AN ABSTRACT OF THE DISSERTATION OF

Ryan R. Singh for the degree of Doctor of Philosophy in Public Health presented on September 15, 2020.

Title: Understanding the Role of First-Level Supervisors in Shaping Implementation Climate: The Development and Examination of a Middle-Range Theoretical Model

Abstract approved: _____

M. Margaret Dolcini

Implementation climate is the most proximal organizational predictor of implementation success. First-level supervisors are in a pivotal position to influence implementation climate, as they directly oversee frontline staff who deliver evidence-based interventions (EBIs). First-level supervisors who exhibit strong leadership and utilize best practices in supervision may be able to establish a strong implementation climate. This study aimed to develop and test a middle-range theory exploring 1) first-level supervisor implementation climate influence on first-level supervisor behaviors (i.e., supervision & implementation leadership), and, 2) the dual role of first-level supervisors in shaping caseworker (i.e., frontline staff) implementation climate within the child welfare system (CWS). The theory, which expands on Aarons and colleagues' organizational framework (2012), was examined using data from a study assessing the implementation of R^3, a CWS supervisor-targeted intervention to promote the effective use of EBIs ($N = 91$ supervisors; 331 caseworkers). A hierarchical linear modeling approach was employed to analyze all paths of the theoretical model. Single timepoint predictors at baseline and one-year later were modeled to estimate associations with change in outcome variables (i.e., supervisor fidelity to R^3, supervisor implementation leadership, caseworker implementation

climate) over time. Descriptively, first-level supervisor perceptions of implementation climate did not demonstrate a strong correlation with the caseworkers whom they supervised (e.g., $r(70) = .119$, $p > .319$), suggesting distinct perceptions of implementation climate are possible. Results support the hypotheses that effective supervision (i.e., fidelity to R^3) and implementation leadership significantly increase caseworker implementation climate (e.g., $\beta = .212$, $p = .010$ & $\beta = .228$, $p = .030$ respectively). Further, first-level supervisor implementation leadership behaviors at baseline were associated with a substantial increase in fidelity ($\beta = .196$, $p < .001$). First-level supervisor implementation climate was associated with an increase in **f**idelity. Results from path analyses between first-level supervisor implementation climate and implementation leadership were inconclusive. In summary, the findings that first-level supervisors serve a dual role in shaping implementation climate supports the theoretical model, and, is a novel contribution to the field. This finding suggests that training initiatives to improve supervision and leadership have the potential to impact implementation success. Further research is needed to understand 1) the antecedent(s) that influence implementation leadership, and, 2) how first-level supervisors support caseworkers even when the organization implementation climate is poor.

Understanding the Role of First-Level Supervisors in Shaping Implementation Climate: The Development and Examination of a Middle-Range Theoretical Model

by
Ryan R. Singh

A DISSERTATION

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Doctor of Philosophy

Presented September 15, 2020
Commencement June 2021

Doctor of Philosophy dissertation of Ryan R. Singh presented on September 15, 2020

APPROVED:

Major Professor, representing Public Health

Head of the School of Social and Behavioral Health Sciences

Dean of the Graduate School

I understand that my dissertation will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my dissertation to any reader upon request.

Ryan R. Singh, Author

ACKNOWLEDGEMENTS

I acknowledge the many professors within the College of Public Health and Human Sciences who have influenced my learning, but none more so than Dr. Peggy Dolcini. Peggy, to say I was lucky to be placed with you as my advisor is an understatement. Your guidance and support were so much more than I could have ever expected. I am grateful for the opportunities you provided for me, and, the times you have advocated on my behalf. Thanks to you, I feel confident in transitioning out of the doctoral program, towards becoming an independent researcher.

To Dr. Joe Catania, thank you for your mentorship, the invaluable lessons from the classroom, and the very many hallway conversations. You have a brilliant mind. You have shown me that big ideas are worth pursuing. I have listened to you, and, I have retained it all.

Thank you to my fellow students. There have been so many moments throughout my time in our program where I have been moved by the level of support and sincere kindness you have all shown to each other and to me. I appreciated the level of depth we, as public health students, brought to the classroom during discussions. I want to acknowledge the inspirational professors that led such classes, particularly Drs. Joe Catania, Peggy Dolcini, Brian Flay, and Veronica Irvin. There are many other wonderful faculty who made time to support me, including Drs. Kari-Lyn Sakuma, Jeff Luck, John Edwards, John Geldoff, Rick Settersten, and Sheryl Thorburn.

To Dr. Lisa Saldana, thank you for investing in me. I look forward to your continued mentorship, as well as the opportunity to work in an organization full of bright, hard-working people. A special thank you goes to one future colleague, Dr. Jason Chapman. Jason, I am grateful for the time you devoted to teaching me the skills necessary to complete this

dissertation. In addition, I want to thank Courtenay Padgett, Holle Schaper, and Don Hood, who all took time from their busy schedules to support me.

To Lilly, I am a proud father to the absolute best daughter and most beautiful person I know. To Xavier, you are the greatest challenge I have ever taken on, and I love it. My children are my happy place, and, dogs truly make this world better. We came to Oregon with Sully, and we will hold him in our hearts forever. Toro was quite literally by my side when I finished this dissertation. Neither asked to be a part of our family, but we would not be the same without them. To my whole family, especially my parents: Thank you, thank you, thank you! Additionally, thanks and gratitude go to the Cusack and Huff families, friends here in Corvallis that my family and I have come to know and love.

Finally, to my Amy, the only person who will ever truly understand what this degree means to me, I love you. It is because of you that we sent in my application to Oregon State University, that we uprooted everything to pursue this degree, and, that I have finished. I needed you through this journey, and you were there for me. Thank you for your ability to hold our family together.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

LIST OF FIGURES (Continued)

LIST OF TABLES

Chapter 1: Introduction

In light of increasing emphasis on dissemination of evidence-based interventions (EBIs), it is important for organizations to establish a climate that conveys support for implementation of new programs. Implementation climate, or the extent to which organizational members perceive that the adoption, implementation, and use of an EBI is expected, rewarded, and supported by the organization (Ehrhart, Aarons, & Farahnak, 2014), is associated with the success of EBI implementation (Aarons et al., 2012) and may serve as the most proximal organizational-level antecedent to implementation success (Williams et al., 2020; Aarons et al., 2017). Leadership at the highest level of an organization (i.e., system-level leadership**;** e.g., administrators, executive directors) establishes an implementation climate through policies, procedures, and practices that demonstrates a level of commitment to implementing a new EBI. Yet, system-level leaders tend to be disconnected to the individuals on the front lines of EBI delivery. This is particularly evident in highly centralized, vertically-structured organizations (Rogers, 2003; Weiner et al., 2011). Regardless, system-level leaders may be able to establish a positive climate that is conveyed through supervisors who directly support frontline staff (i.e., first-level supervisors; Aarons, Ehrhart, Farahnak, & Sklar, 2014). Thus, first-level supervisors may, through supervision and leadership, play a pivotal role in facilitating successful implementation of new EBIs.

EBI Implementation Within Organizational Settings

Organizational structure can impact the degree to which intra-organizational units (i.e., frontline staff, first-level supervisors, system-level leaders) share perceptions of implementation climate. Highly centralized organizations, in which the decision-making power is concentrated among system-level leaders, tend to be less successful in implementing EBIs compared to

organizations in which decision-making power is more evenly dispersed (Rogers, 2003). Leaders in centralized organizations often fail to convey their support for new EBIs throughout the organization (Weiner et al., 2011). In addition, system-level leaders often fail to identify operational-level problems or to suggest relevant innovations to mitigate these problems (Rogers, 2003). Limited opportunity to communicate, and inconsistent messages regarding EBI-related information interfere with the establishment of a cohesive climate (Weiner et al., 2011).

If system-level leaders fail to establish a supportive implementation climate, implementation success is unlikely (Aarons, Ehrhart, Farahnak, & Sklar, 2014). In fact, a change in system-level leader support for an EBI is one of the main reasons for mis-implementation (Brownson et al., 2015). It may be, however, that first-level supervisors are able to shape a positive implementation climate for frontline staff, regardless of higher-level support. Due to their proximity in directly overseeing frontline staff, first-level supervisors can employ effective supervision and leadership that promotes implementation (Bearman et al., 2017; Casillas et al., 2016; Aarons et al., 2012). Yet, first-level supervisors lack the power, and often times, the skills necessary to effectively promote EBI implementation (Aarons et al., 2012). Thus, investing in opportunities to support first-level supervisors through strengthening supervision and leadership may be a key intervention point to strengthen implementation processes.

First-Level Supervision & Leadership

Implementation is a process that unfolds within an organization in which frontline staff are expected to adapt to delivering a new EBI. This period of change can be a time of uncertainty. Thus, frontline staff need to be supported to ensure that EBIs are delivered effectively (Fixsen et al., 2005). Support should begin in the earliest stages of implementation (i.e., EBI adoption; Bertram et al., 2015). External consultation, which is commonplace during

implementation, provides staff support (Dorsey et al., 2018). However, it is generally time-limited. Consequently, successful implementation and subsequent sustainability of EBIs are in jeopardy in the absence of internal organizational support for frontline staff. First-level supervisors have the potential to provide such support because they are positioned to simultaneously employ effective supervision (e.g., direct observation & feedback, positive reinforcement, problem-based learning) and leadership (i.e., implementation leadership) that promote the use of a new EBI (Aarons & Sommerfield, 2012). However, many first-level supervisors are not adequately trained in the skills necessary to support those on the front lines (Aarons, Ehrhart, & Farahnak, 2014).

There is a paucity of research on the effect of training first-level supervisors to support frontline staff (Dorsey, et al., 2018). Existing evidence suggests that training first-level supervisors during EBI implementation in strengthening supervision has a significant impact on implementation outcomes (Casillas et al., 2016; Saldana et al., 2016). Best practices in supervision include such strategies as observation and feedback, but the dose and timing of these strategies are not well understood (Durlak & Dupre, 2008). Further, evidence is lacking for effective strategies on *how* to deliver feedback that, in turn, reinforces positive behaviors and changes negative behaviors (Dorsey et al., 2018).

Research on organizational leadership during implementation is extensive (e.g., Aarons et al., 2012; Aarons, Ehrhart, & Farahnak, 2014; Aarons, Ehrhart, Farahnak, & Sklar, 2014; O'Reilly et al., 2010), but much of this work has focused on system-level leadership. Emerging research has contributed to a better understanding of implementation leadership behaviors of first-level supervisors and others in a position of lower-level leadership (i.e., middle managers; Birken et al., 2018; Williams et al., 2020). Beyond the common deficit in supervision training,

the ability of first-level supervisors to provide effective leadership may be compromised by their limited influence within the organization (Aarons et al., 2012). Thus, a better understanding of the role of first-level supervisors in providing both supervision and leadership during periods of EBI implementation, and how these individuals react to, and impact organizational factors related to implementation success, may inform future implementation practices.

The Current Research

This dissertation sought to understand the role of first-level supervisors in shaping implementation climate for frontline staff (i.e., caseworkers) in the child welfare system (CWS). EBI implementation within the CWS is frequently constrained due to multiple factors within the organizational setting (Institute of Medicine [IOM], 2014). The CWS is a national program that relies on states to operate child welfare programs under federal guidelines. Many states employ a top-down approach in which power is concentrated at the state level (i.e., system-level; IOM, 2014). Undertraining and poor supervision are systemic issues that impede the success of CWS-related EBIs (Gunderson et al., 2018; IOM, 2014). This lack of preparedness leads to compromised EBI delivery, and ultimately, poorer outcomes for children and families who are involved with the system (IOM, 2014; U.S. Department of Health & Human Services [HHS], 2019).

To achieve the study aims, this dissertation used data from a hybrid effectiveness-implementation study of an intervention targeted to first-level supervisors in a state with a highly centralized CWS. The intervention is intended to strengthen first-level supervision and leadership by infusing evidence-based practices into interactions between caseworkers and the children and families they serve. Guided by the framework of organizational factors that influence implementation proposed by Aarons et al. (2012), I examined how first-level

supervisors influence the implementation climate of CWS caseworkers. Based on the existing literature, I proposed that first-level supervisors had the potential to shield caseworkers from organizational factors known to impede implementation. In doing so, first-level supervisors who employ effective supervision and leadership may be able to establish a positive implementation climate for caseworkers, a proxy indicator of implementation success. Pilot data from a previous study of the supervision-based EBI demonstrates that fidelity to this intervention strengthens effective supervision (Saldana et al., 2016).

I constructed a middle-range theoretical model specific to first-level supervision and leadership that amplifies Aarons et al.'s framework. I assessed relationships between implementation climate and first-level supervision and leadership to build a model that explains how first-level supervisors influence the implementation climate of caseworkers. A deeper understanding of supervision and leadership strategies, and the relationship between the two, may provide additional insight into future supervisor-based interventions to promote successful EBI implementation.

Chapter 2: Literature Review

This dissertation is focused on the role of first-level supervisors in establishing a positive implementation climate for frontline staff. When higher-level leaders demonstrate a strong commitment to implementation, first-level supervisors must also be able to convey support for a new EBI. In instances in which system-level leaders fail to demonstrate strong support, mis-implementation is a likely outcome (Brownson et al., 2015). However, first-level supervisors can employ strategies to shield frontline staff from organizational challenges that may be construed as a lack of support for implementation (Aarons et al, 2012). The actions of system-level leaders have an overarching impact on organizational factors that relate to implementation outcomes (Aarons et al., 2012). Yet, relationships among these organizational factors are not well understood (Fernandez et al., 2018). Further, there is a paucity of empirical literature that hones-in on the role of first-level supervisors (i.e., specific strategies for supervision and leadership behaviors) during implementation. Thus, a better understanding of the relationships among such organizational factors may help bridge the gap between the push for increased dissemination of EBIs and the inability to successfully implement these EBIs within organizational settings. This dissertation examines the role of first-level supervisors in establishing a positive implementation climate for frontline staff through an EBI implementation.

Dissemination & Implementation Science

The evidence-based movement has been limited by the challenge of translating EBIs into the real-world (Fixsen et al., 2009). Human service settings struggle with adopting, implementing, and sustaining EBIs that have the potential to improve population health outcomes. Translation of EBIs in human service settings is complex. That is, EBIs have to be delivered by numerous individuals, within a variety of organizations, situated in a larger state or

federal system (Fixsen et al., 2009). This complex system presents challenges for moving effective programs to practice. In fact, it takes considerable time to translate a small proportion of original research into real-world practice for the benefit of the population (Colditz, 2012). Within the medical field, for example, it has been estimated to take 17 years for 14% of original research to move to the benefit of patient care (Balas & Boren, 2000). Scientific discovery does not, in and of itself, lead to the use of new knowledge, and, evidence of EBI efficacy does not automatically lead to the uptake of new interventions (Colditz, 2012). Further, organizations tend to be ill-equipped to support the culture of evidence-based practice. Therefore, it is important to address organizational challenges to improve EBI dissemination and implementation in order to close the research to practice gap.

Dissemination science is the study of the targeted distribution of information and intervention materials to a specific public health or clinical practice audience. The intent is to understand how best to spread and sustain knowledge and the associated EBIs (National Institute of Health [NIH], 2017). Dissemination may involve both passive (e.g., mass publications) and active (e.g., EBI replication manuals, technical assistance) approaches. Passive dissemination involves a non-tailored, mass-messaging effort, and generally one of the most economical strategies of knowledge transfer (Vedel et al., 2018). Active diffusion, on the other hand, is a more targeted approach. It involves actively targeting and packaging information for the end user (Vedel et al., 2018), and, is attributed to greater success in moving EBIs to the point of implementation (Rabin & Brownson, 2012). Implementation science is the study of the use of strategies to adopt and integrate EBIs into clinical and community settings in order to improve patient outcomes and benefit population health (NIH, 2017). Thus, dissemination and implementation (D&I) science, together, can be defined as the active approach of moving EBIs

from research to practice, and integrating these EBIs within an organization for the benefit of a target population.

Factors Influencing D&I

Factors that influence the success of D&I include characteristics associated with, 1) the EBI, 2) the individuals involved in the implementation process, 3) the implementation process itself, and 4) the context in which implementation takes place (Damschroder et al., 2009; Rabin & Brownson, 2012). EBIs are often comprised of multiple program components, which are required for effective delivery in the real-world. These core components represent the operational form of the underlying theoretical framework on which an EBI is built (Leviton & Trujillo, 2017), and are essential to program effectiveness (Fixsen et al., 2005). Fidelity, or the effective implementation of core components (Allen et al., 2012), is strongly associated with improved population health outcomes (Fixsen et al., 2005; Allen et al., 2012; Carroll et al., 2007; Durlak & DuPre, 2008; Eames et al., 2008; Johnson-Kozlow et al., 2008). Generally, the more complex, or more components an EBI has, the more challenging it is to deliver with high fidelity (Fixsen et al., 2005).

Characteristics of the individual include, but are not limited to, attitudes associated with delivering a new EBI (Rabin & Brownson, 2012; Elliot et al., 2003), as well as self-efficacy and motivation (Damschroder et al., 2009). Positive attitudes for those expected to deliver EBIs, in particular, are strongly associated with implementation success (Aarons et al., 2012). Evidence suggests that a positive organizational climate is closely linked to positive attitudes and successful implementation outcomes (Williams et al., 2020; Glisson, Landsverk, Schoenwald, et al., 2008; Aarons & Sawitzky, 2006). Implementation climate, an implementation-specific

component of organizational climate, is the most proximal organization-level predictor of individual attitudes regarding implementation (Williams et al., 2020; Aarons et al., 2012).

Implementation should be considered as a process composed of multiple phases (Saldana, 2016; Chamberlain et al., 2011; Fixsen et al., 2005; Bertram et al., 2015; Aarons et al., 2012; Damschroder et al., 2009). The process generally begins with EBI exploration and adoption and moves towards full implementation in which frontline staff are routinely delivering an EBI with high fidelity (Bertram et al., 2015). Implementation takes place over an extended period of time (e.g., 2 to 4 years), and, requires an organization to adjust to facilitate good fit between the new EBI and the organization itself (Bertram et al., 2015; Bertram et al., 2011; Fixsen et al., 2009). Implementation is a period of uncertainty for frontline staff who are expected to effectively deliver the new program, thus, it is important that organizations support these individuals throughout the process (Lyon et al., 2011).

EBI implementation generally takes place within organizational settings (i.e., the inner setting) that exist within, and are influenced by, the greater economic, political, and social systems (i.e., the outer setting). Organization-related factors that can impact implementation include structural factors (e.g., size, age), as well as factors associated with the relationships among individuals who are part of the organization (e.g., leadership, culture, climate). Although numerous organizational factors are recognized as impacting implementation, there is very little research addressing relationships among the most proximal organization-level factors thought to impact implementation success (Fernandez et al., 2018; Aarons et al., 2012).

Organizational Context: The Inner Setting

Inner Setting Framework

Organizational factors influence frontline staff, who, in turn, react accordingly. Frontline staff behaviors then influence the greater organizational context (Aarons et al., 2012). Therefore, relationships between organizational factors and the individual characteristics are seldomly unidirectional. Drawing on multi-disciplinary organizational research, Aarons et al. (2012) developed a framework to explain relationships among common organizational factors that influence implementation (see Figure 1; Aarons et al., 2012). Aarons et al.'s framework conceptualizes organizational leadership as the overarching influence on implementation outcomes. The highest level of leadership within the organization establishes the culture and climate of the organization. Organizational culture is defined as the organizational norms and expectations regarding how individuals behave in an organization (see Table 1 – Terminology; Rabin & Brownson, 2012; Gilson & Schneider, 2010; Verbeke et al., 1998). Organizational culture is often viewed as static, but some evidence suggests that organizations with cultures that are adaptable are more likely to be successful in implementing EBIs (Aarons et al., 2012; Kotter & Heskett, 1992; Wilderom et al., 2000).

Distinct from organizational culture, organizational climate is the perceived meaning of practices and procedures inferred by organizational members, which are reinforced by leadership practices and procedures (Aarons et al., 2012; James et al., 2008; Ehrhart, Schneider, & Macey, 2014). This is a broad conceptualization of climate measured across multiple dimensions. That is, organizational climate is a generic appraisal of the experiences of organizational members (e.g., frontline staff, supervisors; Aarons et al., 2012; Ehrhart, Schneider, & Macey, 2014). The strategic climate, on the other hand, is organizational members' perceptions of the practices and

procedures with regard to any strategic outcome or organizational process (Aarons et al., 2012). With respect to EBI implementation, this strategic climate is referred to as implementation climate, and is a central focus for the proposed research (see Table 1).

System-level leaders are in a position to establish a positive implementation climate by initiating policies and practices that support the implementation process. Specific leadership strategies (e.g., transformational leadership) are critical to establishing a positive implementation climate that leads to implementation success when organizational changes take place (Aarons et al., 2012; Aarons, Ehrhart, Farahnak, & Sklar, 2014). System-level leaders who are not using these strategies may have to adapt to lead implementation efforts for a new EBI, and in failing to do so, they risk poor implementation outcomes. While policies and practices within an organization stem from system-level leadership, first-level supervisors may play the strongest role in shaping implementation climate because they serve as intermediaries between those at the top of the organization and frontline staff (Priestland & Hanig, 2005; Aarons et al., 2012; Aarons, Ehrhart, & Farahnak, 2014; Birken et al., 2012). The role of first-level supervisors may be two-fold; supervisors utilize strategies for supervision to ensure that EBIs are delivered with high fidelity over time, as well as strategies for strong leadership during times of change and uncertainty. Ideally, first-level supervisors provide support that reinforces the policies and practices established by system-level leadership. If system-level leaders fail to establish a positive implementation climate, first-level supervisors may follow suit. However, first-level supervisors who can effectively supervise and lead, regardless of the behaviors of system-level leaders, may be able to establish a positive implementation climate for the individuals expected to deliver an EBI. Research that exemplifies instances in which first-level supervisors are able to overcome the limitations of system-level leaders in order to continue support for an EBI

implementation is lacking, but literature on adaptive leadership suggest that taking the risk of "going alone" may catalyze change throughout an organization (Heifetz et al., 2009).

