiness were computed using the chi-square statistic (Table 7.14). There were three significant differences between types of articles. Articles that used a case study format were more likely to report changes in readiness (X^2(1, *N* = 173) = 15.54, *p* <0.001), articles that used random assignment procedures were less likely to report changes in readiness (X^2(1, *N* = 173) = 5.87, *p* = 0.02), and articles that did not explicitly state a rationale for the innovation being implemented were less likely to report changes in readiness (X^2(1, *N* = 173) = 7.63, *p* < 0.01).

Table 7.14. Difference in Article Characteristics between Studies that Reported Changes in Readiness vs. Those that Did Not Report Changes in Readiness.

	Source of Bias		Reported Change (N = 142)	No Reported Change (N = 31)	X^2	P value
Evaluation Characteristics	Case Study		103	11	15.54	<0.001*
	Assessment Model	None	23	7	0.72	0.40
		Pretest only	5	0	1.12	0.30
		Posttest only	45	12	0.57	0.45

		Both	69	12	1.00	0.32
	Groups	No Group	105	19	2.01	0.16
		Comparison Groups present	27	7	0.21	0.65
		Random Assignment	4	4	5.87	0.02*
		Test of Between-group equivalence	6	1	0.07	0.80
Innovation-Specification	Rationale	None	3	4	7.63	0.01*
		Included	117	24	0.42	0.52
		Mandated	5	1	0.01	0.94
		Both	17	2	0.79	0.37

*X^2 significant at p <0.05

Logistic regression was used to examine whether implementation quality was a significant predictor of readiness outcomes. The index score on Implementation Quality (IQ) was not a significant predictor of readiness outcomes (log odds = -0.08, SE = 0.16; p = 0.6; OR = 0.92, 95% CI [0.69-1.27]). None of the individual components of implementation quality (e.g. fidelity, dosage, etc.) were significantly linked to readiness outcomes at $p < 0.05$. None of the individual components of EBSIS (i.e. tools, training, TA, QA, and QI) were significantly linked to readiness outcomes at $p < 0.05$.

There are some differences between studies that are linked to changes in readiness outcomes. However, due to difficulties in standardizing measurement of the factors and subcomponents or readiness, it was not possible to statistically determine whether there are particular conditions or "amount" of readiness under which the parts of factors or subcomponents will be non-responsive to support system activities. This will be addressed in the limitations section of the discussion.

Chapter 8: Discussion

Overview.

In the implementation literature, there are a number of factors and subcomponents that are associated with an increased likelihood of achieving outcomes. Organizations who wish to get results from their innovations have an interest in making sure that these factors and subcomponents are in place. However, having awareness that certain capacities and factors that influence motivation are linked to improved innovation outcomes does not necessarily help organizations to get "more ready." There is a need for organizations to know if and how they can effectively put these factors and subcomponents into place. Broadly, can the Support System help to build the readiness of organizations (readiness outcomes) in order to help them achieve better innovation outcomes?

This dissertation set out to synthesize the strength of the evidence on how the Support System can use various techniques and interventions to build organizational readiness for implementing innovations. In the introduction, I first brought together two themes in the readiness literature to enhance current models of organizational readiness: organizational capacity (e.g. Flaspohler et al., 2008) and organization motivation (Weiner, 2009). I then demonstrated how certain factors that influence motivation and subcomponents of the capacities identified in the literature are linked to improved innovation outcomes (e.g. Greenhalgh et al., 2004; Powell et al., 2012; Rogers, 2003).

This dissertation had a number of goals. First, I investigated the strength of the evidence for changing/enhancing different factors and subcomponents of readiness using the strategies of EBSIS (tools, training, technical assistance, and quality assurance/quality improvement). Second, I examined whether support system activities that specifically targeted readiness factors and sub-components as part of an innovation implementation process demonstrated better innovation outcomes than non-targeted support system activities. Finally, I examined whether there was any evidence that particular factors or subcomponents were less responsive to Support System activities, and therefore should get less weight as part of a readiness-building process. Figure 8.1 illustrates the causal chain of this dissertation.

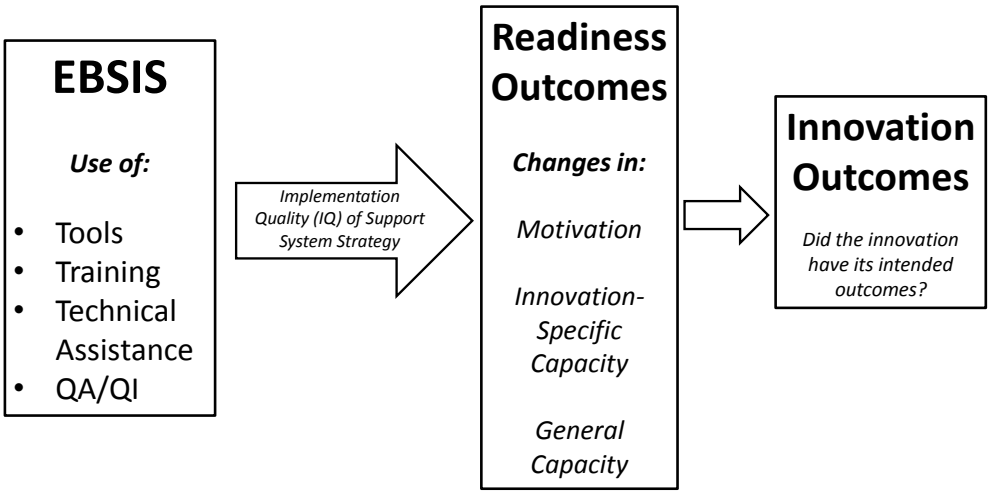


Figure 8.1. Use of EBSIS to influence Readiness Outcomes and Innovation Outcomes

To answer these questions, I screened 4397 articles in the behavioral health and medical literature that potentially dealt with the factors and subcomponents during the process of implementing an innovation. From this larger set, the full text of 297 articles were reviewed and coded. Ultimately, 173 articles were retained and included in the

syntheses (Figure 7.1). The results were: 1) there is evidence that support system activities can enhance certain factors and subcomponents of organizational readiness; 2) support system activities that target readiness are more likely to achieve innovation outcomes than those that do not, and, 3) there are some statistical differences in articles that report changes in readiness versus those that do not. In the following sections, I will discuss some specific findings, study limitations, and possible future directions.

Discussion.

There was a statistically significant negative correlation between motivation and general capacity ($r\varphi = -0.37$; $p < 0.001$), meaning that the more an article addressed the factors that influence motivation, the less likely this article was to address general capacities. This provides some evidence that the concepts of general capacity and motivation have not fully been addressed together within the organizational support literature, which is consistent with the theses in this dissertation's introduction and Scaccia et al. (in press). Although there was a small, statistically significant negative correlation between general capacity and innovation-specific capacity ($r\varphi = -0.25$; $p < 0.001$), this finding was more unexpected since both these concepts are discussed together in the literature (e.g. Wandersman et al., 2008). What this correlation indicates is that when articles focused on at least one innovation-specific specific capacity, it was less likely to address at least one general capacity, and vice versa. While this finding is inconsistent with work by Flaspohler et al. (2008) that articulates the importance of both these components when building capacity for an innovation, a cursory literature search found only one instance of these terms "general capacity," and "innovation-specific capacity" co-occurring together prior to 2008 (Wandersman, Stillman, Horwitz, Duffy,

Blachman, et al., 2005), when a special issue of the American Journal of Community Psychology introduced the ISF. Additionally, this finding may represent a deficit in reporting, wherein factors that were not the primary focus of the article were not discussed. Since the factors and subcomponents of organizational readiness have been shown to be linked to innovation outcomes independently, a broader approach to building readiness that addresses both motivation and capacity represents an improvement in how Support Systems activities can be provided.

Table 8.1 summarizes the strength of the evidence for each factor that influences motivation and subcomponent of innovation-specific capacity and general capacity. While there is variation in the strength of the evidence between the factors and subcomponents, there generally appears support for the hypothesis that the Support System can target and build readiness in organizations to implement innovations. The evidence suggests that Support system activities can be used to enhance nearly all of the components of readiness (except trialability and champion) in order to improve *both* readiness outcomes and innovation outcomes.

Table 8.1. Summary Evidence Table for Factors that Influence Motivation and the Subcomponents of Innovation-Specific and General Capacities

		No Evidence	Minimal Evidence	Limited Evidence	Moderate Direct Evidence	Strong Direct Evidence
Motivation	Relative Advantage		X			
	Compatibility		X			
	Complexity		X			
	Trialability	X				
	Observability			X		
	Priority			X		
Innovation-specific capacity	Knowledge, Skills, and Abilities			X		
	Champion	X				

	Implementation Climate Supports			X		
	Inter-organizational Relationships	Support and Delivery System	X			
		Between Delivery Systems		X		
General Capacity	Organizational Culture			X		
	Organizational Climate			X		
	Organizational Innovativeness				X	
	Resource Utilization			X		
	Leadership			X		
	Organizational Structure				X	
	Staff Capacity				X	

The strongest evidence was found in general capacities (which also had the largest number of overall articles) where all subcomponents met the criteria for *limited* evidence. In only one factor that influenced motivation (trialability) and one subcomponent (program champion) was there no evidence that they can be changed by Support System activities. One possible reason for this can be found in how these constructs are represented. It is difficult to produce variations and changes within a binary construct; the construct is either present or not present. Because there is no variation within trialability, it is not something that can be enhanced, per se, it can only be introduced. While it may be possible to track dosage of trialability (i.e. more opportunity to practice with an innovation), no studies measured the dosage of trialability in this way. Further

research questions might look at how much practice/exposure is necessary before overall motivation to use an innovation is impacted.

The presence of a champion was similar to trialability in that it is treated as a binary condition within the implementation literature. Further studies into the characteristics of champions may provide information about how to effective select and/or cultivate champions. For example, Damschroder, Banaszak-Holl, Kowalski, Forman, Saint et al., (2009) noted,

> Active champions directly shape organizational change through four critical functions: 1) protecting those involved in implementation from organizational rules and systems that may be barriers, 2) building organizational support for new practices, 3) facilitating the use of organizational resources for implementation, and 4) facilitating growth of organizational coalitions in support of implementation. A champion's effectiveness depends on the strategies used to engage individuals across professions, and engagement strategies should be tailored to the organizational setting.

In addition to identifying activities that a champion performs, this observation also highlights an important point about the relationships between readiness subcomponents. There are complex relationships between the components of readiness. There relationships have important implications about the sequence in which these components are addressed.

For example, one phenomenon that emerged from the synthesis was the relationship between implementation climate and organizational culture. In Sables-Baus and Zuk (2012), the mainstreaming of a medical process that was monitored by QA but

without ongoing TA was considered evidence of a culture change in a neonatal intensive care unit (NICU). The mainstreaming (when the innovation becomes part of the shared expectation of the organization) is considered to be indicative of the innovation being incorporated into the organizational culture. Therefore, the process of innovation sustainability (as discussed extensively in Stirman et al., (2012)) may be an integral part of a larger culture change. This was particular true of patient safety initiatives (e.g. Alton et al., 2006), with "culture change is at the heart of this quest [for patient safety]" (Leonard et al., 2004).

However, there was less consensus in the literature around the sequencing of other factors and subcomponents. For example, in some studies, organizational culture preceded staff capacity (Timmel et al., 2010) and organizational climate (Varkey et al., 2008), whereas in Paarlberg & Perry (2007) staff capacity preceded organizational culture. Key individuals (e.g., specific champions and leaders) were seen as important preconditions that preceded other parts of readiness in several studies. Champions were cited as a primary step in several articles in building implementation climate (Rikli et al., 2009; Sipilä et al., 2008; Spence & Henderson-Smart, 2011; Wallis & Kennedy, 2013). Champions were also seen as important in addressing factors that influence motivation. In Leon et al., (2013),

> The champion framed the new intervention not only as a requirement but also as a feasible and desirable [innovation]….the framing of [the innovation] as both an opportunity to address a service gap may have strengthened the willingness of nurses to consider its implementation.