Leadership

Effective leadership during implementation can be classified into two general categories. First, transformational leadership motivates organizational members to follow a specific course of action. This style of leadership emphasizes individualized consideration of each members' contributions and needs, the stimulation of critical thinking and thinking about issues in new ways, the ability to inspire and motivate members, and the ability to act as a role model for all members (Aarons, Ehrhart, & Farahnak, 2014; Aarons et al., 2012; Aarons, 2006; Bass & Avolio, 1999). Transformational leadership has been linked to implementation success (Aarons, Ehrhart, & Farahnak, 2014; Michaelis et al., 2009; Michaelis et al., 2010), increased job satisfaction and organizational commitment (Aarons, Ehrhart, & Farahnak, 2014; Podsakoff et al., 1996; Walumbwa et al., 2005; Bycio et al., 1995), as well as reduced rates of burnout and turnover (Aarons, Ehrhart, & Farahnak, 2014; Bycio et al., 1995; Constable & Russell, 1986; Corrigan et al., 2002). The second category, transactional leadership, involves reinforcement and rewards from leaders to organizational members for engaging in certain behaviors or achieving certain goals. Transactional leadership also involves monitoring and correcting members' behaviors (Aarons et al., 2012; Aarons, 2006). Transactional leadership is associated with increased group and individual performance (Aarons et al., 2012; MacKenzie et al., 2001; Geyer & Steyrer, 1998). Thus, there are a broad range of leadership behaviors relevant during EBI implementation.

Both system-level leaders and first-level supervisors may impact implementation through leadership behaviors. During periods of EBI implementation, the role of system-level leaders

may include developing a positive implementation climate for implementation success (Aarons, Ehrhart, Farahnak, & Sklar, 2014). First-level supervisors also need to react to initiating change within the organization. Utilizing transformational leadership strategies to support implementation provides individuals expected to deliver new EBIs with a role model who may be positioned to offer individualized support during this time of uncertainty (Aarons et al., 2012). Although literature on training supervisors in leadership for implementation are scarce, emerging research demonstrated that supervisors in the field of substance abuse responded favorably to a newly developed leadership training program (Proctor et al., 2019).

First-Level Supervision

The use of effective leadership strategies by both system-level leaders and first-level supervisors demonstrates cohesive support for implementation, and is indicative of implementation success (Aarons, Ehrhart, Farahnak, & Sklar, 2014). In addition, first-level supervisors must employ effective supervision strategies to ensure that EBIs are being delivered with high fidelity. There is likely overlap between strategies for leadership and supervision. For example, a supervisor may set goals to enhance the skills necessary for effective EBI delivery in conjunction with a plan for monitoring these goals (i.e., quality assurance strategies as part of supervision & transactional leadership), as well as establishing a policy to reward individuals who are meeting set goals (i.e., transactional leadership). Both skill sets may strengthen support for EBI implementation and effective delivery to the service population.

Supervision strategies. First-level supervisors may rely on a number of effective strategies to conduct supervision and quality assurance (Dolcini et al., 2019; Dorsey et al., 2018). Standardized use of best practices in supervision provide individuals the support they may need to deliver EBIs with high fidelity over time (Bertram et al., 2015). Active learning strategies,

such as skill demonstration and role play/behavior rehearsal, as well as observation and feedback, are effective if used during an EBI training (Fixsen et al. 2005; Burk & Hutchins, 2007), and can also be employed by supervisors post-training (Dolcini et al., 2019; Dorsey et al., 2018). Active learning strategies coupled with observation and feedback may be especially effective during early implementation when individuals are less likely to be fully proficient in delivering new EBIs (Lyon et al., 2011). While sustained supervision is necessary, higher intensity during periods of uncertainty is critical (Lyon et al., 2011; Durlak & DuPre, 2008). Again, it is likely that high levels of observation and feedback are most useful during initial implementation to attain skill competency, followed by observation and feedback taking place periodically thereafter to ensure effective EBI delivery. There is some evidence that a higher dose of supervision predicts higher competency (Beidas et al., 2012; Schoenwald et al., 2004). Observation and feedback should include problem-based learning strategies. Supervisors who are trained in the EBI being implemented can connect feedback with lessons from the initial training, allowing for self-reflection of behaviors related to EBI delivery (Lyon et al., 2011). Both active learning strategies and observation and feedback provide opportunities for supervisors to reinforce positive behaviors and correct actions that may hinder effective EBI delivery.

First-level supervisors may rely on a number of supervision strategies that have received empirical support, yet most research on supervision has focused heavily on expert consultation as opposed to workplace-based supervision (Dorsey et al., 2018). First-level supervisors have to contend with additional organization-related issues (e.g., administrative tasks) that compete with the time allotted for supervision. Despite the differences between expert consultation and workplace-based supervision, sufficient evidence suggests that there are adequate similarities in terms of strategies to improve the behaviors of those who deliver EBIs to draw generalizable

conclusions (Hengeller et al., 1998; Hengeller et al., 2002; Schoenwald et al., 2009). One meta-analysis found that training supervisors in supervision techniques during the implementation of a new EBI was significantly associated with implementation success (Casillas et al., 2016). Thus, interventions designed to improve supervision for EBIs, while simultaneously implementing new interventions may be advantageous for organizations.

Implementation Climate

Implementation climate is the extent to which organizational employees perceive that the adoption, implementation, and use of an EBI is expected, rewarded, and supported by the organization (Ehrhart, Aarons, and Farahnak, 2014). Theoretically, implementation climate is an organizational-level construct, representing the shared perceptions among intended users of an EBI (Weiner et al., 2011). System-level leaders develop policies and procedures that shape these shared perceptions (Aarons et al., 2012; Weiner et al., 2011). Consistent support for implementation from leadership promotes a common understanding of the value of the new EBI (Weiner et al., 2011; Zohar, 2002; Zohar & Luria, 2004; Gonzalez-Roma et al., 2002; Kozlowski & Doherty, 1989; Luria, 2008). Supportive policies and procedures include access to high-quality training and support for EBI skill mastery, feedback on EBI use, engaging all employees in decision-making regarding an EBI implementation, and providing incentives to intended users of the EBI (i.e., those delivering an EBI and the supervisors that oversee EBI delivery; Weiner et al., 2011; Klein & Sorra, 1996).

Implementation climate reflects a strategic focus on successfully implementing an EBI, rather than encapsulating a general state of affairs in an organization (Weiner et al., 2011). System-level leaders can utilize specific strategies to positively influence implementation climate during these periods of implementation (Aarons et al., 2012; Aarons, Ehrhart, Farahnak, & Sklar,

2014). Utilization of these leadership strategies demonstrates the organizational commitment to implementing a new EBI. The ways in which leaders react to organizational incidents (e.g., funding loss), allocate resources (e.g., shifts in resources to a new EBI), reward their staff (e.g., incentives for high fidelity EBI delivery), and focus attention to a strategic goal (e.g., quality assurance procedures for high fidelity EBI delivery) for instance, shape and reinforce implementation climate (Aarons, Ehrhart, Farahnak, & Sklar, 2014).

Implementation climate level & strength. Both the average magnitude of implementation climate (i.e., climate level), as well as the within-group variability (i.e., climate strength) have important implications for EBI implementation. Organizational employees are likely to share similar perceptions of implementation climate when there are clear cues regarding the desirability of implementing an EBI (Weiner et al., 2011). Thus, a positive climate is one in which the average magnitude of perceptions is high. The degree of within-group variability attests to the strength or weakness of implementation climate. Low variability indicates a shared meaning of implementation climate, while high variability indicates that implementation climate is not cohesive (Weiner et al., 2011). Employees are more likely to effectively deliver an EBI when implementation climate is positive and strong. Yet, employees are unlikely to share common perceptions of implementation climate when intra-organizational units of employees have limited opportunity to interact, when leaders fail to communicate consistent messages or act in consistent ways to support EBI implementation, or when employees do not share similar experiences, values and beliefs (Weiner et al., 2011). In such circumstances, climate is either strong, but negative, or, weak and variable (i.e., there is little shared meaning of climate, and, staff either feel like support for implementation is good or poor). Thus, effective leadership and

supervision that demonstrates EBI support are critical in establishing a positive and strong implementation climate for frontline staff.

Implementation climate influences implementation success. A growing body of evidence suggests that implementation climate is positively associated with implementation success (Weiner et al., 2011; Holahan et al., 2004; Dong et al., 2008; Osei-Bryson et al., 2008; Aarons, Ehrhart, Farahnak, & Sklar, 2014; Ehrhart et al., 2004; Kuenzi & Schminke, 2009). In fact, implementation climate may be the most proximal organizational-level antecedent of implementation success (Williams et al., 2020; Aarons et al., 2017). The implementation climate of first-level supervisors is important to consider, but likely has an indirect effect on implementation outcomes. In contrast, focusing on the shared perceptions of frontline staff is a more proximal indicator of implementation effectiveness (Weiner et al., 2011). Further, while implementation climate is an aggregate construct, an organization-wide assessment may not provide an entirely accurate account of staff perceptions (Weiner et al., 2011). Separate implementation climates can exist between intra-organizational units, and this may, in part, be dependent upon the organizational structure. Distinct climates are more likely in centralized, vertically-structured organizations in which system-level leaders and first-level supervisors vary in their commitment to implementation. Therefore, it is important to study such organizational systems to gain a clearer understanding of the factors that influence implementation, and the relationship among these factors.

Middle-Range Theoretical Models in D&I Science

There is a need to expand theoretical models to account for the complexity of implementation within organizational systems. There are multiple implementation frameworks that guide the research in D&I science. Yet, many of these frameworks tend to be either

taxonomic (e.g., Damschroder et al., 2009) or at the meta-level (e.g., Greenhalgh et al., 2004). In the former case, constructs related to implementation are classified under certain domains. In the latter case, meta-theoretical models have the potential to miss important constructs that are not represented in the more general model. Hence, understanding relationships among constructs and how they interact to influence implementation is limited (Fernandez et al., 2018). However, both taxonomic and meta-theoretical frameworks can stimulate the development of middle-range theoretical models. The development and use of middle-range theoretical models may facilitate theory-driven analytic procedures that can summarize what is known and guide future research and practice (Ogden & Fixsen, 2014).

Currently, there is a lack of empirical work to connect and quantitatively measure organizational-level constructs (Fernandez et al., 2018). Further, theory development in public health-related fields has been limited with regard to lower level supervisor impact on implementation (i.e. first-level supervisors or other middle managers). One theory of "middle managers' role in implementing innovations in healthcare organizations" (Birken et al., 2012) is predicated on middle managers' role of communicating between top managers and frontline staff. Middle managers are defined as employees who are supervised by an organization's top managers and who, themselves, supervise frontline employees (Birken et al., 2012; Noble, 1999). The theory suggests that innovation policies and practices of top managers influence middle managers, who are then able to shape implementation climate, which in turn impacts implementation effectiveness. Middle managers influence this process through four hypothesized roles, including, 1) diffusing and 2) synthesizing information regarding innovation implementation, 3) mediating between strategy and the day-to-day activities required to implement innovations (e.g., translate information from top managers into specific tasks for

frontline staff), and 4) selling innovation implementation (e.g., maintain a positive attitude toward implementation; Birken et al., 2012; Birken et al., 2016).

Birken et al.'s theory has shed light on the role of middle managers across a number of studies (e.g., Birken et al., 2013; Birken et al., 2015; Birken et al., 2016). There are three important findings that may move the field forward in theory development. First, was that proximity to top managers, including open, regular, and informal communication relates to middle managers taking a more proactive approach during implementation (Birken et al., 2015). This suggests that the theory may be more suitable in horizontal organizational systems, or, that increased support for managers most proximal to frontline staff is needed. It is challenging for vertically-structured organizations to effectively communicate through their hierarchy (Rogers, 2003). Within the CWS, for example, first-level supervisors (i.e., middle managers) tend to be far removed from system-level leadership (i.e., top managers) who hold all decision-making power. Interaction between system-level leadership and supervisors is highly unlikely, particularly communication that is open, regular, and informal.

The second finding across studies that examined Birken et al.'s theory reveals that there is substantial variation in the type of middle manager (Birken et al., 2016; Birken et al., 2018). That is, studies assessing the role of middle managers encompass a diverse range of occupations at the level of middle manager. Therefore, strategies used to promote implementation are likely to be different. First-level supervisors are considered middle managers in a number of studies (e.g., Birken et al., 2018; Williams et al., 2020). Due to their proximity to frontline staff, it is important to hone-in on the role of first-level supervisors. Some studies suggest that, within the role of strategies for day-to-day activity mediation, middle managers should be able to train, coach, and monitor frontline staff (Birken et al., 2016; Engle et al., 2017). Connecting training,

coaching, and fidelity monitoring as specific strategies necessary during implementation is a step towards a better understanding of the role of middle managers during implementation.

The proposed middle-range model for this dissertation defines the role of first-level supervisors as two-fold. First, supervisors need to effectively supervise their staff using best practices in supervision, relevant to their respective discipline. Second, supervisors must exhibit leadership attributes that are conducive to frontline staff implementing EBIs effectively. Through this two-fold role, supervisors may demonstrate commitment to EBI implementation through active behaviors, rather than passive dissemination and synthesis. Social learning theory posits that active behaviors, such as modeling, are effective strategies to influence behavior change of others, particularly when translating the importance of implementation (Bandura, 1986; Schein & Schein, 2017). Middle-range theory development that directly connects organizational factors to implementation outcomes may move the field forward by focusing on understanding relationships among these factors, and, identifying points of intervention that are targeted and practical. This study builds on Aarons et al.'s model and examined organizational factors within the CWS. The proposed middle-range theoretical model is depicted in Figure 2.

The Child Welfare System

The CWS is illustrative of the highly centralized, vertically-structured organizations that can be challenging to successful EBI implementation. The Institute of Medicine (2014) released what remains as the most comprehensive report connecting organizational factors to challenges in implementing EBIs within the CWS. Systemic organizational issues within the CWS hinder successful implementation of EBIs that have the potential to improve the well-being of children across the United States (IOM, 2014). Thus, CWS caseworkers (i.e., frontline staff) may be unable to effectively provide EBIs to children and their families (IOM, 2014). Consequently,

child maltreatment continues to be a substantial public health burden in the U.S. In 2018, child protective service agencies across the U.S. received approximately 4.3 million child maltreatment referrals involving roughly 7.8 million children. Of these, 3.5 million children received either an investigation or alternative response (HHS, 2020). Further, children who become involved with the CWS continue to be at risk for poor health outcomes, including mental illness, substance abuse, incarceration, homelessness, unemployment, and chronic disease (HHS, 2019). Risk is amplified for children who enter into the foster system (Rubin et al., 2004; Newton et al., 2000). Thus, it is important to examine potential strategies to improve outcomes for children involved in the CWS. Specifically, strategies to strengthen organizational practices that support caseworkers are needed to ensure effective delivery of EBIs to ultimately improve outcomes for children.

Role of the CWS

The primary objective of the CWS is to maintain children in their homes with caseworker support to help parents establish plans for safety and stability (HHS, 2013). If a child is removed from the home (i.e. foster care), reunification is the first permanency option. Multiple placements within the foster care system and extended periods of instability can have deleterious consequences for the child, yet challenges in timely reunification and in establishing permanency are persistent (IOM, 2014). Evidence suggests that a parent's ability to make consistent progress towards goals to increase safety and stability in the home may be the most significant factor in service plan completion and subsequent case closure, and that reunification is best predicted by caseworker ratings of parental progress towards set goals (Marsh et al., 2014). Further, parents involved with the CWS felt more likely to succeed when there was consistent guidance and support from their caseworker, including reassurance, affirmation, and direct feedback (Altman,

2008). There exists, however, a disconnect between the needs of the service population and the ability of CWS caseworkers to deliver effective programs and practices to meet these needs (IOM, 2014).

The CWS is a federal program, but states are primarily responsible for operating the CWS under their own control. States vary with regard to the services provided, as well as on how the CWS is structured. The vast majority of systems employ a state-supervised, state-administered system. Power and decision-making are centralized amongst system-level leaders, who operate through a vertical (i.e., top-down) approach (IOM, 2014). CWS programs are delivered by caseworkers who interact with and support families in the system. Caseworkers deliver various EBIs to families as a function of meeting the objective of promoting child well-being. Across the nation, caseworkers receive support from first-level supervisors to ensure effective EBI delivery. Yet, poor supervision is pervasive throughout the CWS, which in turn affects delivery of programs for children and families (IOM, 2014).

CWS Organizational Challenges

Numerous challenges within the CWS contribute to poor outcomes for children and families, including turnover throughout the system, poor leadership and supervision, and the inability of caseworkers to effectively deliver programs to children and families (Palinkas, 2018; IOM, 2014). Organizational challenges such as turnover create and propagate a culture and climate that limits the success of implementation efforts (Glisson, Schoenwald, Kelleher, et al., 2008). Change in system-level leadership is common, with turnover occurring as often as every 18 months on average (IOM, 2014). Change in system-level leadership is often the result of a change within the political system, as leaders are often politically appointed, or are operating under a politically-appointed individual (IOM, 2014). As such, newly-appointed system-level

leaders may support different programs and organizational goals compared to their predecessors, resulting in a system of constant change. This has implications for the success of implementation and sustainability of EBIs adopted by one group of system-level leaders since the same program may not be supported by the new leaders. Changes in system-level leadership may result in frequent changes of the mission and values of the CWS. As a result, establishing a consistent positive climate that supports EBI implementation is unlikely (Weiner et al., 2011).

Problems in leadership at the highest level creates challenges for first-level supervisors and caseworkers. Turnover among first-level supervisors is also a major problem in the CWS, which in turn leads to turnover at the caseworker level (IOM, 2014). Along with inadequate support, caseworkers routinely face challenges of high caseloads and insufficient training (IOM, 2014; Government Accountability Office [GAO], 2003; Zlotnik et al., 2005). As a result, caseworkers may be less likely to provide effective services to families. One study, for example, found that children who experienced caseworker turnover had more foster placements (Flower et al., 2005). Thus, organizational factors can significantly impede CWS efforts to mitigate problems that relate directly to child wellbeing (IOM, 2014).

Organizational Change Interventions

Intervening to strengthen organizational processes for the effective delivery of EBIs is challenging (Aarons et al., 2012). Few interventions within the CWS exist, and those that do, are highly complex (e.g., Glisson et al., 2006). R^3, a supervisor-targeted intervention, was developed as a more practical approach to intervening within the CWS to address organizational factors identified to impede CWS EBI implementation efforts (Saldana et al., 2016).

The R^3 Intervention

R^3 was developed to improve upon the systemic CWS issues that impact child and family outcomes, following a federal mandate requiring changes in standards for CWS performance (Saldana et al., 2016; IOM, 2014). CWS leadership and intervention developers created a supervisor-targeted intervention approach to strengthen the services delivered by caseworkers in a single CWS. The goal of the intervention was to infuse the use of reinforcement techniques commonly integrated as core components of CWS-related EBIs, into all caseworker interactions with families. The use of reinforcement techniques has been found to be associated with positive outcomes for CWS families, including stability and permanency (Saldana et al., 2016; Price et al., 2008). A targeted approach aimed at supervisors was both practical and strategic, as supervisors are in a position to manage multiple caseworkers expected to utilize R^3, while interfacing with system-level leadership who supported its development and implementation. Thus, if system-level leaders support R^3 implementation, it is more likely that first-level supervisors can establish a positive implementation climate for caseworkers.

R^3 is grounded in social learning theory, which posits that people learn and their behavior is shaped, through their interactions with others by observation, reinforcement, imitation, and modeling (Saldana et al., 2016; Patterson et al., 1992; Bandura, 1971). Further, behaviors tend to be sustained when reinforced consistently (Bandura, 1971). With R^3, CWS caseworkers are trained to use various reinforcement techniques with the families they serve, and, supervisors are trained to use these same reinforcement techniques during group supervision. Further, R^3 leverages the standard CWS group supervision model by encouraging team-based learning and problem-solving focused on caseworker interactions with families and EBI delivery (Saldana et al., 2016).

Three common reinforcement techniques from two child welfare EBIs were incorporated into R^3. Both EBIs have demonstrated effectiveness (Saldana et al., 2016). These techniques include reinforcement of 1) efforts, 2) relationships and roles, and 3) small steps toward goal achievement. These strategies were selected based on practicality, previous impact on child welfare outcomes, and alignment with the CWS goal of promptly moving families toward stable permanency plans (Saldana et al., 2016). The "three R's" are delivered using four theoretically derived principles, including 1) use of strength-focused language, 2) noticing normative/appropriate behavior, 3) use of a scientific approach of observation and reinforcement, and 4) taking opportunities to smile and laugh (Saldana et al., 2016). The expectation is that CWS staff use these principles to guide how they interact with the families they serve, along with each other, thus having the potential to improve CWS outcomes through stronger program delivery, as well as improvements in inter-organizational relationships (Saldana et al., 2016).

In order to support a behavioral shift of the CWS workforce that can be sustained, the intervention includes ongoing coaching, fidelity monitoring, and feedback provided by expert consultants. In addition, expert consultants model R^3 by utilizing an R^3 approach themselves during coaching interactions with supervisors, along with group consultation with multiple supervisors (Saldana et al., 2016). Results from the pilot study demonstrate feasibility and efficacy of R^3 (Saldana et al., 2016). Further, the fidelity measure, designed and tested in the pilot study, reliably captured adherence and competency in delivering R^3 (Saldana et al., 2016).

R^3 was recently tested in a statewide hybrid effectiveness-implementation study. Results from this study indicate that implementation was successful, but system-level leadership failed to sustain R^3 over time (Saldana et al., 2019). This dissertation analyzes data from the R^3 study.

Specific Aims

This research aimed to strengthen the understanding of the role of first-level supervisors in establishing a positive implementation climate for caseworkers. The CWS is riddled with challenges stemming from undertraining and lack of support for EBI delivery, leading to ineffective delivery of EBIs, and subsequently, poor outcomes for CWS children and families (IOM, 2014). CWS system-level leadership establish the organizational culture and climate in which EBI implementation occurs. System-level leadership that fails to support implementation may compromise the success of EBI delivery (Aarons et al., 2012). However, first-level supervisors may be able to mitigate this impact on implementation, as they are in a position to support caseworkers through effective supervision and leadership. In this sense, first-level supervisors may be able to shield the caseworkers, who are expected to deliver EBIs with high fidelity, from organizational factors that may impede implementation efforts. First-level supervision and leadership, as well as the ability of first-level supervisors to provide such support while managing the impact of negative organizational factors during implementation, are understudied. Change in leadership at the highest level of the CWS is inevitable, and, will continue to present challenges to EBI implementation in the absence of strategies to support effective EBI implementation. Thus, a focus on strengthening supervision and leadership of first-level supervisors may foster more practical implementation and sustainability practices.

This research explains the mechanisms through which first-level supervisors support caseworkers in implementing CWS-related EBIs. I analyzed data from a hybrid effectiveness-implementation study assessing the implementation of a CWS supervisor-targeted intervention (i.e., R^3) to promote the effective use of EBIs in four underperforming regions in a single state. I examined organizational factors that may act as barriers to or facilitators of implementation

success. Specifically, I examined how first-level supervisors influence the implementation climate of caseworkers, regardless of organizational challenges that may have been present (e.g., lack of support from system-level leadership). Pilot data demonstrates that proficiency in the delivery of R^3 can strengthen supervision (Saldana et al., 2016). Additionally, R^3, an intervention to promote the use of EBIs, should have a positive effect on first-level supervisor leadership strategies. Thus, I hypothesized that both supervision and leadership strategies utilized by first-level supervisors would influence the implementation climate of caseworkers, a proxy measure for implementation success. Further, the more proficient first-level supervisors became in R^3 delivery, the more effective they would be in providing leadership that supports EBI implementation. This research was guided by Aarons et al.'s existing framework of organizational factors known to influence implementation outcomes (Figure 1). My goal was to amplify this framework to include additional antecedents with respect to first-level supervisors (i.e., supervision and leadership strategies) that may influence the implementation climate of frontline staff. A better understanding of the potential for first-level supervisors to improve EBI implementation and delivery may provide opportunities to intervene within the CWS for improved child and family outcomes. This study had two overarching aims:

1. Contextualize the organizational factors known to influence implementation processes within the CWS study regions. To achieve this aim, I examined within- and between-group variability in perceptions of leadership and implementation climate for first-level supervisors and caseworkers, and, assessed change over time. Describing variation and magnitude related to the organizational context with regard to implementation set the foundation for understanding how first-level supervisors may be impacted by, and how they react to system-level leadership decisions regarding EBI implementation.

2. Develop a middle-range theoretical model that explores the relationships among leadership, supervision, and implementation climate (see Figure 2). To achieve this aim, I examined the relationships between constructs that are represented as being directly related in the proposed middle-range model (see sub-Aims 2a – 2c). Specifically, I:
    a. Examined the relationship between first-level supervisor implementation climate and supervisor ability to effectively supervise and lead. This sub-aim addressed whether or not R^3 impacted supervision and leadership regardless of supervisor perceptions of implementation climate.
    b. Examined the relationships between first-level supervision and leadership and caseworker implementation climate. I hypothesized that as R^3 implementation progressed:
        i. Effective supervision would be positively associated with quality of leadership.
        ii. Effective supervision would be positively associated with caseworker implementation climate.
        iii. High quality leadership would be positively associated with caseworker implementation climate.
    c. Examined all significant paths in the full theoretical model.

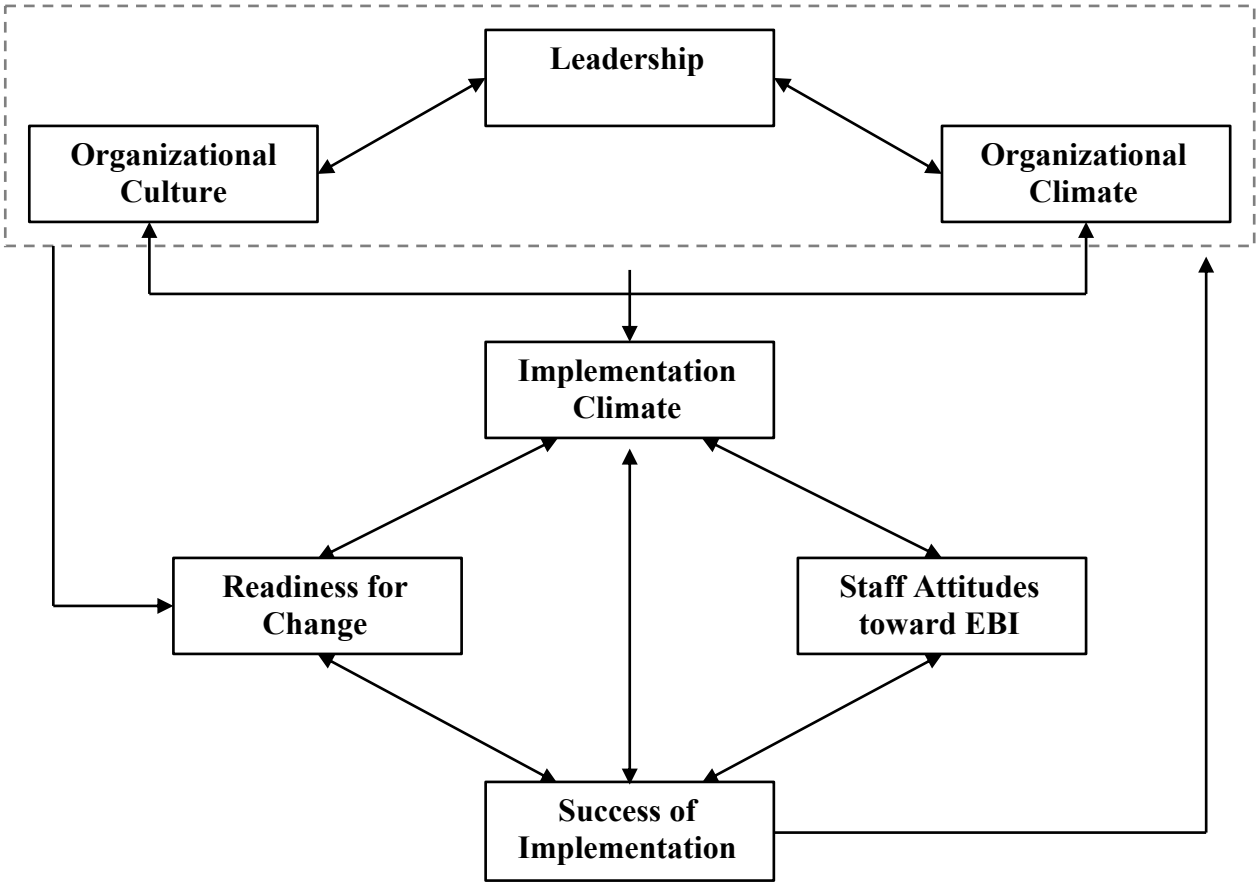


Figure 1. Relationship among organizational factors and EBI implementation (adapted from Aarons et al., 2012, p. 129)

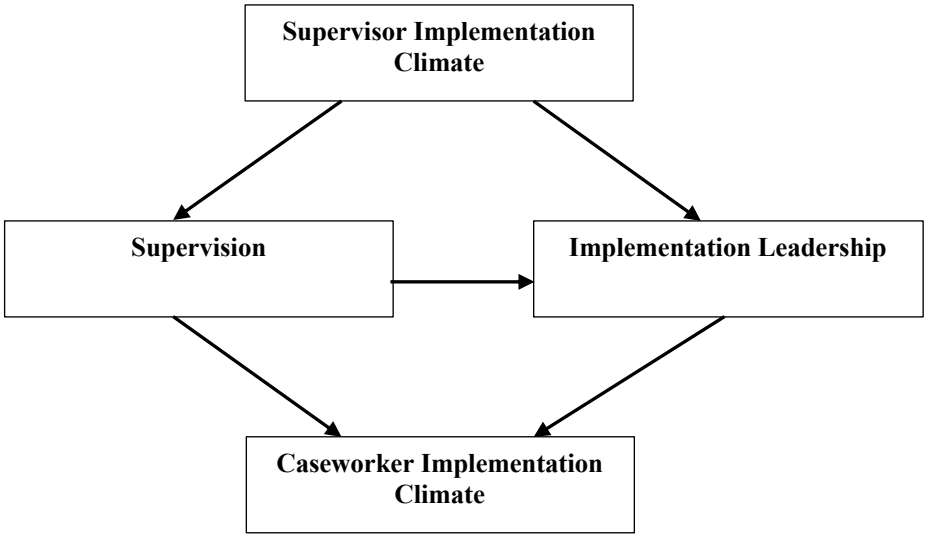


Figure 2. Middle-range theoretical model of relationships among first-level supervision, implementation leadership, and implementation climate

Table 1

Terminology

Organization staff roles	
System-level leadership	Staff at the top of an organization who are ultimately in control of all organizational processes (e.g., administrators, executive directors)
First-level supervisor	Staff that provide direct supervision to frontline staff
Frontline staff	Staff who deliver EBIs to a service population
Organizational constructs	
Organizational culture	The organizational norms and expectations regarding how individuals behave in an organization (Rabin & Brownson, 2012; Gilson & Schneider, 2010; Verbeke, Volgering, & Hessels, 1998)
Organizational climate	The perceived meaning of practices and procedures inferred by organizational members, which are reinforced by leadership practices and procedures (Aarons et al., 2012; James, Choi, Ko, et al., 1989; Schneider, Ehrhart, & Macey, 2011)
Strategic climate	The perceived meaning of practices and procedures inferred by organizational members with regard to any strategic outcome or organizational process (Aarons et al., 2012)
Implementation climate	The extent to which first-level supervisors perceive that the adoption, implementation, and use of an EBI is expected, rewarded, and supported by the organization (Ehrhart, Aarons, & Farahnak, 2014a)
Implementation climate level	The average magnitude of implementation climate-related perceptions (Weiner et al., 2011)
Implementation climate strength	The degree of within-group variability in implementation climate-related perceptions (Weiner et al., 2011)

Table 2

Conceptual & Operational Definitions for Constructs of the Middle-Range Theoretical Model

Construct	Conceptual definition	Operational definition
Supervisor implementation climate	The extent to which first-level supervisors perceive that the adoption, implementation, and use of an EBI is expected, rewarded, and supported by the organization (Ehrhart, Aarons, & Farahnak, 2014a)	Implementation Climate Scale (ICS): Supervisor perceptions of implementation climate
Supervision	The use of evidence-based supervision strategies that promote EBI implementation	R^3 fidelity (FRI_S)
Implementation Leadership	The degree to which first-level supervisors are proactive, knowledgeable, supportive, and perseverant in implementing EBIs (Aarons, Ehrhart, & Farahnak, 2014)	Implementation Leadership Scale (ILS): Aggregate measure of caseworker perceptions of first-level supervisor implementation leadership
Caseworker Implementation Climate	The extent to which caseworkers perceive that the adoption, implementation, and use of an EBI is expected, rewarded, and supported by the organization (Ehrhart, Aarons, and Farahnak, 2014a)	ICS: Aggregate measure of caseworker perceptions of implementation climate

Chapter 3: Methods

Study Setting

This dissertation uses data from the R^3 parent study. The overarching goal of the parent study was to evaluate whether R^3 can facilitate the use of evidence-based practices through the child welfare system (CWS), and in doing so, positively influence the organizational processes that impact implementation (e.g., implementation climate, implementation leadership), and ultimately improve outcomes for children and families. R^3 implementation was initiated at the state-level, targeting four underperforming regions in a single state in the Southeastern U.S. The intervention being evaluated for effectiveness is a supervisor-focused implementation strategy to support the use of evidence-based supervision practices. In addition, R^3 was designed to model reinforcement behaviors for caseworkers during group supervision sessions, that they in turn are expected to model for parents involved with the CWS. Evidence from the pilot study suggests that as first-level supervisors become more proficient in R^3, they are more likely to provide effective supervision to caseworkers, who in turn, may increase their own use of evidence-based practices (Saldana et al., 2016).

The R^3 developers provided training, expert consultation, and fidelity monitoring over the course of the effectiveness-implementation study. Expert consultation included coaching, as well as a certification process for first-level supervisors who met specific requirements (e.g., consistent high fidelity R^3 delivery over a specified time, having a certain proportion of caseworkers attending group-supervision sessions in which R^3 was employed). Fidelity monitoring occurred consistently, with first-level supervisors uploading video-recorded group supervision sessions for coaches to assess. Fidelity assessments were followed by coaching calls, providing feedback to first-level supervisors. This occurred in a group-based format in which

supervisors within a region met once a month with a coach. Coaches utilized R^3 components to provide feedback, modeling the same strategies that supervisors were expected to use with caseworkers.

The R^3 study was designed to include three 12-month study phases, the involved training, transition, and full transfer of R^3 into the CWS. Relevant to this dissertation, were changes in system-level leadership that occurred during implementation. The first change occurred approximately at the one-year mark, which altered the support for R^3. Ultimately, system-level leadership made the decision to end R^3 across the state during the transition phase. Thus, R^3 was terminated prior to full program transfer. Figure 3 represents the planned timeline for the study, including the approximate point at which there was a change in support for R^3. This dissertation focuses on the first year of the parent study (i.e., the training phase; wave 1 to wave 2).

Participants

R^3 study participants were from the pool of staff within each of the four regions in a single state. For the main study, 99 supervisors who provided direct supervision (i.e., first-level supervisors), and 334 caseworkers (i.e., frontline staff) were trained in R^3.

Initial Training

The intervention developers provided standardized training in R^3, followed by expert consultation. R^3 training for CWS staff, including first-level supervisors and caseworkers, was conducted in each of the four regions at separate times. Supervisors received an additional supervision training, in which they were trained on how to deliver R^3 in the group supervision format. Both trainings included the use of best practices for initial training, including didactic components (i.e., slides and manuals), as well as active rehearsal strategies (i.e., video

demonstration of R^3 delivery, role play with feedback). Additionally, there were booster trainings for first-level supervisors every six months (Saldana et al., 2019).

Procedures

First-level supervisors and caseworkers completed annual self-reported assessments beginning in 2015. As a secondary analysis, this dissertation proposed to assess first-level supervisor impact on *their* caseworkers with regard to R^3 fidelity, implementation leadership, and implementation climate. Thus, in order to complete all proposed analyses, caseworkers were linked to supervision groups using available data. As noted, R^3 was terminated following changes in system-level leadership. Although this decision was announced towards the end of 2017, change in system-level support for the program began at the time when wave 2 assessments were being completed by study participants (i.e., following the one-year training phase of R^3). Over the course of the transition phase, a significant number of first-level supervisors ended R^3 sessions. The R^3 session attendance log was the data source used to link caseworkers to supervision groups. As supervisor participation dropped off, the ability to link caseworkers to supervisors became unattainable. Given this limitation, caseworkers were accurately linked to the majority of supervisors ($N = 91$) for the first two waves of the study. That is, baseline assessments (i.e., wave 1) and assessments at the one-year mark (i.e., wave 2) of the study were utilized for all analyses of this dissertation. This provided an opportunity to analyze data, pre- and post-training, assessing the potential impact first-level supervisors had on caseworker implementation climate.

Measures

Assessment timepoints for data that were analyzed for this study are depicted in Figure 3. Perceptions of implementation leadership and implementation climate were self-reported.

Supervisor fidelity to R^3 during caseworker group supervision was assessed by coach observation of recorded videos. The intended use of the fidelity tool was to assess competence and adherence to R^3.

Implementation Leadership

The Implementation Leadership Scale (ILS; 12 items, 4 subscales; Aarons, Ehrhart, & Farahnak, 2014; see Appendix) assesses the degree to which a leader is proactive, knowledgeable, supportive, and perseverant in implementing evidence-based practices. Items are on a five-point Likert scale, ranging from 0 (not at all) to 4 (a very great extent). The scale demonstrated strong reliability, construct-based validity, and, convergent and discriminant validity (Aarons, Ehrhart, & Farahnak, 2014; see Appendix for ILS items). Cronbach's alpha for caseworker-reported implementation leadership for this study was .97. Implementation leadership was assessed at four time points, beginning at baseline, and then following the 12-month phases of training, transition, and full transfer (see Figure 3). The referent was the supervisor who led R^3 supervision groups. Thus, for this dissertation, supervisor implementation leadership behaviors are operationalized as caseworker ILS scores. The scale developers generated total scores by computing a mean score for each subscale, then calculating a mean of all subscale scores (Aarons, Ehrhart, & Farahnak, 2014; see Appendix for ILS items). For this dissertation, each dimension (i.e., subscale) of implementation leadership and total scores were tested for all analyses. ILS developers created and validated the scale by aggregating scores to the workgroup level (Aarons, Ehrhart, & Farahnak, 2014).

Implementation Climate

The Implementation Climate Scale (ICS; 18 items, 6 subscales; Ehrhart, Aarons, & Farahnak, 2014; see Appendix) assesses the degree to which the organizational climate is

supportive of adopting new EBIs. Subscales measure the extent to which an organization, or organizational unit, 1) focuses on EBIs, 2) provides educational support for EBIs, 3) provides recognition for EBI use, 4) rewards EBI use, 5) selects staff likely to use EBIs, and, 6) selects staff who are open to change. Items are on a five-point Likert scale, ranging from 0 (not at all) to 4 (a very great extent). The scale demonstrated strong reliability, construct-based validity, and, convergent and discriminant validity (Ehrhart, Aarons, & Farahnak, 2014; see Appendix for ICS items). Implementation climate was measured for both first-level supervisors and caseworkers at four time points, beginning at baseline, and then following the 12-month phases of training, transition, and full transfer (see Figure 3). Cronbach's alpha for caseworker-reported implementation climate for this study was .87. Cronbach's alpha for supervisor-reported implementation leadership for this study was .86. ICS items were adapted to the context of the CWS (e.g., "One of this region's main goals is to use evidence-based practices effectively."). The scale developers generated total scores by computing a mean score for each subscale, then calculating a mean of all subscale scores (Ehrhart, Aarons, & Farahnak, 2014; see Appendix for ICS items). For this dissertation, each dimension (i.e., subscale) of implementation climate and total scores were tested for all analyses. ICS developers created and validated the scale by aggregating scores to the workgroup level (Ehrhart, Aarons, & Farahnak, 2014).

The ICS was used to operationalize two different constructs within the middle-range theory. First, to represent first-level supervisor perceptions of implementation climate as a predictor variable (i.e., independent variable) in the middle-range model. Second, to represent caseworker perceptions of implementation climate as the main outcome variable (i.e., dependent variable).

Supervision

The FRI_S (15 items, 5-point Likert scale; Saldana et al., 2016; see Appendix) is a fidelity assessment tool completed by R^3 expert coaches. The observational metric of R^3 fidelity was intended to be used for objectively rating the supervisor in R^3 adherence and competency in order to facilitate feedback and coaching. Two sub-scales include content related to 1) supervisor use of R^3 components, and, 2) how the supervisor used the components during group supervision. Scoring is the total percentage rating across all items. FRI_S demonstrated strong psychometric properties in the pilot study, evidenced by Rasch separation reliability estimates (.86 – .92) and Rasch separation index estimates (2.53 – 3.30; Saldana et al., 2016). Further, the FRI_S underwent testing for unidimensionality, and was confirmed as a tool that should be used to measure fidelity as a single dimension. Thus, a total score between the two sub-scales is appropriate for use in statistical assessments (Saldana et al., 2016).

Data Analysis Strategy

The theoretical justification for the proposed middle-range theoretical model was provided in Chapter 2. The next step in theory building is to examine the relationships among leadership, supervision, and implementation climate (Shoemaker et al., 2004). The operational definitions for each theoretical construct in the model are provided in Table 2. The empirical assessment was conducted using hierarchical linear modeling (HLM; Bryk, Raudenbush, & Condon, 1996).

HLM is a multilevel modeling analytical approach designed to test hypotheses about effects at, and across, different organizational levels (Heck & Thomas, 2000). HLM offers many advantages in terms of analyzing nested data compared to other statistical approaches (e.g., ordinary least squares regression analysis that relies on either aggregating or disaggregating all variables in order to test relationships). First, variables can be correctly specified to the

appropriate level of analysis. HLM simultaneously investigates relationships within and between hierarchical levels of grouped data, thereby making it an efficient strategy for estimating variance among variables at different levels (Woltman et al., 2012). Further, HLM identifies the relationships between predictor and outcome variables, by taking both the level-1 and level-2 regression relationships into account, and, is able to assess cross-level relationships. HLM can also incorporate multiple measurements to account for change over time. Finally, HLM requires fewer assumptions to be met than other statistical methods (Woltman et al., 2012; Raudenbush & Bryk, 2002), and, can accommodate non-independence of observations, a lack of sphericity, missing data, small and/or discrepant group sample sizes, and heterogeneity of variance across repeated measures (Woltman et al., 2012).

All statistical analyses were conducted using HLM software version 8.0. The HLM software program can include predictor variables at the individual, intra-organizational, and organizational level; incorporate variation occurring at multiple levels that is distinct from measurement error variance; and estimate models with multivariate outcomes (Heck & Thomas, 2000; Bryk & Raudenbush, 1992; Supovitz & Brennan, 1997).

Data Structure

The ICS and ILS are structured with repeated measurements (level-1) that are nested within respondents (level-2; either supervisor or caseworker). Caseworkers then are nested within supervision groups (level-3), led by a single supervisor. The fidelity outcome is similar, as monthly measurements lead to repeated measures (level-1), nested within supervisors (level-2). Respondents are nested within the four regions, but the low number of regions cannot support a random effect. Thus, fixed-effect indicators tested and control for systematic differences across regions. Each outcome was inspected to determine the appropriate modeling distribution. All

analyses were conducted using HLM techniques. HLMs are able to capture change over time, and, can be used to compare outcomes with potentially different structures (e.g., R^3 fidelity relationship with leadership perceptions).