Leadership was seen as a primary step for building implementation climate and priorities (Bonuel et al., 2009; Cullen, Greiner, Greiner, Bombei, & Comried, 2005; Ellman et al., 2007; Ganz et al., 2009; Gifford et al., 2011), organizational climate (Cummings et al., 2012), organizational culture (Kennerly et al., 2011), organizational structure (Gaucher & Kratochwill, 1993; Perry, 2000; Lekan et al., 2010), and factors that influence motivation (Schleyer et al., 2005). It is likely that there are multiple feedback loops that influence the development (or deterioration) of various components. As illustrated in Mohammadi et al., (2007),

> CQI is an organizational culture and largely the product of an organization's leadership and motivational system. Building a culture takes time. Although CQI is a long term effort, we should not wait until the ideal culture has evolved. Results themselves build culture.

As there is no consensus about the sequence with which the components and factors should be addressed, a more comprehensive Support System approach that address many (if not all) parts may be the most impactful strategy until there is greater evidence about the relative strengths and interrelationships among the subcomponents and factors.

One counter-intuitive finding of note was the minimal evidence that addressing compatibility of an innovation did not necessarily lead to better quality of implementation. Although compatibility was a major theme in the implementation literature (Greenhalgh et al., 2004; Powell et al., 2012; Rogers, 2003), several studies qualitatively reported that attempts to increase compatibility negatively impact the quality of implementation and subsequently innovation outcomes (e.g. Bonvin et al., 2013;

Flaschberger et al., 2012). So while compatibility (and other factors and subcomponents) are important predictors of innovation use, organizational readiness by itself will not guarantee innovation outcomes. The innovation still must be implemented and evaluated with quality.

Following the results from dissertation research questions one through four, if the support system can properly and accurately determine specific areas of low readiness in an organization, it is possible to build readiness with targeted interventions. Support system strategies that specifically target readiness are about three times more likely to see changes in the factors and subcomponents of readiness, and nearly seven times more likely to see positive innovation outcomes. This highlights the utility of using this model of organizational readiness as a means of getting organizational prepared for putting innovations into practice.

Only two EBSIS techniques approached significance for innovation outcomes. QI had a positive impact on innovation use (log odds = -2.39; SE = 1.21; $p < 0.05$; OR = 10.90; 95% CI [1.47-243.76]). QI tends to be more involved than other EBSIS activities, and therefore there may be a dosage or participatory component of QI that makes this a more useful strategy for achieving innovation outcomes. The use of tools (log odds = -1.49; SE = 0.79; $p = 0.06$; OR =0.23; 95% CI [0.04-1.01]) had a negative impact; i.e. using tools means that innovation outcomes were less likely to be achieved. This is consistent with discussion by Wandersman et al., (2012) that using tools will not be sufficient to have innovation outcomes. Although the statistical significance of this finding was just outside of $p = 0.05$, what this suggests is that tools may be harmful if not combined with other EBSIS strategies. As tools are commonly distributed through

websites without any additional oversight or guidance, future research should examine the soundness of this strategy.

While it was not statistically possible to isolate the influence of each individual support method (i.e. TA, QI, etc.) on a particular specific factor or subcomponent due to low power and subsequently biased parameter estimates, there is some preliminary support that using techniques in combination with each other leads to incrementally better results. In a noteworthy study, Lamb et al (2013) showed that cumulative introduction of training, QI, then tools led to statistically significant improvements in measures of organizational structure. Although QA and QI are presented together within the EBSIS framework, there was a low, and non-significant correlation between them ($r\varphi = 0.07$; $p = 0.38$). However, QA appeared in only 11% ($N = 20$) of the included articles, and this may have biased parameter estimates.

There were several quantitative differences between studies that showed readiness outcomes and those that did not show readiness outcomes. First, case studies were more likely to have readiness outcomes. This may be an artifact of publication bias, whereby articles that may be more subjected to confounds (like some case studies and process narratives) might more likely to be submitted for publications because they are showing results. Second, articles that showed no change in the components of readiness were more likely to have used random assignment procedures. While this finding is tempered by a very small sample size ($N = 15$), it indicates the need for more controlled models to test the influence on support systems strategies on readiness. Small sample size may also influence the interpretation of the finding that articles that did not state a rationale for an innovation were less like to report readiness outcomes. Although this is consistent with

the concept of *theory failure* (Rossi et al., 2004; Wandersman, 2009), this finding should be interpreted with caution because so few articles did not state an innovation rationale ($N = 7$).

Overall, these results synthesize the literature on targeted support. While it has been previously noted that it is important to account for characteristics of the host organization (Damschroder et al., 2009; Greenhalgh et al., 2004), this dissertation presents evidence that it is possible to enhance specific parts of the organization that are important to reach innovation outcomes. Consistent with the principles of empowerment evaluation, specifically the principles of *improvement* and *capacity-building* (Fetterman & Wandersman, 2005) it appears from the evidence that organizations have the potential to get more ready by specifically addressing distinct parts of readiness. It is a somewhat common phenomenon that the most capable organizations (i.e. the ones who are most ready) are the ones that will qualify for externally funding. However, many organizations may be strategically positioned (e.g., in underserved areas) but have deficits in their readiness to implement high-priority programming like the *Community Health Needs Assessments* specified by the Affordable Care Act. What the evidence in this synthesis shows is that organizations can generally be assisted to get more ready for an innovation. There is potential to enhance the capabilities of organizations and therefore improve their ability to get positive innovation outcomes. This is an important finding because it allows funders to maximize their investments in organizations by more effectively providing supports to build the capabilities to put innovations into place.

Limitations.

There were a number of related limitations that qualify how the results from this dissertation can be interpreted.

Publication Bias. As with all research syntheses, there is a strong potential that not all relevant articles were included. In the file drawer problem, null results are underrepresented because they are not submitted for publication (Shadish et al., 2002). This is a particular problem in the research on readiness because so many of the studies are single organizations case studies and process narratives of a particular innovation. It is more than likely that many organizations do not submit their internal innovation change processes to the academic literature. While there was an attempt to gather unpublished reports through various grey literature databases, the number of change efforts that had null results is likely to be underreported, and subsequently may influence the conclusions in this study. However, it is also plausible that a number of positive findings are not reported and remain internal to an organization. So while there are likely to be underreported null finding, it is also possible that many positive findings are not reported.

Methodological Characteristics of the Studies. As noted earlier, a substantial number of studies (66%) were organizational case studies. As such, these are subject to many sources of bias. This is not to say that the data that is presented in these studies is flawed, but rather there is greater potential for other sources of variation that could have confounded the results. Since so many of studies organizational readiness literature come from a case study approach, it may be difficult to generalize findings from a single organization or a single innovation across multiple settings. Therefore, this dissertation

should be thought of as an incremental step toward assembling evidence that can improve the focus of support system activities.