With repeated measurements of organizational factors (i.e., leadership and implementation climate; level-1) nested within supervisors and caseworkers (level-2), models included indicators for the phase of the study (i.e., baseline & post-training phase). This allowed for testing changes in organizational factors over the study phase.

Preliminary Analyses

Distributions of variables were examined to determine the most appropriate modeling strategy. All HLM assumptions were determined to be met (e.g., linearity, homogeneity of variance, residuals are normally distributed). Missing data and outliers were also examined. Missing data were handled in HLM using restricted maximum likelihood estimation.

Prior to all analyses, caseworkers were linked to R^3 supervision groups, which they attended as part of monthly supervision. Each supervision group was assigned a single first-level supervisor who delivered R^3 during each session. Establishing a supervision group for each caseworker at each wave was necessary to answer this study's research questions. As stated previously, due to system-level leadership change leading to the elimination of support for R^3, linking caseworkers to supervisors accurately past the wave 2 timepoint was not feasible. Thus, all analyses for this dissertation include data for the first two waves of the main study.

Aim 1: Assessing Within- & Between-Group Variance

Aim 1 lays the foundation for constructing a middle-range model and exploring relationships among organizational processes. The analyses examined within- and between-group variation to confirm that the use of an HLM approach is appropriate. Estimates of

variability also provide insight into scoring decisions for each variable, justification for aggregating to a higher level, as well as how the variables will be modeled over time.

I estimated within- and between-group variance for all outcome variables using the HLM-based intraclass correlation coefficient (ICC). First, I constructed unconditional models for estimating variance components. The unconditional model includes an intercept estimate, but no predictors. Unconditional models provide the necessary variance components to calculate ICCs. In a series of models I sequentially added predictors to the unconditional model. Fixed effects indicators to control for study region, and, main effects indicators for study wave to control for change over time were included (see Aim 2 below for a detailed description of model building). The variables included in the theoretical model are described as follows:

First-level supervisor leadership. ICC_1 analyses were run to estimate the variance within and between caseworkers' perceptions of first-level supervisors implementation leadership characteristics. Measure: The ILS was used to assess the perceptions of first-level supervisors by caseworkers (see Measures, above). Data structure: The data are structured in three levels, with repeated measurements (level-1; *N = 2 per caseworker*) nested within caseworkers (level-2; *N* = 331 caseworkers*)* nested within first-level supervisors (level-3; *N* = 91 supervisors).

First-level supervisor implementation climate. ICC_1 analyses were run to estimate the variance within and between supervisors' perceptions of implementation climate. Measure: The ICS was used to assess the perceptions of implementation climate from supervisors (see Measures, above). Data structure: The data are structured in two levels, with repeated measurements (level-1; *N* = 2 per supervisor) nested within first-level supervisors (level-2; *N* = 91 supervisors).

Caseworker implementation climate. ICC_1 analyses were run to estimate the variance within and between caseworkers' perceptions of implementation climate. Measure: The ICS was used to assess the perceptions of implementation climate from caseworkers (see Measures, above). Data structure: The data are structured in three levels, with repeated measurements (level-1; $N = 2$ per caseworker) nested within caseworkers (level-2; $N = 331$ caseworkers*)* nested within first-level supervisors (level-3; $N = 91$ supervisors).

Implementation climate strength. Estimating within- and between-group variance of implementation climate is particularly important in the model, because it portrays the story of what is occurring within a CWS over the year-long training phase of R^3 implementation. That is, variance statistics yield important insight into the strength (i.e., the level of within-group variability) of implementation climate. As previously stated, cohesive perceptions of climate within supervision groups attests to a stronger implementation climate (see Chapter 2: Literature Review).

Implementation climate level. Implementation climate level was assessed descriptively by calculating the average total ICS score for each supervision group. I used the Pearson correlation coefficient (Rodgers & Nicewander, 1988) to test the bivariate association between each first-level supervisor's and their caseworkers' (i.e., group average) perceptions of implementation climate.

First-level supervision. Supervision was operationally defined as first-level supervisor fidelity to R^3. R^3 fidelity was assessed, scored, and converted into a percentage score (i.e., out of 100%) for all analyses. Fidelity was assessed on a different timeline than the self-report measures. That is, monthly assessments began as baseline measures at the start of the study period (i.e., around the wave 1 assessment period) and continued throughout the study.

Therefore, modeling decisions with respect to fidelity differed from other variables in the model (see Aim 2 below). Data structure: Fidelity data are structured in two levels, with monthly repeated measurements (level-1; N = up to 12 assessments per supervisor) nested within first-level supervisors (level-2; N = 91 supervisors).

Aim 2: Building & Examining the Middle-Range Theoretical Model

The hypothesized middle-range theoretical model was examined through an exploratory process. The theory is based on evidence to support the pathways suggested in Figure 2. Analyses consisted of a stepwise testing process in which decisions were made with regard to aggregating data, modeling predictors and outcomes to incorporate two waves of data, and, maximizing the use of all available data.

Stepwise HLM testing. Analyses for Aim 2 consisted of step-wise HLM testing of all hypothesized pathways. In a series of models, I sequentially added predictors to each unconditional model. This began with building the unconditional growth model, adding the study wave indicator (uncentered) as a main effect to all unconditional models to determine change over the two time points. Next, predictors were added as a main effect (grand mean centered). Then, region indicators were added as a main effect as control variables (uncentered). Finally, predictors were added as an interaction term with the wave indicator (grand mean centered). Inclusion of the interaction term is similar to a difference-in-difference design. Central to such a design is the comparison between units that may never experience a change over time and those units that do experience change over time. The effect is then estimated as the difference between the change in the outcome that occurs in the groups that have experienced change and the groups that never changed (Williams et al., 2020; Wing et al., 2018). For this dissertation, the interaction

term is the "difference in difference" of change in the outcome over time for any level of the predictor compared to having a predictor score that is one standard deviation higher or lower.

The exception to this modeling approach were the models in which fidelity was treated as an outcome variable. In this case, it was appropriate to create a more precise variable than the wave indicator to align with the monthly repeated measurements of fidelity. I created a variable that calculated time since the initial training, which was added as a linear time term to the growth models to indicate change over the two waves (i.e., the year-long training phase). Including the linear time term provided more assessment data points over a one-year period, which supports modeling a random effect.

Aggregating data. Modeling strategies for aggregating data (e.g., individual scores versus supervision group averages) within the proposed theoretical model were determined based on a priori theoretical conceptualizations of implementation leadership and implementation climate, as well as the resulting ICCs from Aim 1. That is, implementation climate and implementation leadership should theoretically be aggregated to the work group or organizational level (Weiner et al., 2011; Ehrhart, Aarons, & Farahnak, 2014; Aarons, Ehrhart, & Farahnak, 2014). Further, ICCs should demonstrate sufficient within-group agreement to justify aggregation. Missingness and cohort size (i.e., number of caseworkers within a supervision group) also impacted decisions on how to handle nesting. That is, in certain circumstances, a model truly represented by a three-level nesting structure had to be reduced to two levels in order to accommodate running models successfully in the HLM software (Raudenbush et al., 2019).

Modeling predictor & outcome variables for two study waves. As a predictor, first-level supervisor implementation climate (i.e., across all dimensions & total score) included a wave 1 and a wave 2 score, represented by each first-level supervisor's ICS assessment at each

respective wave. Implementation leadership predictors (i.e., across all dimensions & total score) included a wave 1 and a wave 2 score, represented by the average across all caseworker ILS assessments in each supervision group at each respective wave. Finally, R^3 fidelity, as a predictor, also included a wave 1 and a wave 2 score. Fidelity assessments were on a monthly schedule that began with baseline assessments (i.e., up to two initial assessments) after first-level supervisors were trained in R^3. An average score at baseline was calculated for the wave 1 predictor. For wave 2, the last three fidelity scores prior to wave 2 assessments for implementation climate and implementation leadership were averaged for the wave 2 predictor.

Outcomes were modeled to detect change over the two waves. That is, models were built to test two potential associations. First, I analyzed whether a predictor at wave 1 was associated with a change over time in the outcome (e.g., first-level supervisor implementation leadership at wave 1 predicting a change in caseworker implementation climate from wave 1 to wave 2). This approach provided insight into how baseline levels (i.e., wave 1) of each predictor might influence change in an outcome over time. Second, I analyzed whether a predictor at wave 2 was associated with a change over time in the outcome. This second approach provides a descriptive look back in time (e.g., the association between first-level supervisor implementation leadership at wave 2 and caseworker implementation climate change from wave 1 to wave 2). Modeling predictors at each wave enabled me to make use of all available data at both timepoints.

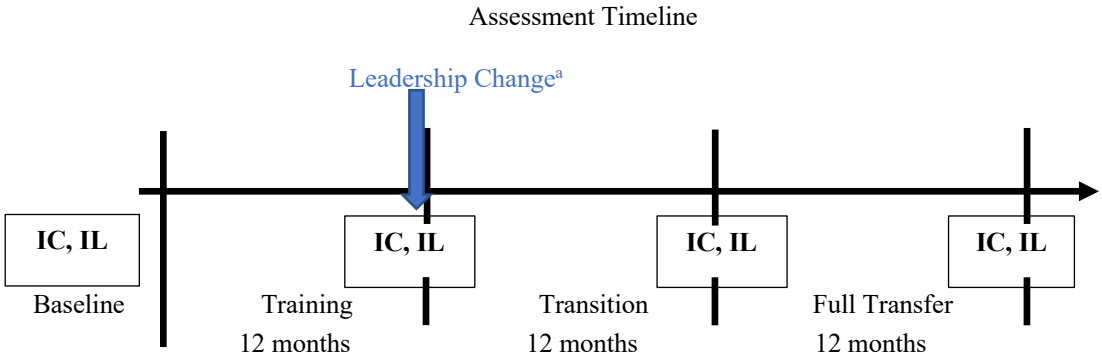
Alternative strategies considered. Although modeling a longitudinal predictor on a longitudinal outcome in a parallel process was considered, it was not practical. Missingness at higher levels within the data (i.e., supervisor assessment data) between the two timepoints confirmed that it was not possible to model a longitudinal predictor. Another approach that was considered was to treat the predictors as time-varying covariates. The limitation of this design,

however, is that associations tend to be methodical in nature. In other words, the implementation climate and implementation leadership assessments were taken by participants at the same time, and scoring may correlate.

Statistical Power

Drawing on the original funded proposal for the main R^3 study, statistical power was determined to be sufficient for all analyses. Power was calculated in a three-step process that, first estimates power using traditional, single-level methods, then computes the actual number of observations, and, penalizes these observations for nesting. This is exemplified with the fidelity measure. With a conservative nesting effect for 36 repeated measurements within each supervisor, and, requiring a sample of 90 observations to detect a small-to-medium effect of $R = .09$, the 1,800 level-1 observations (an estimated 50 supervisors x 36 repeated measures = 1,800) offer sufficient power, equal to 91 observations (PI: Lisa Saldana; NIH R01DA040416). The actual number of supervisors in the study is nearly double the predicted supervisor participants ($N = 91$), thus, it was determined that there was sufficient power for all analyses.

Figure 3



Note. **IC** = implementation climate; **IL** = implementation leadership; Fidelity is measured monthly throughout the assessment period; Figure adapted from the grant proposal of the parent R^3 study (Saldana, NIH R01DA040416)

[a]Leadership change is an approximation, as the four study regions initiated R^3 at different time periods. The change in higher-level leadership occurred at the end of the training phase or at the beginning of the transition phase depending on when R^3 was initiated.

Chapter 4: Results

The results chapter first presents preliminary analyses (Aim 1), which report on first-level supervisor implementation leadership, caseworker implementation climate, and implementation climate level and strength. This is followed by results of the examination of the middle-range theoretical model (Aim 2). The latter section reports on each path analysis, first beginning with the wave 1 predictor model, then, the wave 2 predictor model. Due to variation in study outcomes for first-level supervisor implementation leadership predicting a change in caseworker climate from wave 1 to wave 2, each dimension of implementation climate was reported separately (see below).

Preliminary Analyses (Aim 1)

The first step in examining each path of the middle-range theory involved building unconditional HLM models. Unconditional models provide the variance attributed to each level of the model in order to calculate ICCs to determine within- and between-group agreement. Additionally, ICCs were used as the descriptive statistic to report implementation climate strength, or, how cohesive perceptions are within supervision groups. Implementation climate level, the second descriptive component of implementation climate, was calculated as the supervision group average of all ICS scores. Relevant to this dissertation, was understanding the correlation between first-level supervisor implementation climate and their supervision group (i.e., Do caseworkers within a supervision group share the same perceptions of implementation climate as their supervisor?). It is important to understand this correlation within the context of how implementation proceeded over the first year of the R^3 study, and, how associations, or non-associations, between variables of the middle-range theory may be explained.

Table 3 presents descriptive statistics of supervisor and caseworker assessments relevant to this dissertation. Based on the unconditional models, Table 4 provides the variance components and associated ICCs for each implementation climate and implementation leadership dimension. Each wave was analyzed separately. Decisions to aggregate lower-level data were made based on ICCs, as well as theoretical and practical considerations.

Implementation Leadership

The Implementation Leadership Scale (ILS) was developed and tested at the level of the work-group (Aarons, Ehrhart, & Farahnak, 2014). Table 4 shows implementation leadership dimension ICC results, indicating that a significant portion of the total variance in caseworker assessments was explained by the supervision group. Additionally, missing data and supervision group size were taken into account. Each of these factors impacted the decision to aggregate caseworker perceptions of implementation leadership into a 2-level nested structure. That is, average scores (i.e., level 1) for each supervision group (i.e., level 2) were derived to represent first-level supervisor implementation leadership behaviors. Aggregated unconditional models (i.e., all dimensions & total score) in which implementation leadership was treated as an outcome variable indicate that there was sufficient variance in each outcome variable by the level-2 supervision groupings, justifying that multi-level analyses are appropriate.

Following ICC analyses, wave indicators (i.e., representing waves 1 & 2) were added to the unconditional models (i.e., all dimensions & total score). Unconditional growth models determine whether there was a statistically significant change in the outcome (i.e., implementation leadership) from wave 1 to wave 2. The results did not indicate that leadership changed significantly from wave 1 to wave 2. Although implementation leadership did not

change, proceeding with analyses of the full models is warranted to detect whether an interaction effect is present or not.

Caseworker Implementation Climate

Implementation climate is construed as either an organization-wide or work group-level construct (e.g., Klein & Sorra, 1996; Weiner et al., 2011; Ehrhart, Aarons, & Farahnak, 2014). Further, the Implementation Climate Scale (ICS) was developed and tested at the level of the work group (Ehrhart, Aarons, & Farahnak, 2014). Table 4 provides the variance components and associated ICCs for each climate dimension for waves 1 and 2, based on the unconditional means models. Although ICCs do not provide clear justification for aggregating, theoretical and practical considerations were taken into account in deriving average scores across caseworkers in each supervision group. Aggregated unconditional models (i.e., all dimensions & total score) in which implementation climate was treated as an outcome variable indicate that there was sufficient variance in each outcome variable by the level-2 supervision groupings, justifying that multi-level analyses are appropriate. Unconditional growth models for caseworker implementation climate (i.e., across all dimensions & total score) revealed significant change in the outcome from wave 1 to wave 2.

Implementation climate level & strength. Implementation climate includes the magnitude of collective perceptions (i.e., climate level) and how cohesive perceptions are (i.e., climate strength) within an organization. Perceptions of implementation climate might differ between intra-organization units, particularly when interaction between units is not the norm. Specific to caseworker supervision group implementation climate scores (i.e., average total ICS scores for each supervision group; complete data at each wave) over the two study waves, implementation climate improved for 61% of the groups and declined for 38% of the groups. At

wave 1, 67% of caseworker supervision groups rated implementation climate higher than their first-level supervisor, whereas 31% rated implementation climate as lower. Results were similar at wave 2, in which 69% of caseworker group scores were higher than their supervisor, and, 31% of group scores were lower.

Pearson's correlation coefficients for first-level supervisors and their caseworkers with complete data for each wave were calculated at wave 1 and wave 2. Supervisors' perceptions of overall implementation climate (i.e., total ICS score) demonstrate a weak, non-linear correlation with their caseworkers' perceptions of overall implementation climate: $r(70) = .119$, $p = .319$ at wave 1; and, $r(66) = .083$, $p = .501$ at wave 2. These weak associations indicate that first-level supervisors do not share similar perceptions of implementation climate, suggesting the possibility that first-level supervisors establish distinct within-group implementation climates. In summary, the majority of supervisors are able to establish a more positive implementation climate for their caseworkers, and, implementation climate improved within the majority of supervision groups over time.

Empirical Examination of the Middle-Range Theoretical Model (Aim 2)

Path analyses are described below and results from the full analytic models are presented in Tables 5 through 12. A comprehensive set of analyses were conducted across waves 1 and 2. Although a number of analyses were not significant, all foundational relationships are reported to add to the Aim 1 results in order to understand the context of R^3 implementation over the first year of the parent study. Results are reported with a focus on four different β-coefficients and corresponding p-values for each analytic model: 1) The intercept coefficient (labeled as "intercept" in the corresponding tables) represents the wave 1 (i.e., baseline) outcome score for having an average level of a predictor for the region of reference (i.e., one region was selected as

the referent, and region indicators for the other three regions were included in all models in comparison to the referent); 2) The main effect coefficient (labeled as “main effect”) represents the difference in wave 1 levels of an outcome between having an average predictor score for an outcome and having a one standard deviation higher or lower predictor score, and if this difference is statistically significant; 3) The wave 2 indicator coefficient (labeled as “Wave 2” in the corresponding tables) indicates if the outcome for having an average level of the predictor significantly changed from wave 1 to wave 2. The exception to the wave 2 indicator is the linear time term included in all models in which fidelity is the outcome (i.e., supervisor implementation climate predicting change in fidelity & supervisor implementation leadership predicting change in fidelity; labeled as “time term” in the corresponding tables); 4) Finally, the interaction term (labeled as “interaction” in the corresponding tables) represents the interaction effect between a level-2 predictor and the level-1 wave indicator or linear time term. This represents whether there is a statistically significant difference in outcome change over time between different levels (i.e., assessment scores) of each predictor in the models (i.e., the difference-in difference component of the analyses (see Methods). For analyses in which there was a significant interaction effect, planned contrasts were evaluated as a post hoc test to determine if having a one standard deviation higher level of a predictor is associated with a significant change in the outcome over time. Visual representation of the most meaningful analyses supporting, or disconfirming, associations of the proposed models are presented as graphs. All analyses were grand mean centered, thus each graph depicts the outcome change slope for having an average level of the predictor from wave 1 to wave 2 in comparison to the slopes of having a one standard deviation higher or lower level of the predictor. For all analyses, compared to the referent region, regional variation was negligible, and is not discussed further.

Supervisor Implementation Climate Predicting Change in Implementation Leadership

Wave 1. Table 5 presents the analyses testing if supervisor perceptions of implementation climate at wave 1 predicts a change in their implementation leadership behaviors (i.e., caseworker-reported) from wave 1 to wave 2. At wave 1, there were no statistically significant differences in implementation leadership (i.e., all dimensions & total score) based on implementation climate (i.e., all dimensions & total score). From wave 1 to wave 2, implementation leadership did not change significantly based on implementation climate. Level of implementation climate was not associated with different rates of change in implementation leadership from wave 1 to wave 2. Thus, there is no evidence to suggest an interaction effect. Based on these results, first-level supervisor perceptions of implementation climate at wave 1 were not associated with a change in their implementation leadership behaviors from wave 1 to wave 2 (e.g., see Figure 4).

Wave 2. Table 6 presents the analyses testing if supervisor perceptions of implementation climate at wave 2 predicts a change in their implementation leadership over the two waves. At wave 1, there were no statistically significant differences in implementation leadership based on implementation climate, with the exception of one dimension of implementation climate (i.e., EBP selection) predicting total implementation leadership and one dimension of implementation leadership (i.e., knowledge). Compared to an average level of EBP selection, a one-point increase in level of EBP selection at wave 2 was associated with a lower total implementation leadership or knowledge score at wave 1 (e.g., see Figure 5). From wave 1 to wave 2, implementation leadership (i.e., all dimensions & total score) did not change significantly based on implementation climate. Change in knowledge from wave 1 to wave 2 was significantly different based on level of total implementation climate, and three dimensions of

implementation climate (i.e., focus, recognition, & EBP selection; e.g., see Figure 5). Based on these results, there is insufficient evidence to support an association between first-level supervisor perceptions of implementation climate at wave 2 and a change in their implementation leadership behaviors from wave 1 to wave 2.

Supervisor Implementation Climate Predicting Change in Supervision Fidelity

Wave 1. Table 7 presents the results for all analyses modeling first-level supervisor implementation climate predicting change in fidelity. At wave 1, there were no statistically significant differences in fidelity based on implementation climate (i.e., all dimensions & total implementation climate). Over the one-year R^3 training phase, fidelity increased significantly based on implementation climate. The interaction effect was not statistically significant. That is, the rate of change in fidelity over time did not differ based on the level of implementation climate. Therefore, holding implementation climate constant, there is a significant increase in fidelity over time (see Figure 6). Figure 6 portrays wave 1 total implementation climate predicting change in fidelity over time, revealing an increase in fidelity that equates to over two percentage points per month. Such a change would indicate that first-level supervisors are able to deliver R^3 with high fidelity (i.e., having a fidelity score at 80% or higher) by wave 2.

Wave 2. At wave 1, there were no statistically significant differences in fidelity based on implementation climate, with the exception of one dimension (i.e., EBP selection). Having a one-point higher level of EBP selection at wave 2 was associated with a lower fidelity score at wave 1. From wave 1 to wave 2, fidelity increased significantly based on implementation climate (i.e., all dimensions & total score). This increase in fidelity over time did not differ based on the level of implementation climate (i.e., interaction effect was not statistically significant; see Table 7). Figure 7 portrays wave 2 total implementation climate predicting change in fidelity over time,

revealing an increase in fidelity that equates to over two percentage points per month. Such a change would indicate that, holding level of implementation climate constant at wave 2, first-level supervisors are able to deliver R^3 with high fidelity by wave 2.

Supervision Fidelity Predicting Change in Implementation Leadership

Wave 1. Table 8 presents the analyses testing the hypothesis that supervision (i.e., R^3 fidelity) will be positively associated with implementation leadership. At wave 1, there were statistically significant differences in two implementation leadership dimensions (i.e., proactive & knowledge; e.g., see Figure 8). From wave 1 to wave 2, implementation leadership did not change significantly based on fidelity. The rate of change in total implementation leadership and one dimension of implementation leadership (i.e., perseverant) from wave 1 to wave 2 were significantly different based on level of fidelity (e.g., see Figure 9). Results, however, indicate that there is insufficient evidence to support the hypothesis. That is, Figures 8 and 9 show that the rate of change in implementation leadership may be statistically significant for first-level supervisors who had a higher or lower level of fidelity at wave 1, but such conclusions cannot be made without further examination (e.g., simple slopes test).

Wave 2. At wave 1, there were statistically significant differences in implementation leadership (i.e., all dimensions & total score), with the exception of knowledge, which was marginally significant. From wave 1 to wave 2, implementation leadership did not change significantly based on fidelity. The rate of change in implementation leadership (i.e., all dimensions & total score) from wave 1 to wave 2 was not significantly different based on level of fidelity (e.g., see Figure 10). Thus, results indicate that there is insufficient evidence to support the hypothesis.

Supervisor Implementation Leadership Predicting Fidelity

Wave 1. Although fidelity was not associated with a change in implementation leadership, an additional set of analyses were modeled and tested for an alternative path: Implementation leadership predicting a change in fidelity over time (see Table 9). At wave 1, there were statistically significant differences in fidelity based on implementation leadership (i.e., all dimensions & total score). Having a one-point higher level of implementation leadership at wave 1 was associated with a higher level of fidelity. Figure 11, for example, depicts wave 1 total implementation leadership predicting change in fidelity over time. Higher levels of implementation leadership were associated with a substantially higher fidelity score at baseline (i.e., 7.86 percentage points higher). Over the one-year R^3 training phase, and holding implementation leadership constant, fidelity increased significantly based on implementation leadership. This rate of increase in fidelity over time did not differ based on the level of implementation leadership (i.e., no interaction effect; see Figure 11).

Wave 2. At wave 1, there were no statistically significant differences in fidelity based on implementation leadership (i.e., all dimensions & total implementation leadership). Over the one-year R^3 training phase, fidelity increased significantly based on implementation leadership (e.g., see Figure 12). That is, holding implementation leadership constant, fidelity increased significantly over time. This rate of change in fidelity did not differ based on the level of implementation leadership, although, total implementation leadership, knowledge, and support were marginally significant (see Table 9).

Supervision Fidelity Predicting Change in Caseworker Implementation Climate

Wave 1. Table 10 presents the analyses testing the hypothesis that supervision will be positively associated with caseworker implementation climate. At wave 1, there were no

statistically significant differences in implementation climate (i.e., all dimensions & total score) based on fidelity. From wave 1 to wave 2, implementation climate increased significantly based on total score, education support, and rewards. From wave 1 to wave 2, EBP selection decreased significantly. The rate of change in implementation climate from wave 1 to wave 2 did not significantly differ based on level of fidelity. Thus, for an average level of fidelity at wave 1, there was a significant increase in total implementation climate, education support, and rewards from wave 1 to wave 2, and, a significant decrease in EBP selection (e.g., see Figures 13 & 14). Overall, there is evidence to support the hypothesis.

Wave 2. At wave 1, there were no statistically significant differences in implementation climate (i.e., all dimensions & total score) based on fidelity at wave 2. From wave 1 to wave 2, implementation climate increased significantly based on education support and rewards (e.g., see Figure 15). Total implementation climate trended towards a significant increase ($p = .068$). For an average level of fidelity at wave 2, certain dimensions of implementation climate (i.e., education support & rewards) increased significantly from wave 1 to wave 2. From wave 1 to wave 2, EBP selection decreased significantly (see Figure 16). The change in implementation climate from wave 1 to wave 2 did not differ based on level of fidelity.

Implementation Leadership Predicting Change in Caseworker Implementation Climate

Tables 11 and 12 present the analyses that tested the hypothesis that implementation leadership will be positively associated with caseworker implementation climate. Results reveal variation in single dimensions of implementation leadership predicting change in implementation climate, and, are reported separately for each outcome variable: Total implementation climate, focus on evidence-based practice (i.e., “focus”), educational support for evidence-based practice (i.e., “education support”), recognition for evidence based practice (i.e., “recognition”), rewards

for evidence-based practice (i.e., “rewards”), selection for evidence-based practice (i.e., “EBP selection”), and selection for openness (i.e., “openness”).

Total implementation climate.

Wave 1. At wave 1, there were statistically significant differences in total implementation climate based on implementation leadership (i.e., all dimensions & total implementation leadership; see Table 11). A one-point higher level of total implementation leadership, for example, was associated with a higher level of total implementation climate at wave 1 (i.e., approximately .5 points higher). From wave 1 to wave 2, total implementation climate increased significantly based on implementation leadership (i.e., all dimensions & total score; e.g., see Figure 17). The rate of increase in total implementation climate from wave 1 to wave 2 did not differ based on the level of leadership.

Wave 2. At wave 1, there were no statistically significant differences in total implementation climate based on implementation leadership (i.e., all dimensions & total score). From wave 1 to wave 2, for an average level of implementation leadership at wave 2, total implementation climate did not change significantly. However, for an implementation leadership score that was one standard deviation higher than average, and based on a planned contrast, the change in total implementation climate from wave 1 to wave 2 was statistically significant (e.g., see Figure 18).

Focus on evidence-based practice.

Wave 1. At wave 1, there were statistically significant differences in focus based on implementation leadership (i.e., all dimensions & total score). Having a one-point higher level of implementation leadership was associated with a higher level of focus at wave 1. From wave 1 to wave 2, focus trended towards statistically significant change based on having an average level

of total implementation leadership, proactive, and support. The rate of change in focus from wave 1 to wave 2 significantly differed based on the level of implementation leadership (i.e., all dimensions & total score; e.g., see Figure 19).

Wave 2. At wave 1, there were no statistically significant differences in focus based on implementation leadership (i.e., all dimensions & total score). From wave 1 to wave 2, focus did not change significantly based on implementation leadership. The rate of change in focus from wave 1 to wave 2 significantly differed based on the level of implementation leadership (i.e., all dimensions & total score; e.g., see Figure 20).

Educational support for evidence-based practice.

Wave 1. At wave 1, there were statistically significant differences in education support based on implementation leadership (i.e., all dimensions & total score). Having a one-point higher level of implementation leadership was associated with a higher level of education support. From wave 1 to wave 2, education support increased significantly based on implementation leadership (i.e., all dimensions & total score). Change in education support from wave 1 to wave 2 significantly differed based on level of total implementation leadership, proactive, and knowledge (e.g., see Figure 21). The rate of change in education support from wave 1 to wave 2 did not differ based on level of perseverant or support.

Wave 2. At wave 1, there were no statistically significant differences in education support based on implementation leadership (i.e., all dimensions & total score). From wave 1 to wave 2, education support increased significantly based on implementation leadership (i.e., all dimensions & total score). The rate of change in education support from wave 1 to wave 2 significantly differed based on implementation leadership (i.e., all dimensions & total score; e.g., see Figure 22).

Recognition for evidence-based practice.

Wave 1. At wave 1, there were statistically significant differences in recognition based on implementation leadership (i.e., all dimensions & total score). Having a one-point higher level of implementation leadership was associated with a higher level of recognition. From wave 1 to wave 2, recognition increased significantly based on proactive. Recognition trended towards a significant increase based on all other predictors (i.e., knowledge, perseverant, & total score). The rate of change in recognition from wave 1 to wave 2 did not significantly differ based on level of implementation leadership. However, change trended towards being significant based on levels of proactive (see Figure 23).

Wave 2. At wave 1, there were no statistically significant differences in recognition based on implementation leadership (i.e., all dimensions & total score). From wave 1 to wave 2, recognition did not significantly change based on implementation leadership (i.e., all dimensions & total score). The rate of change in recognition from wave 1 to wave 2 did not significantly differ based on implementation leadership (i.e., all dimensions & total score; e.g., see Figure 24).

Rewards for evidence-based practice.

Wave 1. At wave 1, there were statistically significant differences in rewards based on implementation leadership (i.e., all dimensions & total score). From wave 1 to wave 2, rewards increased significantly based on implementation leadership. The rate of change in rewards from wave 1 to wave 2 did not significantly differ based on level of implementation leadership (e.g., see Figure 25).

Wave 2. At wave 1, there were no statistically significant differences in rewards based on implementation leadership (i.e., all dimensions & total score). From wave 1 to wave 2, rewards increased significantly based on implementation leadership (i.e., all dimensions & total score).

The rate of change in rewards from wave 1 to wave 2 did not significantly differ based on implementation leadership (i.e., all dimensions & total score; e.g., see Figure 26).

Selection for evidence-based practice.

Wave 1. At wave 1, there were statistically significant differences in EBP selection based on implementation leadership (i.e., all dimensions & total score). From wave 1 to wave 2, EBP selection did not change significantly based on implementation leadership. The rate of change in EBP selection from wave 1 to wave 2 did not significantly differ based on implementation leadership (e.g., see Figure 27).

Wave 2. At wave 1, there were no statistically significant differences in EBP selection based on implementation leadership (i.e., all dimensions & total implementation leadership). From wave 1 to wave 2, EBP selection decreased significantly based on implementation leadership (i.e., all dimensions & total score). The rate of change in EBP selection from wave 1 to wave 2 significantly differed based on total implementation leadership, proactive, and perseverance. Having a one standard deviation higher level of each implementation leadership predictor compared to an average level was associated with a smaller decline in EBP support from wave 1 to wave 2 (e.g., see Figure 28).

Selection for openness.

Wave 1. At wave 1, there were statistically significant differences in openness based on implementation leadership (i.e., all dimensions & total score). From wave 1 to wave 2, openness did not change significantly based on implementation leadership (i.e., all dimensions & total score). Openness did trend towards a significant change based on proactive. The rate of change in openness from wave 1 to wave 2 significantly differed based on level of proactive (see Figure 29).

Wave 2. At wave 1, there were no statistically significant differences in openness based on implementation leadership (i.e., all dimensions & total score). From wave 1 to wave 2, openness did not change significantly based on implementation leadership (i.e., all dimensions & total score). The rate of change in openness from wave 1 to wave 2 significantly differed based on level of implementation climate (e.g., see Figure 30).

Summary across all dimensions of implementation climate. Although there was variation across the analyses, there is evidence to support the hypothesis. That is, results demonstrate that first-level supervisor implementation leadership is, overall, positively associated with a change in caseworker implementation climate over time. As a wave 1 predictor, a one-point increase in level of implementation leadership (i.e., all dimensions & total score) was associated with an increase in total implementation climate, and, dimensions of education support and rewards from wave 1 to wave 2. Dependent on the implementation leadership predictor, there was a marginal association with change in two other dimensions of implementation climate (i.e., focus & recognition). As a wave 2 predictor, a one-point increase in level of implementation leadership (i.e., all dimensions & total score) was associated with an increase in two dimensions of implementation climate (i.e., education support & rewards). Graphs of wave 2 predictor models reveal substantial differences in having a higher or lower level of implementation leadership, with the exception of one dimension of implementation climate (i.e., rewards). These findings should be explored further (see Discussion).

Summary of the Empirical Examination of the Middle-Range Theoretical Model

Results across all path analyses support the dual role of first-level supervisors in shaping caseworker implementation climate. However, the mechanisms which influence a first-level

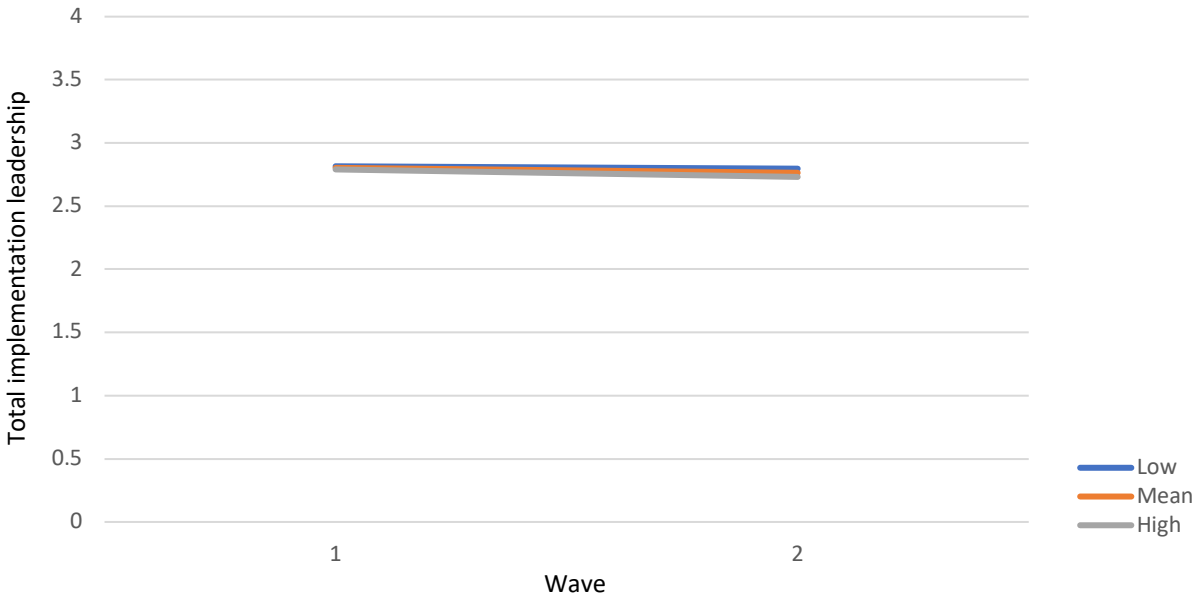
supervisor's ability to effectively supervise and provide high levels of implementation leadership remains unclear. Below is a brief summary of each set of path analyses.

1. Supervisor implementation climate predicting change in implementation leadership: Results indicate that implementation leadership did not change from wave 1 to wave 2. Further, there is no evidence to suggest that first-level supervisor implementation climate is associated with implementation leadership.
2. Supervisor implementation climate predicting change in supervision fidelity: Results show that first-level supervisor implementation climate was associated with an increase in first-level supervisor fidelity. However, there was no difference in the rate of change over time for having different perceptions of implementation climate.
3. Supervision fidelity predicting change in implementation leadership: There is no evidence to suggest that fidelity is associated with implementation leadership. Thus, the hypothesis for this path was not supported.
4. Supervisor implementation leadership predicting fidelity: Implementation leadership was associated with a substantial increase in fidelity over time. Further, stronger implementation leadership behaviors can be attributed to more effective supervision (i.e., fidelity) at baseline. Thus, results from these analyses provide evidence linking implementation leadership and supervision.
5. Supervision fidelity predicting change in caseworker implementation climate: Early fidelity to R^3 was associated with an increase in caseworker implementation climate over time. Results support the hypothesis for this path. That is, there is evidence demonstrating that supervision can influence implementation climate.

6. Implementation leadership predicting change in caseworker implementation climate: Although there was variation across the analyses, overall, the results demonstrate support for the hypothesis. These findings provide evidence demonstrating that first-level supervisor implementation leadership can influence implementation climate.

Figure 4

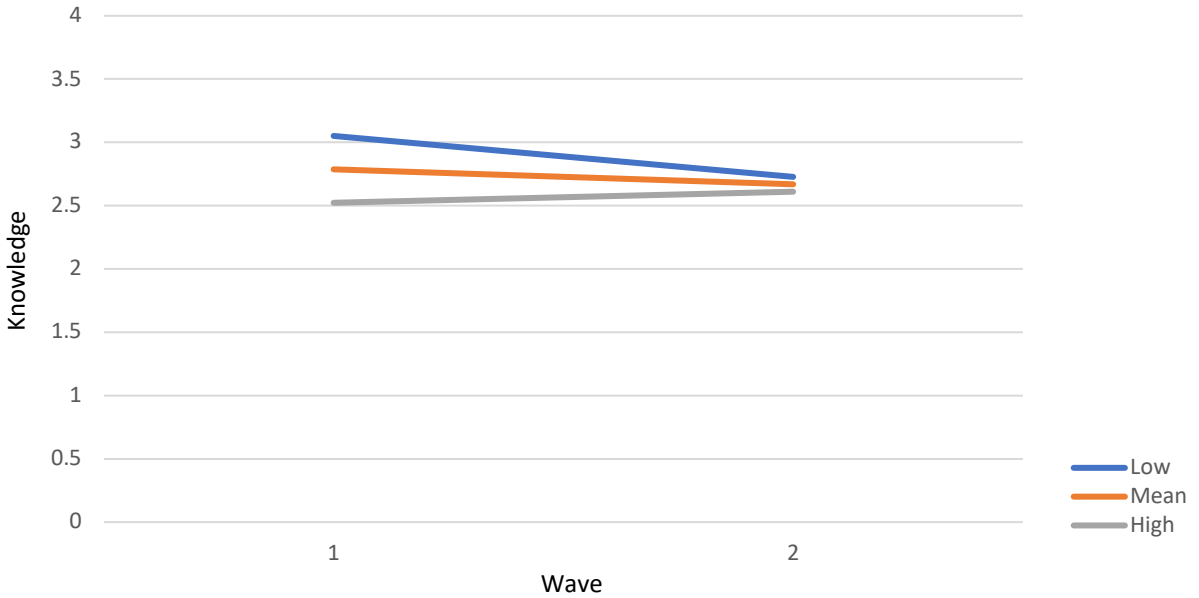
Wave 1 total implementation climate predicting change in total implementation leadership from wave 1 to wave 2



Note. High and low scores were calculated as +/- 1 standard deviation from the mean outcome score at wave 1 (grand mean centered).

Figure 5

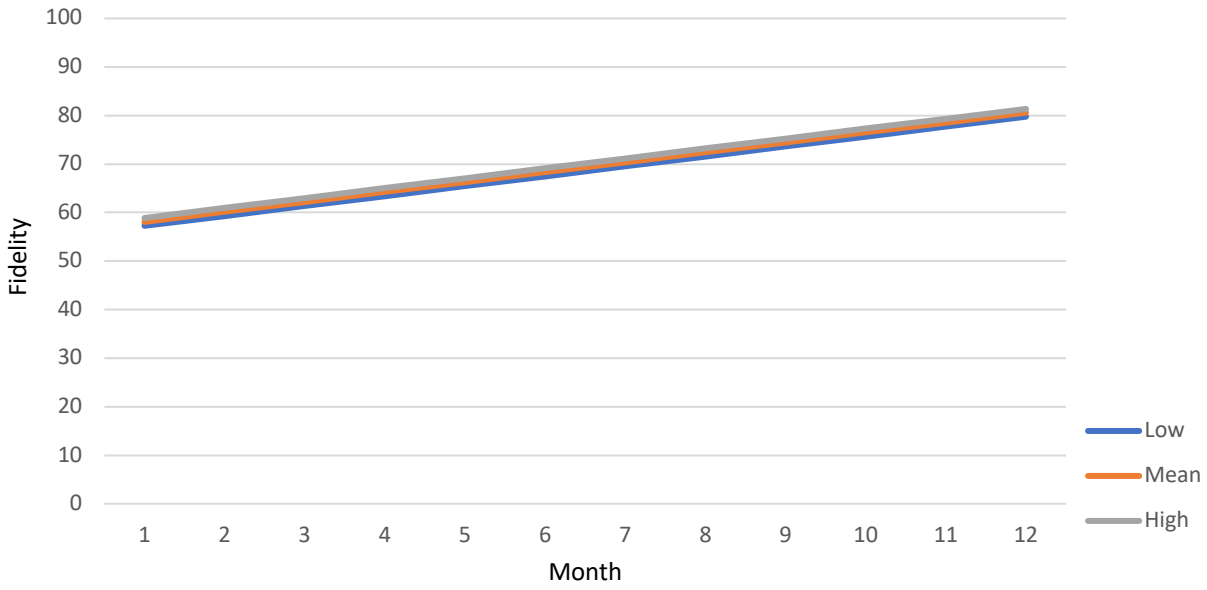
Wave 2 EBP selection predicting change in knowledge from wave 1 to wave 2



Note. High and low scores were calculated as +/- 1 standard deviation from the mean outcome score at wave 1 (grand mean centered).

Figure 6

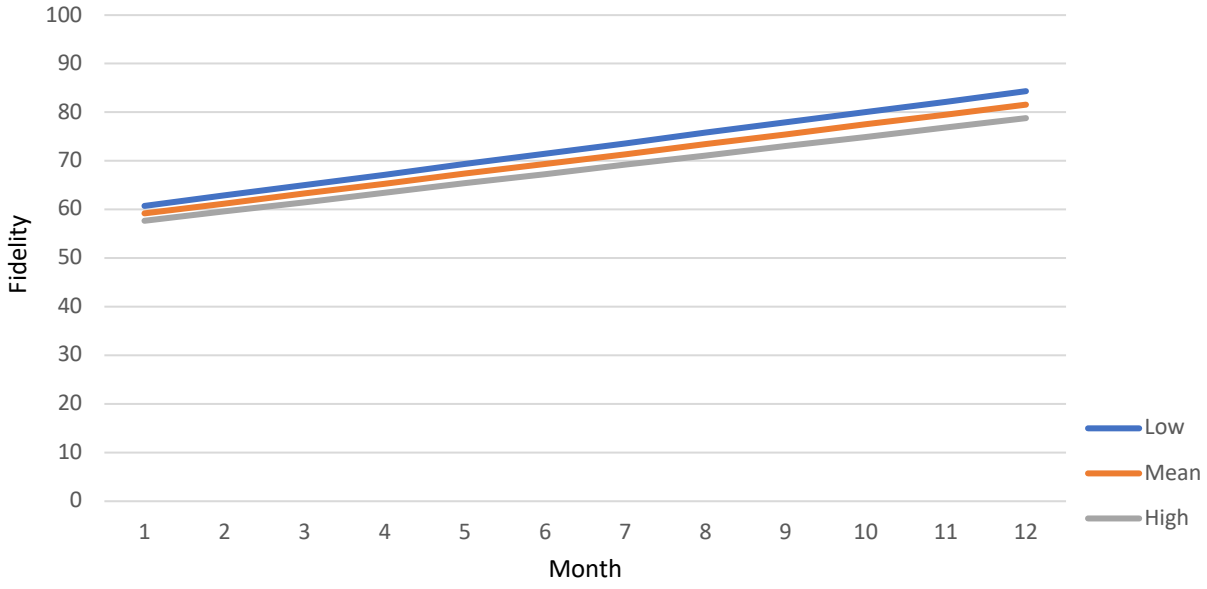
Wave 1 total implementation climate predicting change in fidelity over 12 months



Note. High and low scores were calculated based off of having a +/- 1 standard deviation from the mean outcome score (grand mean centered).