Reported Support Strategies Quality. Related to the above challenge, the specific techniques of the support systems (e.g., the training or TA model) was described in adequate detail in very few instances. As noted earlier, the average implementation quality of support system strategy was 1.28 across all studies (on a scale of 0 – 6), meaning that most studies did not report important support strategy implementation characteristics like dosage and adaptation. Because of this, it is difficult to determine whether or not a particular support strategy in a particular study was better than another since there was no uniform way in which the strategy was described. The lack of reporting on quality negatively impacts specific utility of many articles. Even with a promising finding, it is difficult for another organization to replicate the strategy. Some possible solutions to address this are discussed in the *future directions* section.

Lack of measurement standardization: Only 30% of the articles had any sort of quantitative measurement model. Due to variation of measurement rigor and the number of constructs involved, it was not possible to synthesize findings in a way that would lead to estimates of effect size. In a particularly strange example, even though five studies used the same reporting tool (the AHRQ HSOPSC; Edwards et al., 2008; Kennerly et al., 2009; Mayer et al., 2011; Schwoebel & Creely, 2010; Thomas & Galla, 2013), they all reported different subscales as they pertained to specific projects. In the case of Kennerly et al. (2011), readiness outcomes were framed as a snapshot of "key results." Although there was the potential to gather effects sizes on organizational culture and organizational structure, the lack of standardized reporting prevented stronger

inferences about the strength of the support system strategy for these subcomponents. The lack of measurement standardization was more pronounced across other factors and subcomponents. While there were differences in the characteristics of studies that reported readiness outcomes, it was not possible to attribute any difference in outcomes to a small "amount" of a factor or subcomponent.

In addition to the major limitations above, other sources of bias may have been introduced through reactivity (both coders knew of this dissertation's hypotheses). Although the readiness model introduced in this dissertation attempted to be comprehensive, it is possible that other constructs may influence organizational readiness are needed. Possible candidates include organization momentum (D. Osher, personal communication, 7.29.14) and organizational affect (Markle, in prep)

Future Directions:

Although this dissertation provides preliminary evidence that organizational readiness can be enhanced by Support System activities, there are a number of future avenues that could continue to enhance Support System effectiveness. First, there is a need to more fully examine the interrelationships between the factors that influence motivation and subcomponents of innovation-specific and general capacity in order to gain a better understanding of how they may interact synergistically or antagonistically. One possible method is to utilize qualitative comparison analysis (QCA; Kane, Lewis, Williams, Kahwati, 2014; Ragin, 1999). In QCA, set theory is used to examine necessary and sufficient components that are related to outcomes of interest. Once items are coded, the proportion of cases that show outcomes that exhibit a particular component are reported (Kane et al., 2014; Ragin, 1999). Using this method, certain factors and

subcomponents may emerge as being more critical to achieving innovation outcomes than others. Furthermore, the factors and subcomponents themselves may be coded as outcomes to determine which factors and subcomponents are necessary and sufficient to produce changes in them. For example, QCA could be used to examine how organizational climate is influenced by leadership (Cummings et al., 2012), organizational culture (Varkey et al., 2008) and champions (Rikli et al., 2009; Sipilä et al., 2008; Spence & Henderson-Smart, 2011; Wallis & Kennedy, 2013). This may allow the Support System to focus even further to target specific components first as part of a comprehensive readiness-building strategy. The data gathered in this dissertation may allow for such a follow-up analyses.

Second, there is a need to develop standard readiness evaluation models that incorporate all components of $R=MC^2$. Several new measures like (Shea et al., 2014) that are adapted from the Weiner model (Weiner, 2009) get at some, but not all of these constructs. Within the studies that were reviewed for this synthesis, there was negative correlation between motivation and general capacity and a negative correlation between innovation-specific and general capacity. Therefore, a standardized framework that addresses all three of the components is needed. The relatively broad range of definitions for several subcomponents (e.g. implementation climate supports) highlights the need for better qualitative and quantitative standardization. Already some evaluation frameworks are looking to assess organizational readiness for external funding by examining their responses to Funding Opportunity Announcements (Dymnicki, Wandersman, Osher, Grigorescu, & Huang, 2014). Similar work is being prepared to address how public health departments can enhance their readiness to implement quality improvement

practices. This work will help to more precisely measure readiness when making decisions about the how viable and sustainable an organizational change processes might be. This has the potential to benefit funders by providing more information about where their investments might be most effective. This will also allow for more detailed analyses of when a factor or subcomponent might be too low for support system activities.

When more advanced measurement models are developed, structural equation modeling can also be used to examine the possible sequencing of the components. For example, in the relative advantage literature, the use of incentives led to increased use of the innovation (e.g. Bassett et al., 2013). In this case, it is plausible that trialability can be a mediating step toward increasing relative advantage. This type of information would further allow the Support System to be even more targeted in building organizational readiness.

Thirdly, the quality with which support system strategies are reported can be improved. Currently, there is an extensive syntheses being prepared that examines the quality with which technical assistance is being provided (Katz, in prep). There is no similar reporting framework for training and tools, which is especially troubling since 117 articles included training as some part of a support strategy. While the quality of QA/QI reporting is improving, there is not a consensus around a reporting framework. Some frameworks have been proposed like the *S*tandards for *QU*ality *I*mprovement *R*eporting *E*xcellence process (SQUIRE; Davidoff, Batalden, Stevens, Ogrinc, & Mooney, 2008). Similar communities of practice are being built around the use of QI in public health. When describing lessons learned from how support was provided during

the Multi-State Learning Collaborative (seen in Joly et al. (2012), which was included in the synthesis), Robert Wood Johnson Foundation senior program officer Pamela Russo said,

> One element you didn't mention was learning by peer exchange. This was a huge part of building the momentum and showing people models done by their peers, on public health issues rather than Toyota or health care examples….We have tried a number of different methods of learning from peers – plenary sessions, concurrent seminars, small roundtables where people can get into the weeds and ask questions they'd be shy to ask in a larger group. And that's why we built PHQIX.org [an online QI repository]– so that people could continue to learn from their peers, see the tools they used, the materials they created (templates and others that they upload) at any time, as most of the field doesn't manage to go to Open Forum or…trainings. (Russo, P. 3.28.14, personal communication)

This type of setting could provide a collective template to specify the precise elements of a QI process. These are critical steps if organizational use of innovations is to incrementally improve through the use of smaller, iterative interventions like QI.