Figure 7

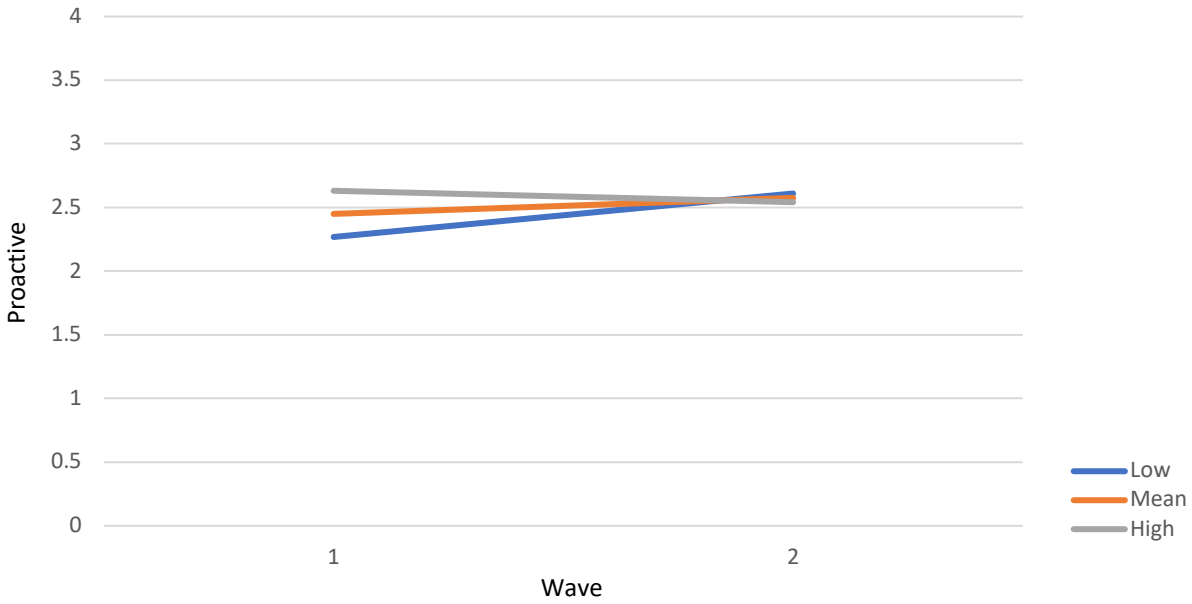
Wave 2 total implementation climate predicting change in fidelity over 12 months



Note. High and low scores were calculated based off of having a +/- 1 standard deviation from the mean outcome score (grand mean centered).

Figure 8

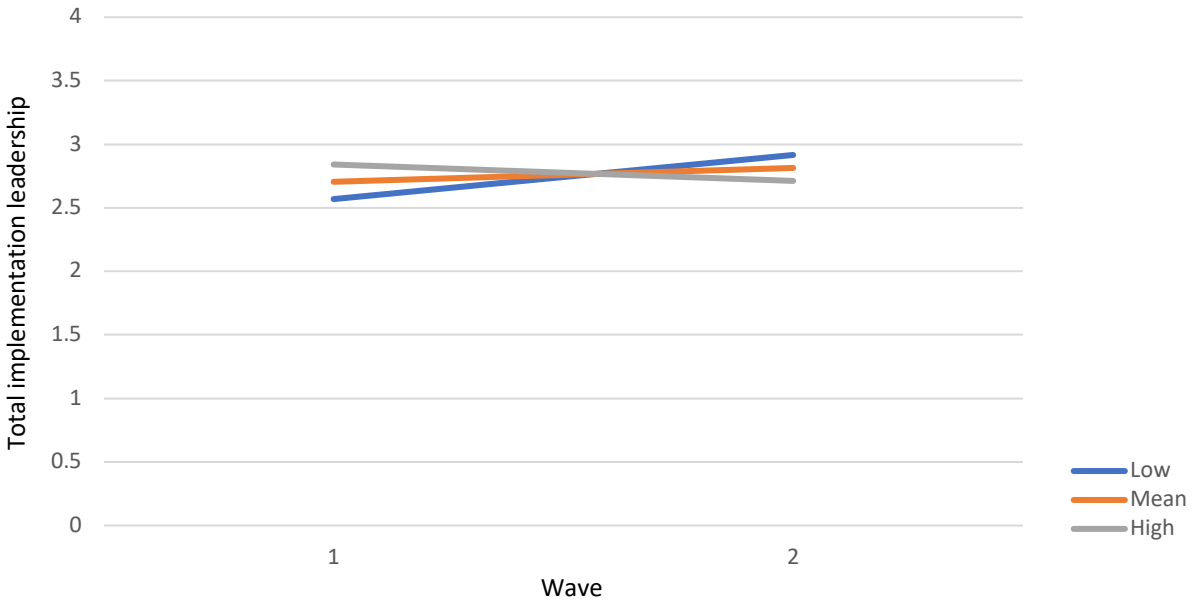
Wave 1 fidelity predicting change in proactive from wave 1 to wave 2



Note. High and low scores were calculated as +/- 1 standard deviation from the mean outcome score at wave 1 (grand mean centered).

Figure 9

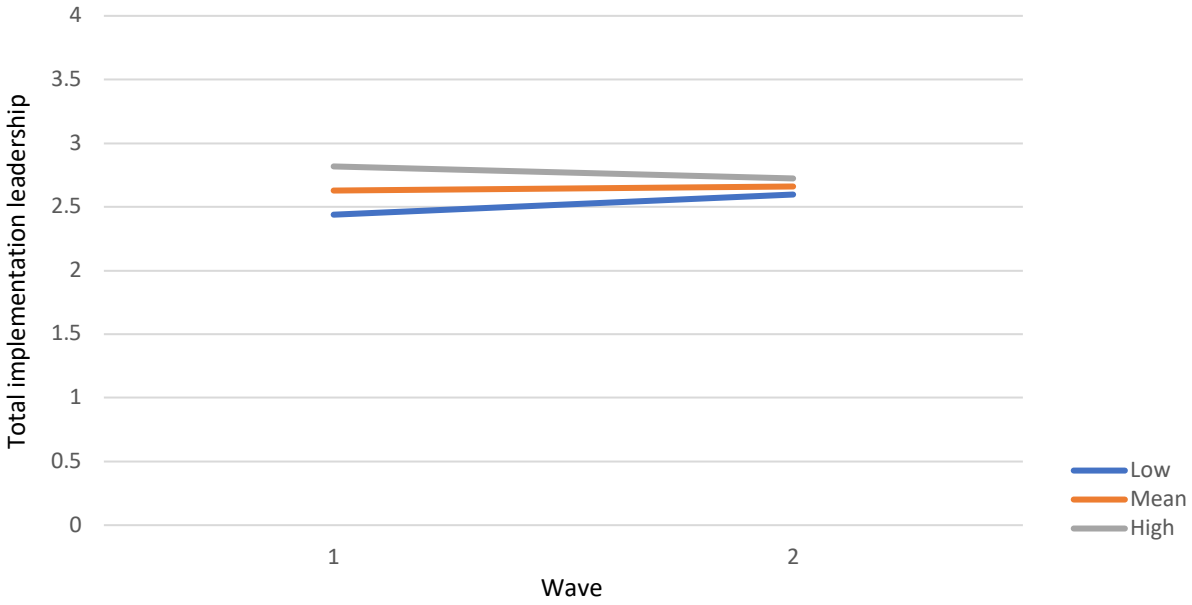
Wave 1 fidelity predicting change in total implementation leadership from wave 1 to wave 2



Note. High and low scores were calculated as +/- 1 standard deviation from the mean outcome score at wave 1 (grand mean centered).

Figure 10

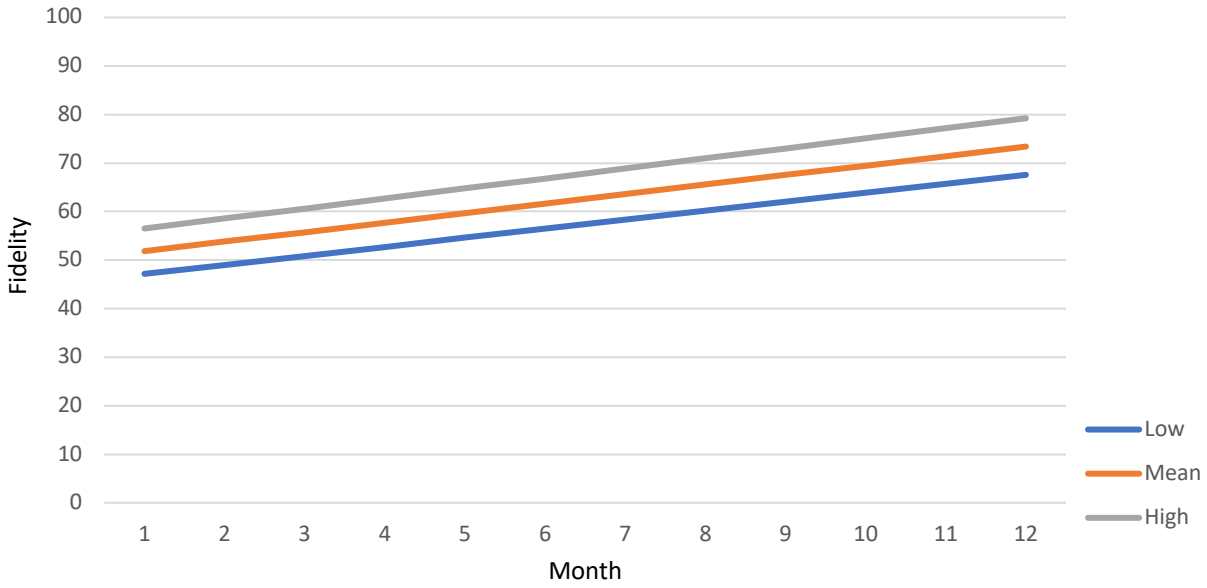
Wave 2 fidelity predicting change in total implementation leadership from wave 1 to wave 2



Note. High and low scores were calculated as +/- 1 standard deviation from the mean outcome score at wave 1 (grand mean centered).

Figure 11

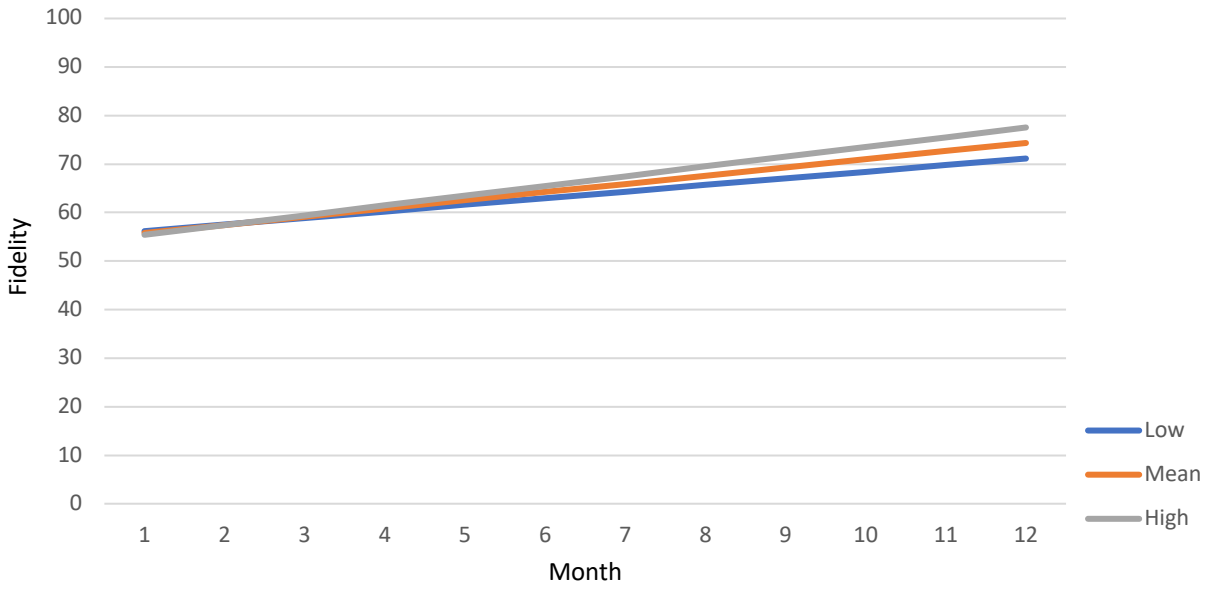
Wave 1 total implementation leadership predicting change in fidelity over 12 months



Note. High and low scores were calculated based off of having a +/- 1 standard deviation from the mean outcome score (grand mean centered).

Figure 12

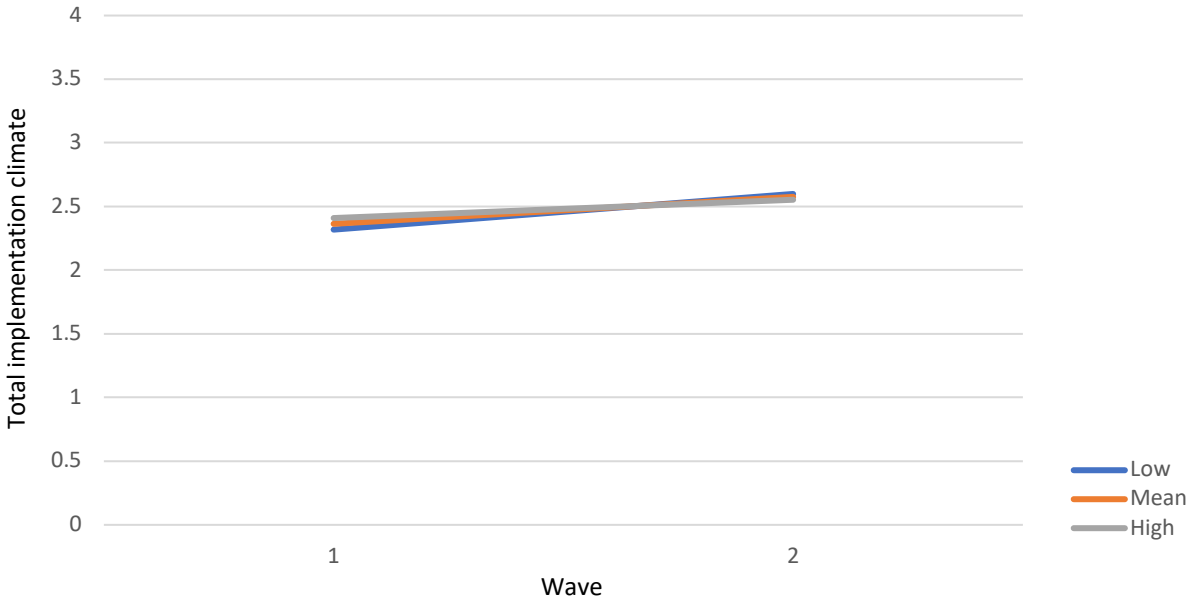
Wave 2 total implementation leadership predicting change in fidelity over 12 months



Note. High and low scores were calculated based off of having a +/- 1 standard deviation from the mean outcome score (grand mean centered).

Figure 13

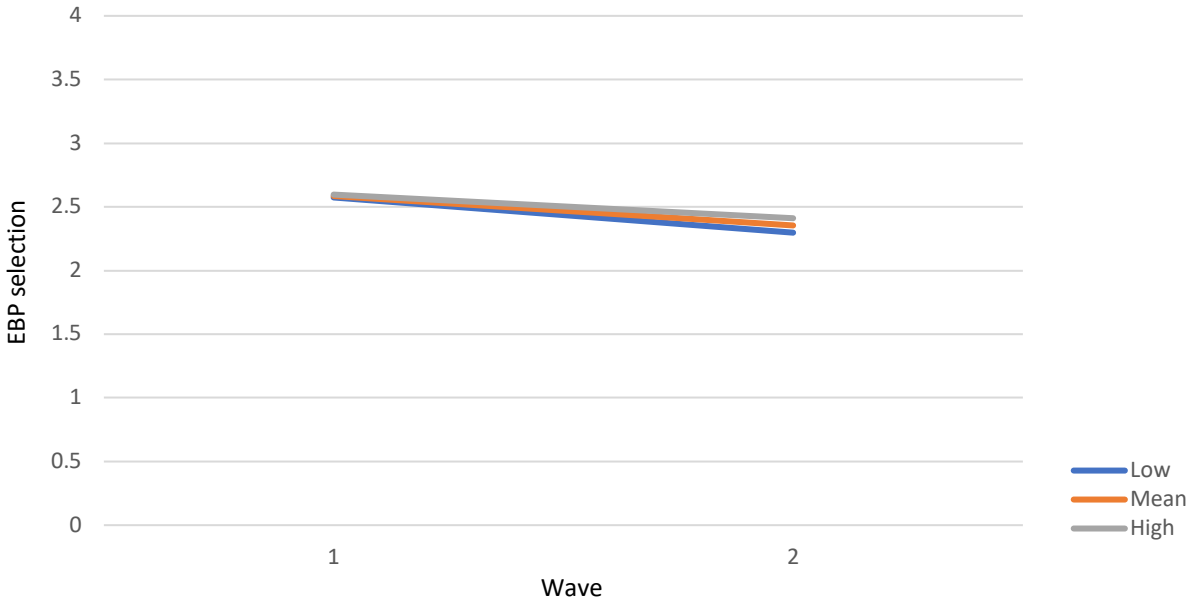
Wave 1 fidelity predicting change in total implementation climate from wave 1 to wave 2



Note. High and low scores were calculated as +/- 1 standard deviation from the mean outcome score at wave 1 (grand mean centered).

Figure 14

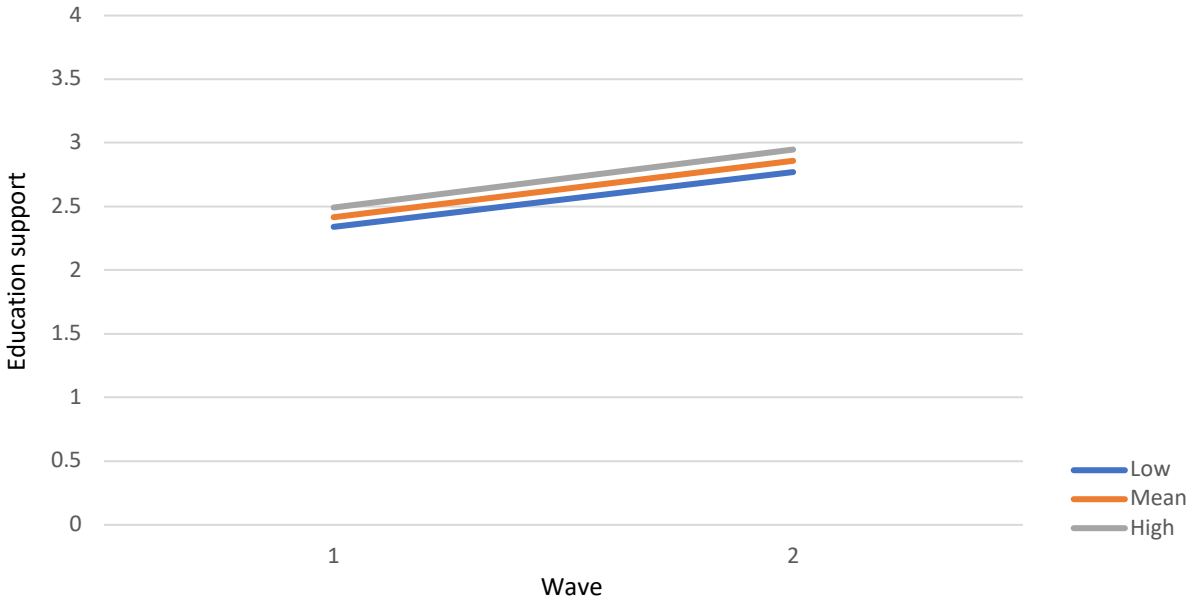
Wave 1 fidelity predicting change in EBP selection from wave 1 to wave 2



Note. High and low scores were calculated as +/- 1 standard deviation from the mean outcome score at wave 1 (grand mean centered).