Improving quality of support system reporting is critical because even when innovation results are reported, it is currently difficult for others to learn from the support system on how to improve specific parts of readiness. Application of the EBSIS framework, which is grounded in the Getting to Outcomes ® process (Wandersman, Chien, & Katz, 2012; Chinman et al., 2004) provides an additional method of evaluating support system strategies. A more thorough and standardized methodological framework will allow the lessons learned from these case studies to be 1) more thoroughly evaluated

so their conclusions can be vetted, and 2) more precisely disseminated throughout the Support System. When this happens, the overall quality of support systems activities will be improved and consequently the services that the support system provides will have a higher likelihood of reaching intended outcomes.

Finally, there is opportunity to better explore the use of *communities of practice* for building readiness (Donald et al., 2013; Williams et al., 2002). A community of practice is akin to developing a Support System within the Delivery System to help foster sustainability (Stirman et al., 2012) and institutionalization (Hall & Hord, 2010).

> Communities of practice (or collaborative learning communities, which are similar, or professional learning communities) can play supportive function that is, in a way, embedded in the Delivery System. The Support System can help to facilitate the communities of practice, which can then serve as sustainable sources of support for the communities. (Katz, J. personal communication, 4.24.14)

This helps to reduce the likelihood that new knowledge will be lost as it is invested across the network rather than one individual (Donald et al., 2013). However, there is a danger if communities of practices are used as a complete substitute for externally delivered support systems strategies, the communities of practices can actually lead to sharing of poor practices if not done in an evidence-based way. Applying the EBSIS framework to communities of practice can help to develop and evaluate how these collectives can be used to continue to foster ongoing organizational readiness for innovations.

Conclusions:

This dissertation provides evidence that readiness (the factors that influence motivation, innovation-specific capacities, and general capacities) can be enhanced in organizations. Because of these findings, the Support System can provide targeted support in order to facilitate positive changes in the readiness of organization. This dissertation has provided a step in improving how the Support System conceptualizes possible targets for support. This targeted readiness-building process can help to improve the ability of all organizations to reach outcomes in the population that they serve. It is possible for organizations to improve readiness.

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Appendix A: Three Athletes

Consider three individuals and their relation to a running program. Fitz is young and healthy. He eats well and tries to live an overall healthy lifestyle. His running schedule is fairly regimented. Fitz runs approximately seven miles each morning before breakfast. Three days a week after work, he adds an additional afternoon run, usually at a faster pace. He sometimes also does repeated 400 meter intervals on a local high school track. On Sunday mornings, he goes for a long run of about 14 miles. He is especially excited about an upcoming race, where he hopes to get a Boston Marathon qualifying time (under 3 hours, 5 minutes).

James is overweight. He neglected his health for a few years, and has begun to notice the negative effects on his quality of life. He gets heartburn and feels winded when walking up the stairs. While he generally eats fairly well, his exercise routine has been nonexistent. With the encouragement of his wife, James has decided to recommit himself to a healthy lifestyle. He has decided to train for a five kilometer race two months from this time. Because he has been somewhat sedentary, his runs are short in distance and at a measured pace. His wife is very proud of his progress so far, which had increased and sustained his desire to maintain his plan.

Cory is very healthy and fit. He has very nutritious and health-conscious diet. On the weekends, he likes to hike in the nearby national park. He also boulders (i.e. climbs short, very technical rock-climbing routes), and is considered an exceptionally strong climber among his friends. He has no interest in running, nor has he trained for any type of race since his time in high school fifteen years ago.

These examples present three different types of athletes. They vary on three critical dimensions that are essential to gaining a better understanding of readiness (see Table A.1). These are their motivations to engage in this innovation, their innovation-specific skill, their general characteristics that can be applied to any innovation. This innovation is the running program. We can see that this might include several components, including quality shoes, workout clothing, knowledge of efficient training models, even the physical ability to keep both feet off the ground at a threshold pace.

For Fitz, he is high on all of these components. He has the health, the specific training program, and the motivations to perform at a high level. James lacks health and is just a novice at the training process. However, his has specific goal in mind, along with the support and desire to achieve his goal. Finally, Cory has a strong set of healthy living skills. However, when it comes to running, he lacks the desire and the specific skills necessary to implement a running program. This is not to say that he should run instead of bouldering and hiking; rather, he is not fully ready to start running at this particular time.

Table A.1: Comparing three example athletes

	Motivation to Start a Running Program	Running-Specific Skills and Knowledge needed	General Health
Fitz	High	High	High
James	High	Low	Low
Cory	Low	Low	High

Appendix B: Readiness Article coding forms

Box 1. Background (To be collected for all articles)

<table>
<tr><td colspan="5">Article Title:</td></tr>
<tr><td colspan="5">Author(s): Research Group</td></tr>
<tr><td colspan="2">Year of Publication</td><td colspan="3"></td></tr>
<tr><td colspan="2">Is this article codable?</td><td colspan="3">☐ Yes, ☐ If no, for what reason (Specify)</td></tr>
<tr><td colspan="2" rowspan="4">Innovation (Specify)</td><td colspan="3">☐ Policy</td></tr>
<tr><td>☐ Program/ intervention</td><td colspan="2">☐ Promotion
☐ Prevention
☐ Treatment
☐ Could not determine</td></tr>
<tr><td colspan="3">☐ Process</td></tr>
<tr><td colspan="3">☐ Other (Specify):</td></tr>
<tr><td colspan="2" rowspan="2">Content Area:</td><td colspan="3">☐ Behavioral Health
☐ Health Care
☐ Public Health
☐ Business
☐ Educational</td></tr>
<tr><td colspan="3">☐ Other (Specify):</td></tr>
<tr><td colspan="2" rowspan="3">Sample Size</td><td># of Organizations</td><td colspan="2"></td></tr>
<tr><td># of individuals</td><td colspan="2"></td></tr>
<tr><td colspan="3">☐ Could not determine</td></tr>
<tr><td rowspan="4">Project Timeline</td><td>When was the innovation selected?</td><td></td><td>☐ Could not determine</td></tr>
<tr><td>How much time passed until implementation planning began?</td><td></td><td>☐ Could not determine</td></tr>
<tr><td>How much time passed until implementation began?</td><td></td><td>☐ Could not determine</td></tr>
<tr><td>Was the innovation discontinued?</td><td colspan="2">☐ Yes (Reason given:_____)
☐ No
☐ Could not determine</td></tr>
</table>