Figure 15

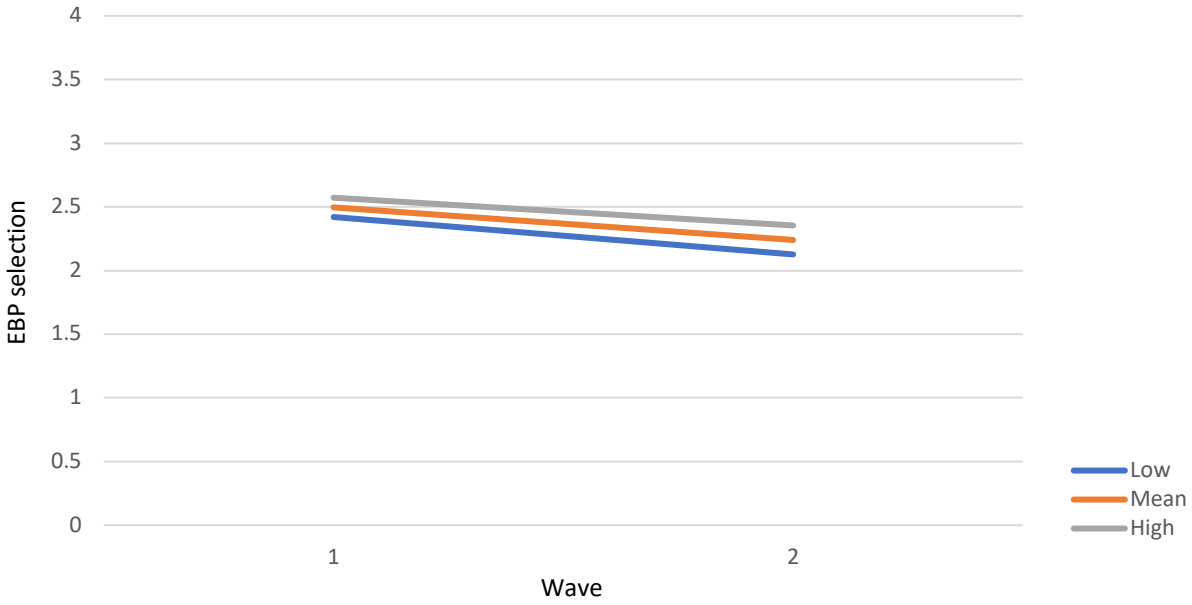
Wave 2 fidelity predicting change in education support from wave 1 to wave 2



Note. High and low scores were calculated as +/- 1 standard deviation from the mean outcome score at wave 1 (grand mean centered).

Figure 16

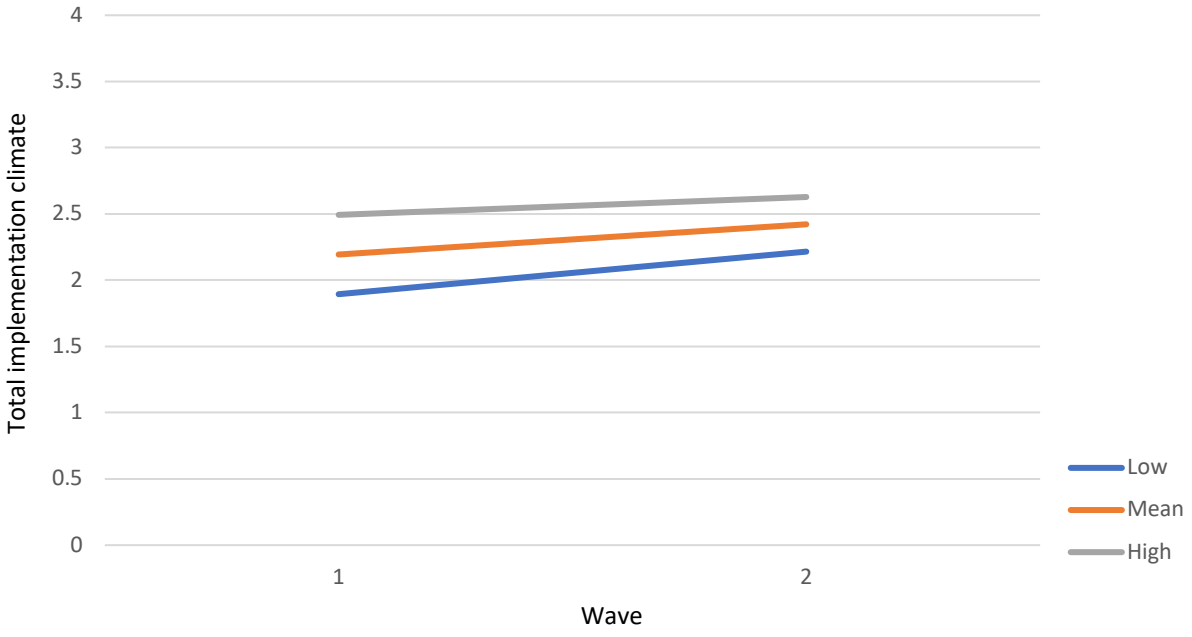
Wave 2 fidelity predicting change in EBP selection from wave 1 to wave 2



Note. High and low scores were calculated as +/- 1 standard deviation from the mean outcome score at wave 1 (grand mean centered).

Figure 17

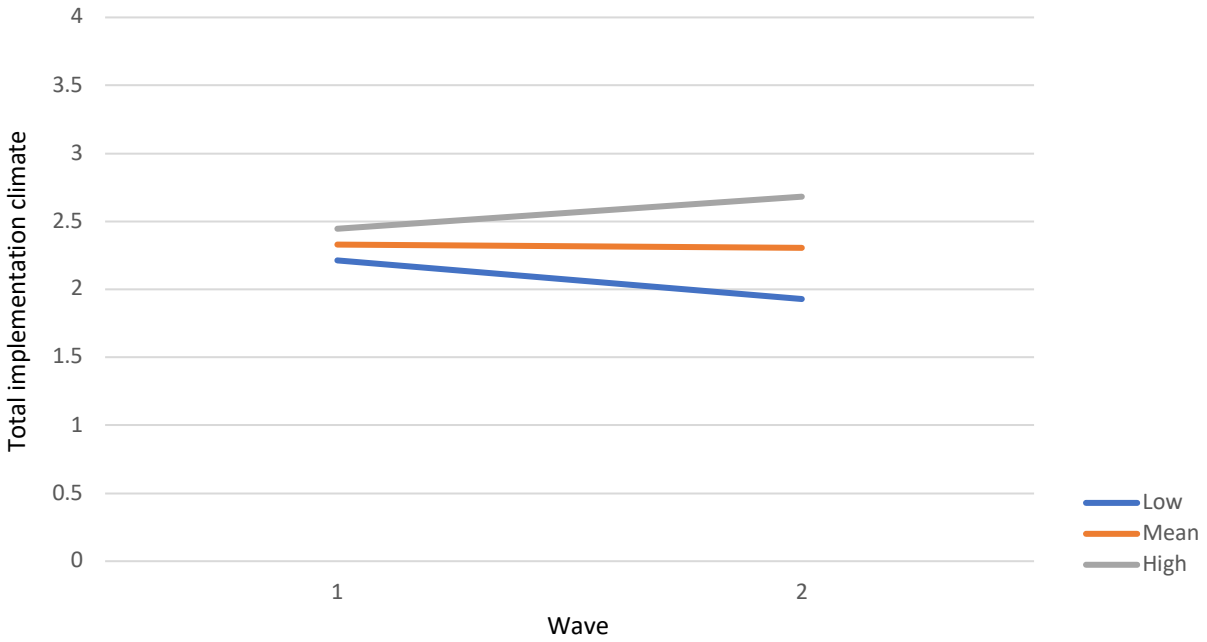
Wave 1 total implementation leadership predicting change in total implementation climate from wave 1 to wave 2



Note. High and low scores were calculated as +/- 1 standard deviation from the mean outcome score at wave 1 (grand mean centered).

Figure 18

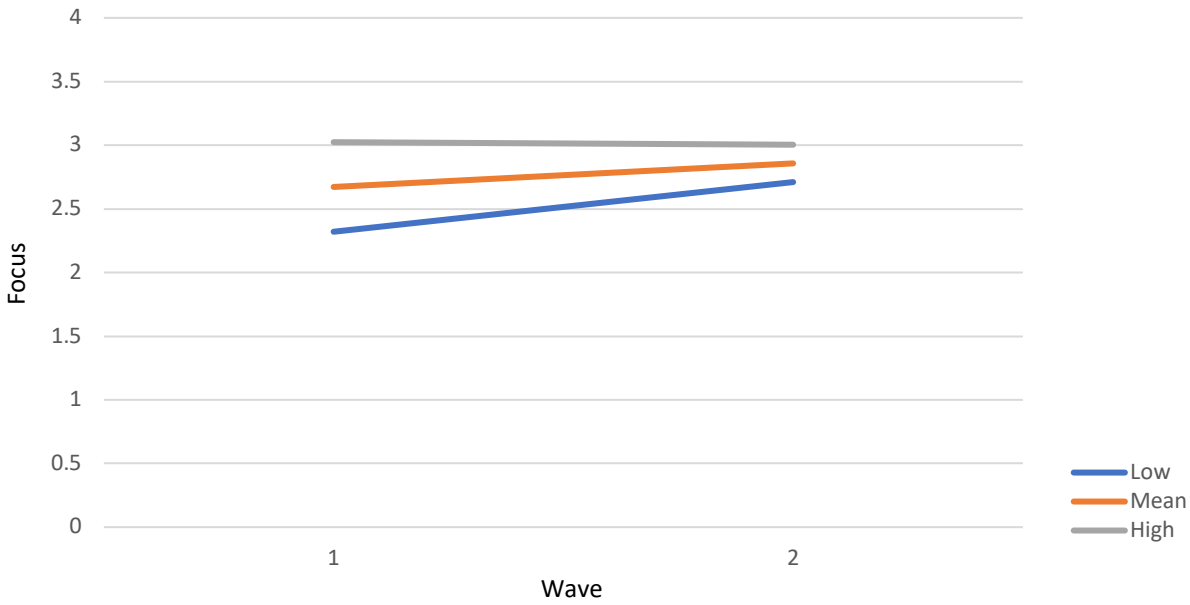
Wave 2 total implementation leadership predicting change in total implementation climate from wave 1 to wave 2



Note. High and low scores were calculated as +/- 1 standard deviation from the mean outcome score at wave 1 (grand mean centered).

Figure 19

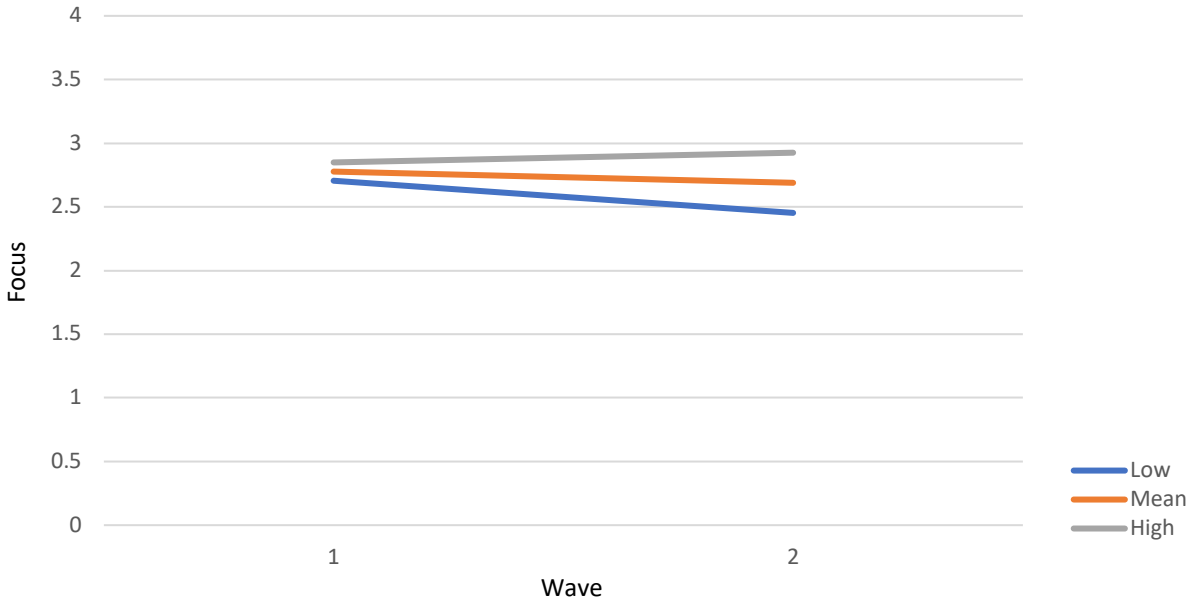
Wave 1 total implementation leadership predicting change in focus from wave 1 to wave 2



Note. High and low scores were calculated as +/- 1 standard deviation from the mean outcome score at wave 1 (grand mean centered).

Figure 20

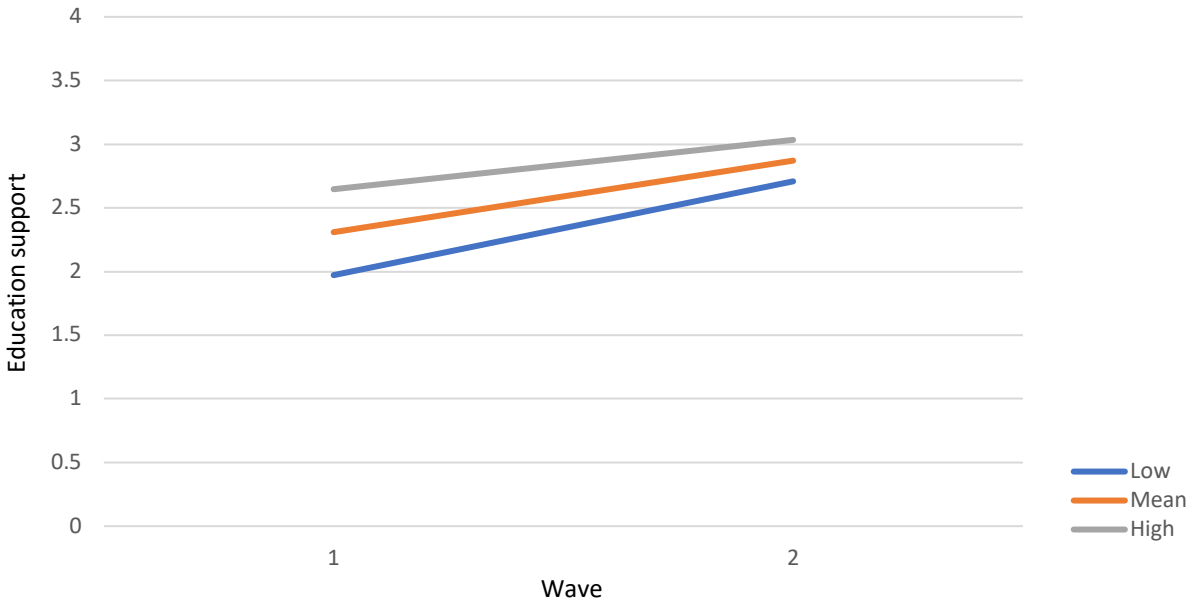
Wave 2 total implementation leadership predicting change in focus from wave 1 to wave 2



Note. High and low scores were calculated as +/- 1 standard deviation from the mean outcome score at wave 1 (grand mean centered).

Figure 21

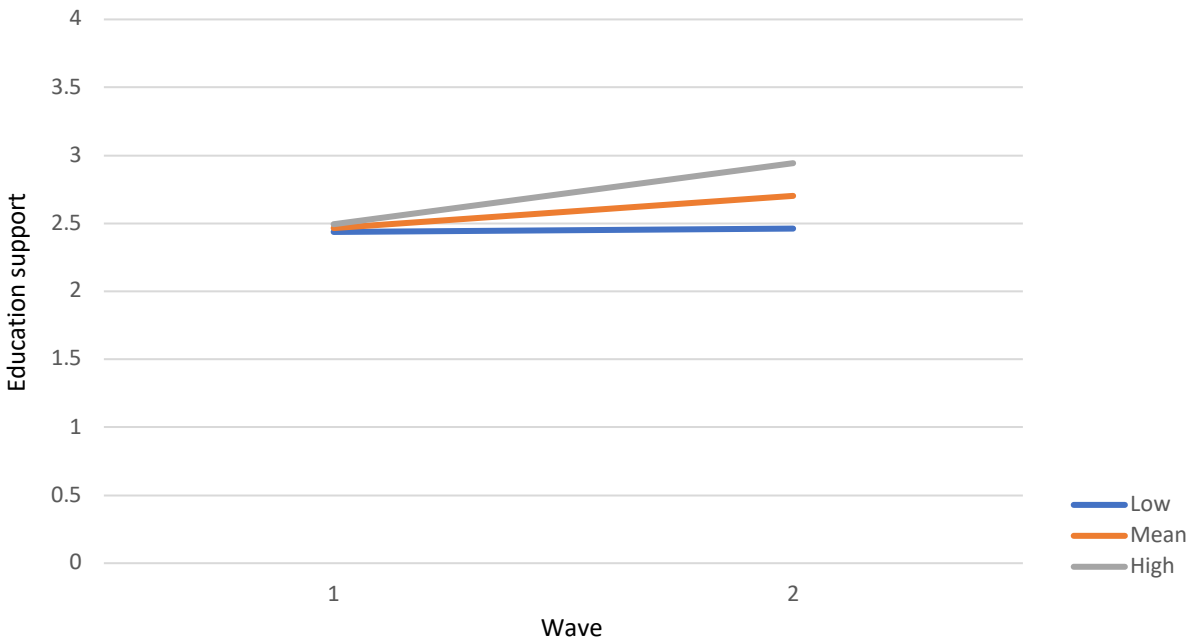
Wave 1 total implementation leadership predicting change in education support from wave 1 to wave 2



Note. High and low scores were calculated as +/- 1 standard deviation from the mean outcome score at wave 1 (grand mean centered).

Figure 22

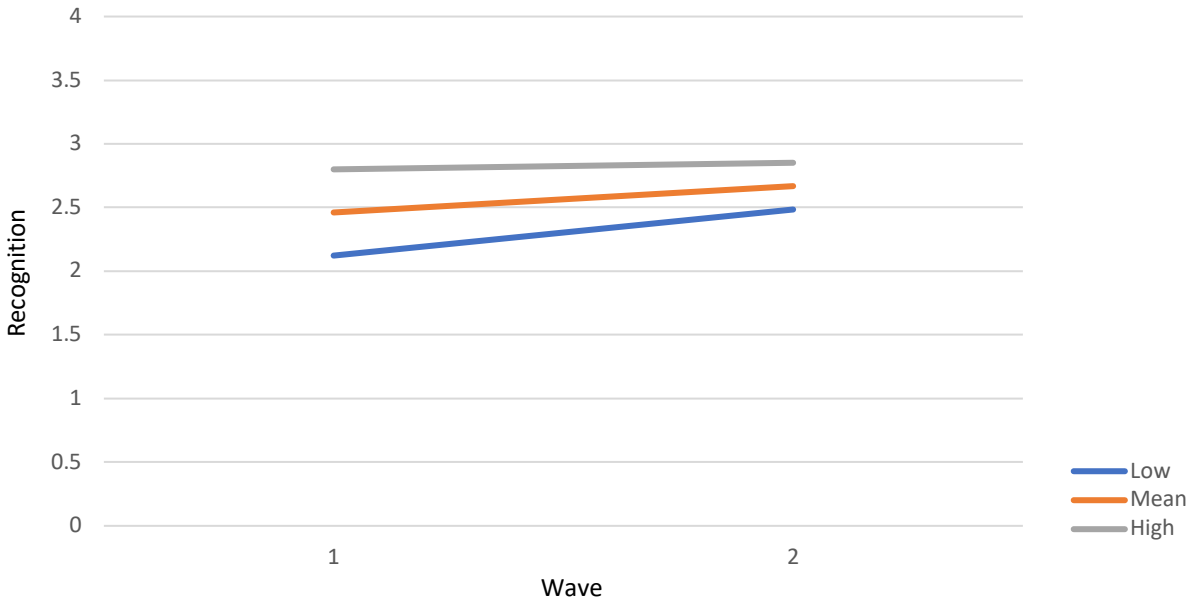
Wave 2 total implementation leadership predicting change in education support from wave 1 to wave 2



Note. High and low scores were calculated as +/- 1 standard deviation from the mean outcome score at wave 1 (grand mean centered).

Figure 23

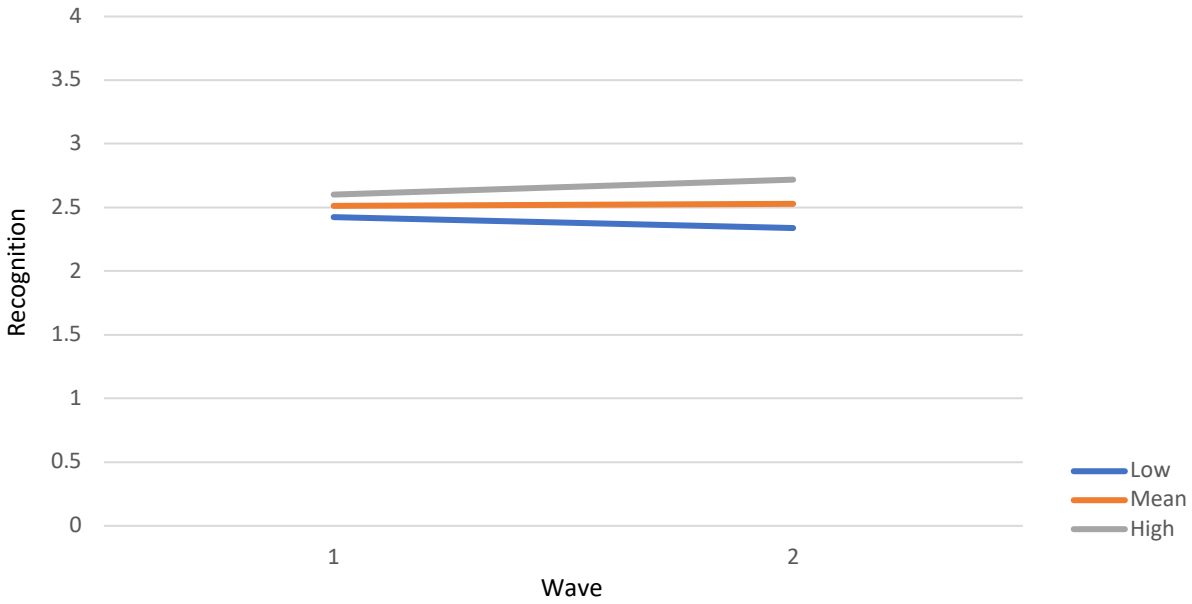
Wave 1 proactive predicting change in recognition from wave 1 to wave 2



Note. High and low scores were calculated as +/- 1 standard deviation from the mean outcome score at wave 1 (grand mean centered).