The Relationship between Support System Activities and the Subcomponents of R=MC^2

Box 2: Components of Readiness

<table>
<tr><th>Motivation</th><th colspan="2">Innovation-Specific Capacity</th><th>General Capacity</th></tr>
<tr><td>☐ Relative Advantage</td><td colspan="2">☐ Knowledge, Skills, Abilities</td><td>☐ Organizational Culture</td></tr>
<tr><td>☐ Compatibility</td><td colspan="2">☐ Program Champion</td><td>☐ Organizational Climate</td></tr>
<tr><td>☐ Complexity</td><td colspan="2">☐ Implementation Supports</td><td>☐ Organizational Innovativeness</td></tr>
<tr><td rowspan="2">☐ Trialability</td><td rowspan="2">☐ Inter organizations Relationships</td><td>☐ Between Support and Delivery System</td><td rowspan="2">☐ Resource Utilization</td></tr>
<tr><td>☐ Between Delivery Systems</td></tr>
<tr><td>☐ Observability</td><td colspan="2" rowspan="3">☐ Other</td><td>☐ Leadership</td></tr>
<tr><td>☐ Priority</td><td>☐ Organizational Structure</td></tr>
<tr><td rowspan="2">☐ Other</td><td>☐ Staff Capacity</td></tr>
<tr><td></td><td>☐ Other</td></tr>
</table>

Box 3: Measuring the Subcomponents of Readiness

<table>
<tr><td rowspan="4">Measurement</td><td colspan="3">☐ Qualitatively (Define)</td></tr>
<tr><td rowspan="3">☐ Quantitatively</td><td colspan="2">☐ Instrument (Name):</td></tr>
<tr><td rowspan="2">☐Psychometric Data Available</td><td>☐ Reliability</td></tr>
<tr><td>☐ Validity</td></tr>
<tr><td colspan="3">☐ Could not determine</td></tr>
<tr><td>Level of Subcomponent</td><td colspan="3">☐ Individual
☐ Organizational
☐ Could not determine</td></tr>
<tr><td>Timing</td><td colspan="3">☐ Before Implementation
☐ During Implementation
☐ Could not determine</td></tr>
</table>

Box 4: Independent Variable: Support System Strategy

What was name of the intervention or method?

What did this method consist of? (Check all that apply)	☐ Tools ☐ Training ☐ Technical Assistance (TA) ☐ Quality Assurance (QA) ☐ Quality Improvement (QI)
	☐ Other: write in:
Who provided this support?	☐ Internal to Organization ☐ External to Organization ☐ Could not determine

Box 5: Dependent Variable: Readiness Outcomes

Did the support system strategy specifically target a subcomponent of readiness?	☐ Yes ☐ No ☐ Could not determine		
Did component of readiness change?	☐ Yes ☐ No ☐ Could not determine		
How are Outcomes Reported	☐ Qualitatively (write in)		
	☐ Quantitatively	☐ Effect Size Reported	
		☐ Effect Size can be computed	☐ write in parameters:

Box 6: Outcomes of Innovation

What were outcomes of the innovation?			
Did innovation have intended outcomes?	☐ Yes ☐ No ☐ Could not determine		
How are Outcomes Reported	☐ Qualitatively (write in)		
	☐ Quantitatively	☐ Effect Size Reported	
		☐ Effect Size can be computed	☐ write in parameters:

Assessing Risk of Bias

Box 7: Assessing Risk of Bias

Evaluation Design	☐ Case Study	Pre-Post Assessment ☐ Yes ☐ No
	☐ Comparison Group	
	☐ Random Assignment	☐ Test of equivalence
	☐ Other Possible Sources of Internal Bias: write in:	
Innovation Rationale	☐ Included ☐ Mandated Use	
Implementation Quality	☐ Fidelity	
	☐ Dosage	
	☐ Participant Responsiveness	
	☐ Differentiation	
	☐ Reach	
	☐ Adaption	

Box 8: Illustrative Narrative Passages

Appendix C: Coding Guidebook

Evidence for Support Strategy Effectiveness

Box 1: Background information

- Authors/Research Group
- Year of publication
    - By month, if reported
- Content area
    - Behavioral Health: The setting in which the innovation in introduced pertains to a disorder or a condition that is primarily psychological in nature.
    - Health Care: The setting in which disorder or conditions that is primarily medical in nature
    - Public Health: the formal and informal network of organizations that focus on promoting and preventing community-level health concerns (Honoré et al., 2011)
    - Business: The setting in which the innovation is introduced attempts to sell a product or service that is not primarily behavioral health, health care, or educationally oriented.
    - Education: The setting in which the innovation is introduced is primarily instructional
        - If a behavioral health or health disorder is being addressed in a school setting, the content area should be coded as education.
    - Other:
- What is the innovation being implemented?
    - Policy: course or method of action to guide and determine present and future decisions
    - Program: A specific intervention designed to change a specific condition
        - Promotion: Designed to foster proactively foster positive conditions
        - Prevention: Designed to prevent an adverse condition from occurring
        - Treatment: Designed to reduce an existing, adverse condition
        - Could not determine
    - Process: a continuous operation or method of completing a task
    - Could not determine
- Sample Size
    - # of organizations involved in the innovation that were studied
    - # of individuals: a singular person
    - Not reported

- Project timeline (“Could not determine”) is option for all of before
    - When was the innovation selected?
    - How much time passed until implementation planning began?
        - Intentional efforts to build conditions needed for the innovations
    - How much time passed until implementation began?
        - The innovation was put into practice
    - Was innovation discontinued?
        - Yes: Record the reason, if given, why the innovation stopped
        - No
        - Could not determine

Box 2: What is the construct(s) being defined?

To ascertain initial consensus around the definitions of each subcomponent of readiness, three articles were selected from the initial literature search (Table 6.1). These are listed under each subcomponent and included in the appended references.

Motivation: Perceived incentives and disincentives that contribute to the desirability to use an innovation (Scaccia et al., under review)

- **Relative Advantage:** Degree to which a particular innovation is perceived as being better than what it is being compared against; can include perceptions of anticipated outcomes (Rogers, 2003)
    - The degree to which an innovation is perceived as better than the idea it supersedes (Vedel et al., 2013)
    - The degree to which the treatment innovation is perceived as being better than the idea, product, or method it will replace (Windsor et al., 2013)
    - Positive opinion of guidelines relative to the status quo (Mâsse et al., 2013)
- **Compatibility:** Degree to which an innovation is perceived at being consistent with existing values, cultural norms, experiences, and needs of potential users (Rogers, 2003)
    - Management and systems developers must choose the software that matches the current legacy systems (Rahimi et al., 2009)
    - Consistent with the existing values, past experiences, and needs of potential adopters (Philliber & Nolte, 2008)
    - [qualitatively defined for specific innovation] (Carlfjord et al., 2010)
- **Complexity:** Degree to which innovation is perceived as relatively difficult to understand and use (Rogers, 2003)
    - Perception that the innovation is difficult to learn and use (Greiver et al, 2011)
    - Characteristics of the intervention, delivery, requirements on government capacity, and usage characteristics (Yamey, 2012)
    - The degree to which an innovation is perceived as being simple to comprehend and utilize (Patel & Antonarkis, 2012)
- **Trialability:** Degree to which an innovation can be tested and experimented with (Rogers, 2003)
    - "When participating in the system implementation, the users should be allowed a transition period that gives them time to understand and appreciate the outcome of the system implementation." Rahimi et al., 2009)
    - Limited testing to explore process and outcomes (Luxford et al., 2006).
    - Degree to which the innovation can be attempted or sampled on a partial basis (Lafferty et al., 2003)
- **Observability:** Degree to which outcomes that result from the innovation are visible to others (Rogers, 2003)
    - Whether results of the innovation are visible (Nieboer et al., 2011).

    - Positive impacts and unintended consequences were observed as a result of implementing guidelines (Mâsse et al., 2013)
    - [Being able to watch the conduct on live meetings (innovation-specific)] (Sakraida & Drous, 2003)
- **Priority:** Collective expectations about the extent to which innovation use is expected and meriting attention (Klein et al., 2001).
    - Extent to which teachers believed it was their responsibility [to teach students social and character development concept], (i.e. the innovation) (Beets et al., 2008).
    - Perceived support to adopt [specific innovation] (Leitlein et al., 2011).
    - Voluntariness; i.e. perception of implementation as voluntary (Vyth et al., 2011).
- **Other:** Does not conform to any of the above motivations
    - Write description of subcomponent
    - Propose name for subcomponent (drawing from literature)

Innovation-Specific Capacity: the human, technical, and fiscal conditions that are important for successfully implementing a *particular* innovation with quality (Flaspohler et al., 2008)

- **innovation-specific knowledge, skills, and abilities:** The technical knowledge, skills, and abilities needed for the innovation
    - Not searched
- **Champion**: Individual(s) who put charismatic support behind an innovation through connections, expertise, and social influence
    - Those who act entrepreneurially to engage themselves and others with the innovation (Hendy & Barlow, 2012).
    - Those who have knowledge of innovation with leadership skills and are interested in ensuring knowledge transfer (Gagnon et al., 2010).
    - Individuals who would be the point person for the project and help drive their team's QI efforts (Shaw et al., 2012).
        - Shaw et al (2012) also noted that champions: (1) actively and enthusiastically promoting a new innovation(2) making connections between different people in the organization, (3) mobilizing resources, (4) navigating the sociopolitical environment inside the organization, (5) building support for the innovation by expressing a compelling vision and boosting organizational members' skills and confidence and (6) ensuring that the innovation is implemented in the face of organizational inertia or resistance. ”
- **Specific Implementation Climate Supports**: Extent to which the innovation is supported; presence of strong, convincing, informed, and demonstrable management support (Klein & Knight, 2005).
    - Management provides a clear, strategic vision for the innovation; management champions and has clear strategic investment rationale (Choi & Chang, 2009)

    - Effective middle and upper managers who are actively involved in implementing and sustaining [the innovation]… show a clear understanding of the [innovation], communicated that understanding to agency staff, allocated sufficient resources to the team, and monitored the team's fiscal viability (Mancini et al., 2009).
    - Managers' commitment to conduct transformation of the organization and to invest in quality implementation policies and procedures to implement the innovation (Klein, Conn, &Sorra, 2001).
- **Interorganizational Relationships:** Consists of relationships between
    - Providers and support systems
        - Accessing services from "Resource System" (Riley et al., 2003).
    - between different provider organizations that are used to facilitate implementation
        - Integrative processes (communication, cooperation, and coordination) and integrative performance (strategy implementation, willing to continue to work together and growth and well-being) (Evans & Baker, 2012)
        - Normative (commitments & values), functional (innovation-specific), and clinical (organizational supports) (Touati et al., 2006).

General Capacity: Activities related to maintaining a functioning organization (e.g., maintaining sufficient staffing, developing organizational leadership) and connecting with other organizations and the community (Wandersman et al., 2008)

- **Culture:** Expectations about how things are done in an organization; (Glisson & James, 2002; Hemmelgarn, Glisson, & James, 2006). This is how an organization or a system functions (Glisson, 2007).
    - A pattern of shared basic assumptions – invented, discovered or developed by a given group as it learns to cope with its problems of external adaption and internal integration – that has worked well enough to be considered valid and, therefore to be taught to new members as the correct way to perceive, think, and feel in relation to those problems (Schein (1985) cited by Scahill (2012) and Marchionni & Ritchie (2008)).
    - Organizational values, expectations and assumptions that exist within an organization (Austin & Claasen, 2008)
    - Model of norms, values, beliefs and attitudes which affects organizational behavior (Allame et al 2011).
- **Climate:** How employees collectively perceive, appraise and feel about their current working environment
    - Reflects workers' perceptions of, and emotional responses to, the characteristics of their work environment (Aarons and Sawitzky, 2006).
- **Organizational Innovativeness:** General receptiveness toward change; i.e., an organizational learning environment (Fetterman & Wandersman, 2005; Rogers, 2003)
    - An organization's tendency to engage in and support new ideas, novelty, experimentation, and creative processes that may result in new products, services, or technological processes. Although innovations can vary in

their degree of radicalness, innovativeness represents a basic willingness to depart from existing technologies or practices and venture beyond the current state of the art." Lumpkin and Dess (1996) quoted in Vrontis et al., (2012).
    - "A creative climate," see climate above (Zain et al., 2002)
    - *JPS: climate and innovativeness are conflated sometimes.*
- **Resource Utilization:** How discretionary/uncommitted resources are devoted to innovations.
    - *JPS note: Alternate search terms (resource allocation)*
    - Financial constraints, mobilizing new resources, developing financial accountability (Yamey, 2012)
    - Capacity to dedicate to innovation (Griever et al., 2011).
    - Resources dedicated to the implementation of an innovation (Gray et al., 2013).
- **Leadership:** Whether power authorities articulate and support organizational activities
    - Leadership begins with a clear vision of a goal, and effective leaders articulate the vision and inspire people to follow (Murphy, 2011).
    - The ability of a leader to exercise diffuse and intense influence over the beliefs, values, behavior, and performance of others through his or her own behavior, beliefs, and personal example (Michaelis et al., 2009).
    - Middle managers who show good leadership help to diffuse information, synthesize information, provide day to day activity mediation and strategy, and sell innovation implementation (Birken et al., 2012).
- **Structure:** Processes that impact how well an organization functions on a day-to-day basis
    - Internal policies and processes (Riley et al., 2003)
    - Standardization of implementation approaches (Drach-Zahavy et al., 2004).
    - Two broad structuring processes:
        - bureaucratic job structuring: developing implementation quality through such mechanisms as centralization of authority, routinization of the job's requirements, and formalization of work through extensive emphasis on documentation and written procedures
        - person-job integration: developing good learning conditions and free access to feedback information for enhanced sense-making and improvisation, and designing complete jobs that foster incumbents' identification with them
    - Processes that can facilitate or impede use of innovation (Zazzali et al., 2008).
- **Staff Capacity:** General skills, education, and expertise that the staff possesses (Flaspohler et al., 2008)
    - Initial capabilities for implementation (Lundgren et al., 2011)
    - Necessary staff skills (Walker & Matarese, 2011).

- Skill variety includes the number of different activities, work procedures, and processes necessary to accomplish a task that involves talents and skills on the part of the employee (Noefer et al., 2009).

Box 3. Measuring the Subcomponents of Readiness

- How was the subcomponent of readiness measured?
  - Qualitatively (the subcomponent is described through narrative)
  - Quantitatively (a measure is used that yields numerical data)
    - Instrument:
      - Name
      - What psychometric data is available?
        - Validity
        - Reliability
  - Could not determine
- What is the measurement level of the subcomponent?
  - Individual: the individual provides ratings on themselves at the person-level
  - Organization: ratings are provided on the organizational as a whole
  - Could not determine
- When were subcomponent measured?
  - Before implementation (the innovation is not yet being used)
  - During implementation (after innovation use has started)
  - Could not determine

Box 4: Support system strategies.

- Write name of intervention (if provided)
- What techniques were used to address the subcomponents of readiness?
  - Tools: resources designed to synthesize and communicate knowledge about the innovation
  - Training: planned, instructional activity intended to facilitate acquisition of knowledge, skills, and attitudes in order to enhance learner performance
  - Technical Assistance: ongoing, hands on coaching to enhance use of an innovation
  - QA/QI: involves the use of tools and logic to assess (QA) or enhance (QI) quality performance
  - Other technique (write it):
- Who is providing the support?
  - External to the organization: Supports are being provided by people who work for a different agency than the organization being studied.
  - Internal to the organization: Supports are being provided by people who work within the same organization being studied.

Box 5: Dependent Variable: Readiness Outcomes

- Did Support Strategy target explicitly specific components of $R=MC^2$?
  - Yes: designed to change subcomponent of readiness
  - No: did not explicitly target subcomponent of readiness
  - Could not determine

- Did readiness change as a result of support strategies:
    - Yes: changes explicitly reported in readiness
    - No: no changes reported
- How was the subcomponent of readiness measured?
    - Qualitatively (the subcomponent is described through narrative)
    - Quantitatively (a measure is used that yields numerical data)
        - Instrument:
            - Name
            - What psychometric data is available?
                - Validity
                - Reliability
    - Could not determine

Box 6: Outcomes of the Innovation

- What were the outcomes of the innovation
- Did the innovation have intended outcomes:
    - Yes (outcomes were predicted)
    - No (outcomes were not reached)
    - Could not determine
- How were outcomes measured?
    - Qualitatively?
        - Write it
    - Quantitatively?
        - Effect size: Strength of finding based on sample size
        - Effect size can be computed

Box 7: Assessing Study Design Characteristics

- What was the evaluation design? (evaluation failure)
    - Case Study (one (or more) organization is described through narrative (e.g. Armenakis et al, 1993)
        - Pre-post assessment included?
            - (there is a survey or measure that quantitatively tracked changed over the course of the innovation)
    - Comparison Group: one group did not received the same support strategy
        - Control Group: One group did not receive a support strategy.
    - Random Assignment: Organizations were randomly assigned to receive a tailored vs. non-tailored support strategy
    - Other sources of Bias: (From Higgins et al. 2011)
        - Selection: how participants were selected/assigned
        - Performance: participant blinding
        - Detection: outcome blinding
        - Attrition: reason for exclusion specified
        - Reporting: selective reported of outcomes
        - Other
- Is there rationale for the innovation reported? (theory failure).
    - The theory or reason behind the innovation (i.e. innovation specified)

        - Mandated innovation: The organization is required to put the innovation into place by a third party external to the organization)
- Information about implementation (Implementation failure)
    - How was implementation quality assessed?
        - Fidelity (adherence or integrity to the innovation protocol)
        - Dosage (amount of innovation used)
        - Participant Responsiveness (engagement in the innovation)
        - Differentiation (differences from other innovations)
        - Reach (proportion and representativeness of end users)
        - Adaption (documented changes in the innovation)

Box 8

- Qualitative quotes
    - Illustrative passages

Appendix D: Coding Form References

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