Figure 24

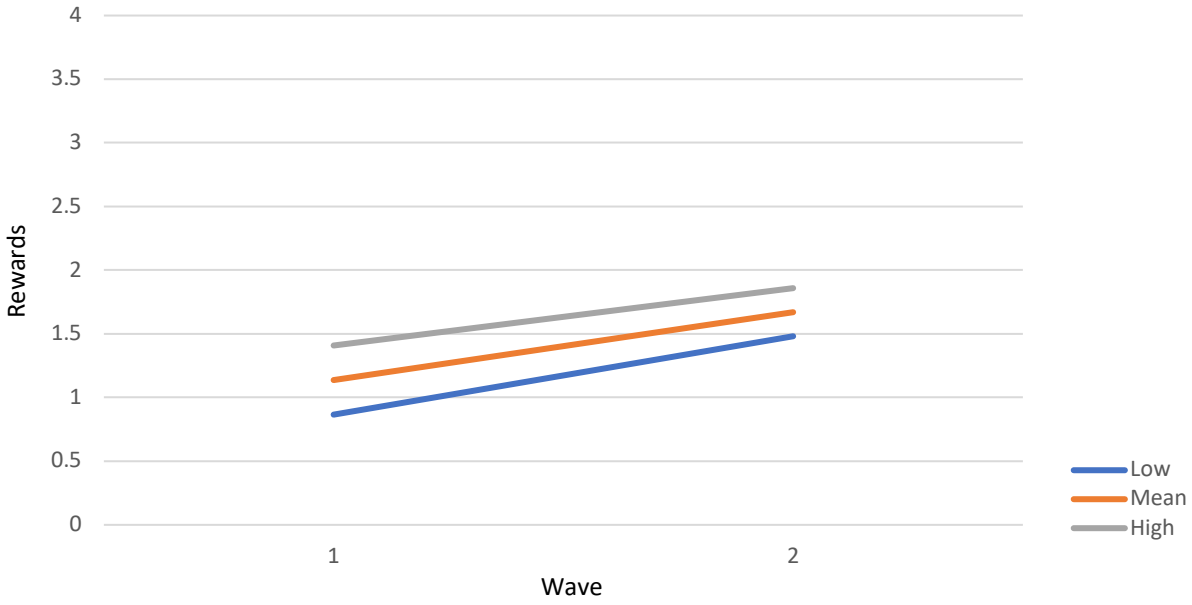
Wave 2 total implementation leadership predicting change in recognition from wave 1 to wave 2



Note. High and low scores were calculated as +/- 1 standard deviation from the mean outcome score at wave 1 (grand mean centered).

Figure 25

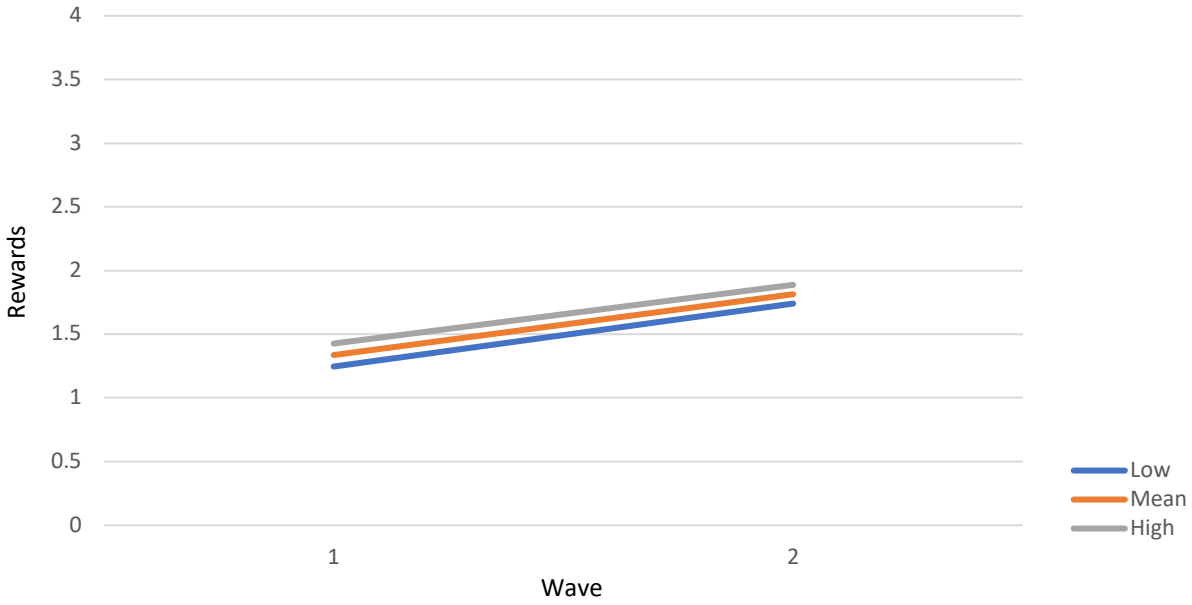
Wave 1 total implementation leadership predicting change in rewards from wave 1 to wave 2



Note. High and low scores were calculated as +/- 1 standard deviation from the mean outcome score at wave 1 (grand mean centered).

Figure 26

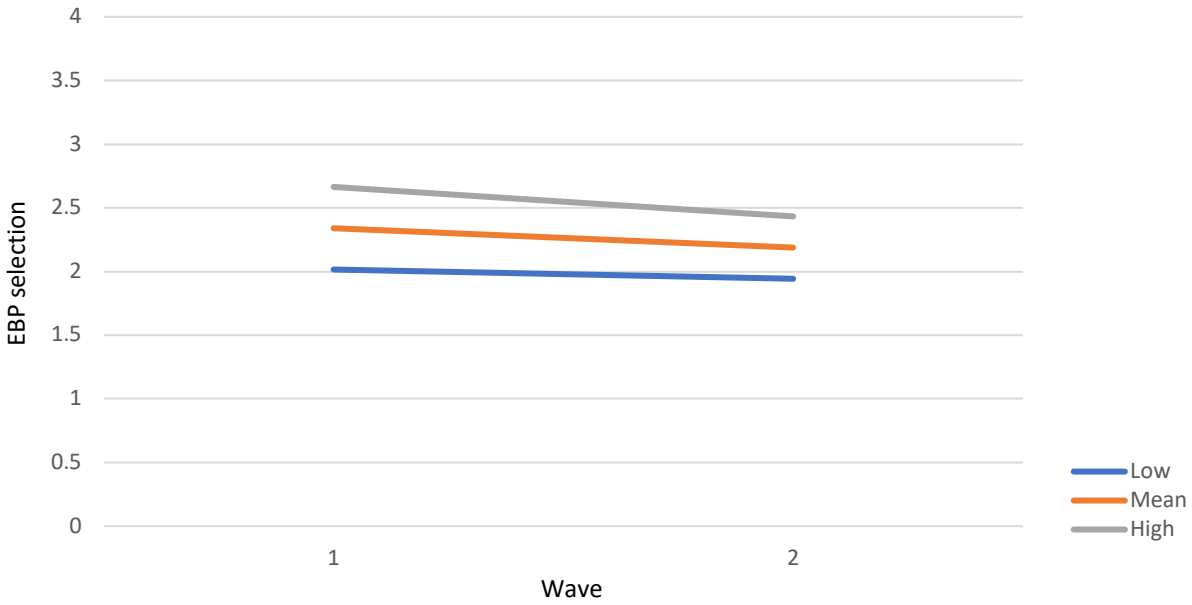
Wave 2 total implementation leadership predicting change in rewards from wave 1 to wave 2



Note. High and low scores were calculated as +/- 1 standard deviation from the mean outcome score at wave 1 (grand mean centered).

Figure 27

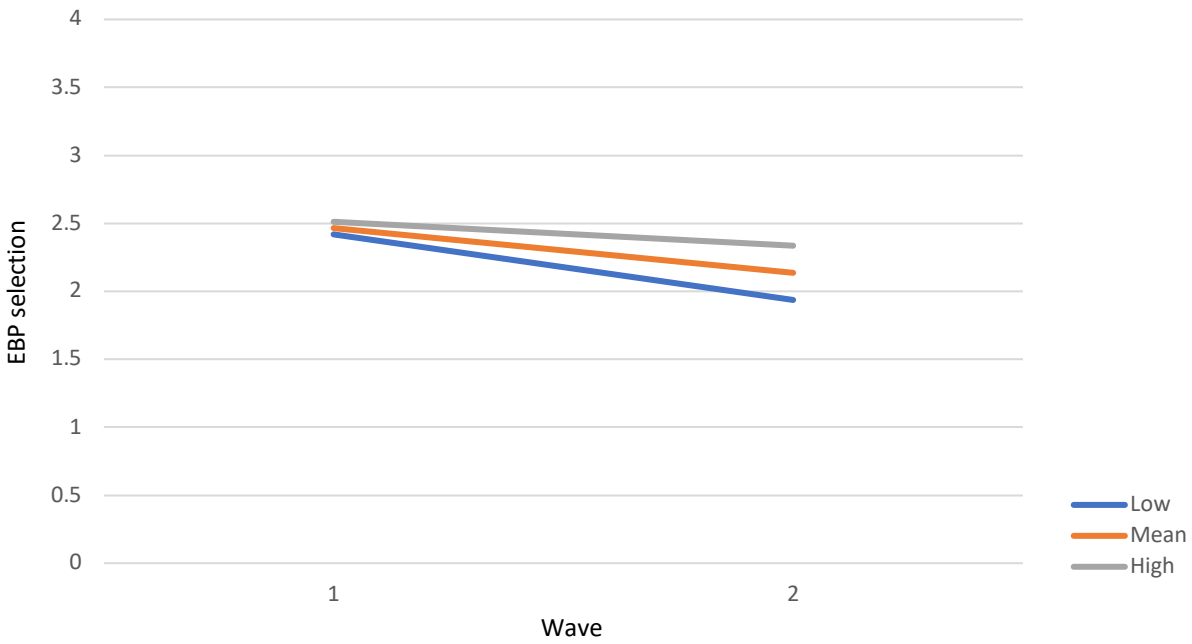
Wave 1 total implementation leadership predicting change in EBP selection from wave 1 to wave 2



Note. High and low scores were calculated as +/- 1 standard deviation from the mean outcome score at wave 1 (grand mean centered).

Figure 28

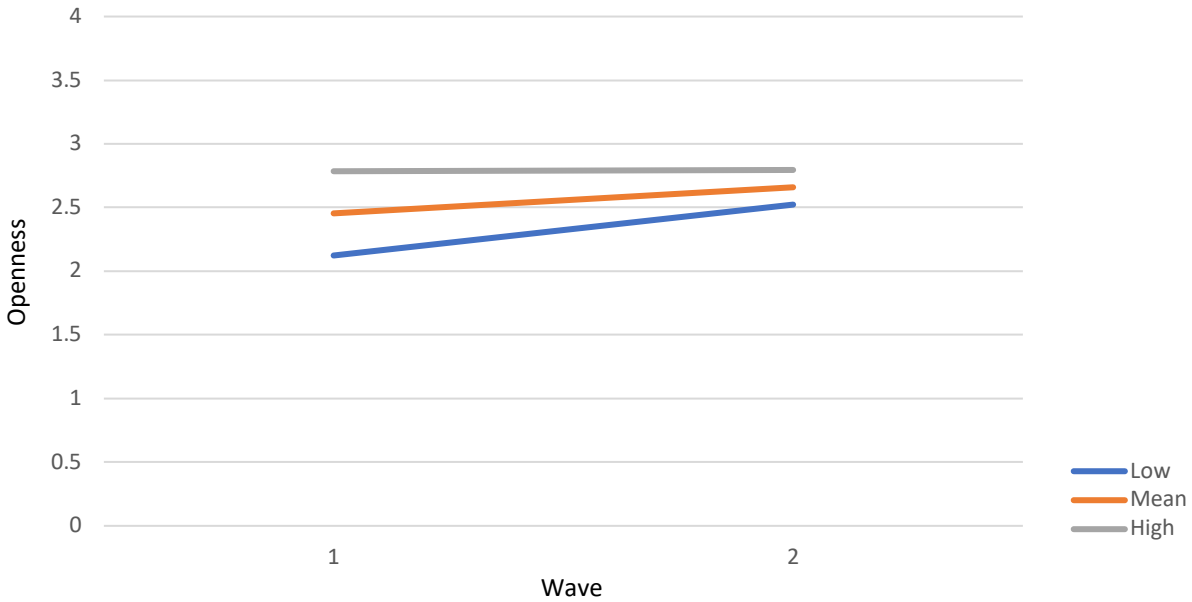
Wave 2 total implementation leadership predicting change in EBP selection from wave 1 to wave 2



Note. High and low scores were calculated as +/- 1 standard deviation from the mean outcome score at wave 1 (grand mean centered).

Figure 29

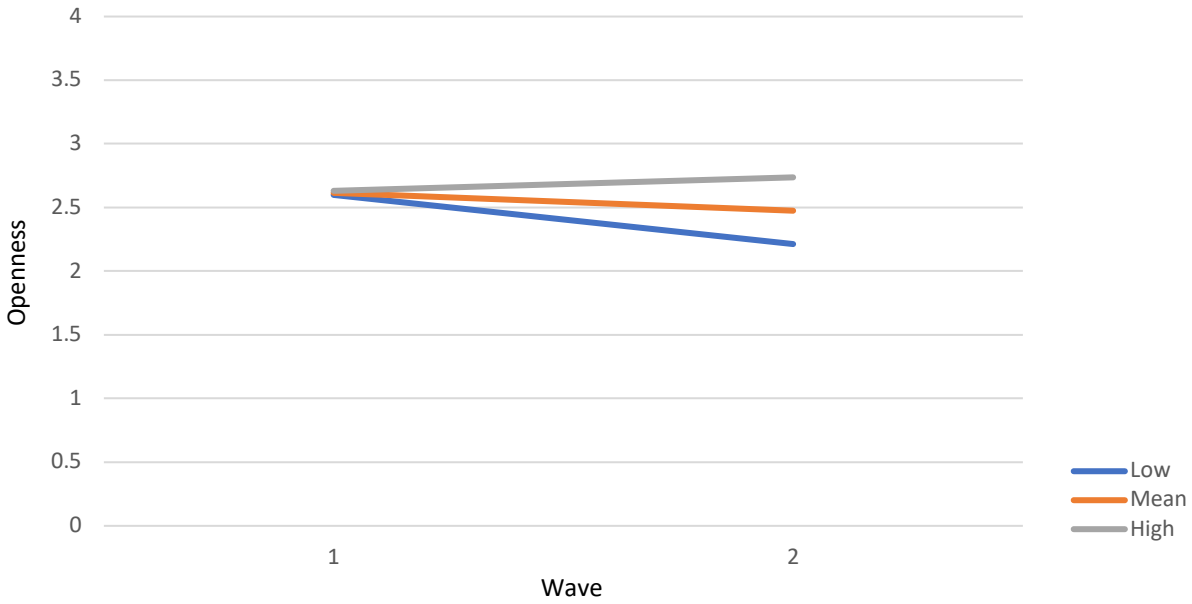
Wave 1 proactive predicting change in openness from wave 1 to wave 2



Note. High and low scores were calculated as +/- 1 standard deviation from the mean outcome score at wave 1 (grand mean centered).

Figure 30

Wave 2 total implementation leadership predicting change in openness from wave 1 to wave 2



Note. High and low scores were calculated as +/- 1 standard deviation from the mean outcome score at wave 1 (grand mean centered).

Table 3

Supervisor & Supervision Group Descriptives

	N[a]	*Mean*	*SD*	*Min*	*Max*
Implementation Leadership Scale					
Wave 1 group score	76	2.966	0.594	1.040	4.000
Wave 2 group score	76	2.812	0.887	0.080	4.000
Implementation Climate Scale					
Wave 1 group score	76	2.381	0.499	0.556	3.467
Wave 1 supervisor score	76	2.482	0.601	1.028	4.000
Wave 2 group score	78	2.015	0.693	0.333	3.556
Wave 2 supervisor score	74	2.018	0.798	0.000	3.500
Fidelity					
Wave 1 supervisor score	80	53.264	11.341	23.33	80.83
Wave 2 supervisor score	82	71.304	12.631	41.110	93.33

[a] The total number of caseworkers across both waves within supervision groups = 331. The total number of supervisors across both waves = 91.

Table 4

Unconditional Means Models (2-level)

	Wave 1			Wave 2		
Outcome	*σ2*	*τ*	*ICC*	*σ2*	*τ*	*ICC*
Implementation leadership						
Proactive	0.940	0.069	0.068	1.076	0.107	0.091
Knowledge	0.866	0.087	0.092	1.018	0.131	0.114
Perseverant	0.859	0.114	0.117	0.999	0.106	0.096
Supportive	0.801	0.087	0.098	0.939	0.056	0.056
Implementation climate						
Focus	0.807	0.033	0.039	0.873	0.026	0.029
Education support	0.891	0.083	0.086	0.987	0.040	0.039
Recognition	0.972	0.025	0.025	1.056	0.013	0.012
Rewards	1.300	0.025	0.019	1.571	0.065	0.039
EBP selection	1.088	0.047	0.042	1.404	0.001	0.001
Openness	0.902	0.065	0.068	1.183	0.004	0.004

Note. ICCs were calculated as $\tau/(\tau + \sigma 2)$

Table 5

Wave 1 Supervisor Implementation Climate Predicting Change in Supervisor Implementation Leadership

	Outcome														
	Total IL			Proactive			Knowledge			Perseverant			Supportive		
Model Term	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*
Total IC															
Intercept	2.803	0.128	0.000	2.590	0.133	0.000	2.821	0.137	0.000	2.844	0.137	0.000	3.001	0.121	0.000
Main effect	-0.018	0.111	0.875	-0.019	0.117	0.868	-0.081	0.120	0.499	0.042	0.118	0.721	-0.024	0.106	0.823
Wave 2	-0.039	0.102	0.702	0.001	0.108	0.992	-0.087	0.113	0.443	-0.013	0.102	0.897	-0.026	0.098	0.796
Interaction	-0.029	0.147	0.845	-0.056	0.156	0.721	0.087	0.162	0.593	-0.045	0.147	0.761	-0.028	0.141	0.842
Focus															
Intercept	2.838	0.123	0.000	2.615	0.128	0.000	2.848	0.133	0.000	2.886	0.133	0.000	3.041	0.118	0.000
Main effect	-0.100	0.083	0.231	-0.081	0.086	0.352	-0.123	0.090	0.175	-0.071	0.088	0.421	-0.116	0.079	0.147
Wave 2	-0.004	0.104	0.969	0.058	0.109	0.593	-0.044	0.116	0.707	0.023	0.104	0.825	-0.014	0.101	0.890
Interaction	-0.124	0.108	0.254	-0.200	0.112	0.080	-0.084	0.120	0.488	-0.139	0.108	0.202	-0.053	0.105	0.615
Edu support															
Intercept	2.801	0.126	0.000	2.368	0.171	0.000	2.813	0.134	0.000	2.846	0.135	0.000	2.997	0.120	0.000
Main effect	-0.021	0.078	0.792	-0.061	0.102	0.554	-0.058	0.083	0.491	0.021	0.082	0.796	-0.015	0.074	0.845
Wave 2	-0.056	0.100	0.582	-0.051	0.115	0.658	-0.094	0.111	0.400	-0.028	0.100	0.784	-0.035	0.097	0.718
Interaction	0.059	0.102	0.567	0.020	0.113	0.860	0.118	0.113	0.303	0.034	0.103	0.741	0.028	0.099	0.780
Recognition															
Intercept	2.847	0.131	0.000	2.655	0.133	0.000	2.843	0.139	0.000	2.906	0.139	0.000	3.015	0.130	0.000
Main effect	-0.001	0.086	0.993	-0.026	0.087	0.767	-0.010	0.091	0.913	0.030	0.090	0.735	0.017	0.084	0.844
Wave 2	-0.066	0.106	0.537	-0.035	0.110	0.749	-0.112	0.116	0.338	-0.033	0.106	0.760	-0.043	0.103	0.678
Interaction	0.111	0.119	0.355	0.149	0.124	0.233	0.226	0.130	0.089	0.071	0.120	0.559	0.051	0.116	0.661

Continued

Table 5 (Continued)

Rewards															
Intercept	2.753	0.128	0.000	2.529	0.132	0.000	2.766	0.137	0.000	2.806	0.136	0.000	2.960	0.121	0.000
Main effect	0.105	0.093	0.264	0.131	0.096	0.180	0.027	0.101	0.786	0.118	0.098	0.234	0.083	0.089	0.355
Wave 2	-0.034	0.102	0.739	-0.004	0.107	0.968	-0.063	0.113	0.578	-0.024	0.102	0.814	-0.034	0.099	0.736
Interaction	0.016	0.114	0.889	0.032	0.120	0.787	0.127	0.126	0.321	0.060	0.114	0.600	0.033	0.111	0.764
EBP select															
Intercept	2.892	0.122	0.000	2.694	0.124	0.000	2.905	0.130	0.000	2.977	0.121	0.000	3.066	0.116	0.000
Main effect	-0.127	0.083	0.129	-0.158	0.085	0.067	-0.162	0.089	0.073	-0.095	0.077	0.221	-0.099	0.076	0.200
Wave 2	-0.062	0.099	0.537	-0.022	0.106	0.838	-0.097	0.109	0.379	-0.034	0.101	0.737	-0.048	0.096	0.623
Interaction	0.038	0.105	0.715	0.007	0.111	0.950	0.074	0.115	0.520	0.023	0.106	0.830	0.042	0.101	0.676
Openness															
Intercept	2.885	0.121	0.000	2.683	0.123	0.000	2.902	0.130	0.000	2.968	0.121	0.000	3.060	0.116	0.000
Main effect	-0.071	0.082	0.384	-0.074	0.084	0.383	-0.116	0.089	0.194	-0.046	0.077	0.550	-0.064	0.076	0.406
Wave 2	-0.034	0.101	0.740	0.017	0.107	0.876	-0.075	0.112	0.506	-0.004	0.102	0.966	-0.025	0.098	0.801
Interaction	-0.104	0.106	0.331	-0.167	0.112	0.141	-0.056	0.117	0.634	-0.126	0.108	0.244	-0.079	0.103	0.445

Note. The intercept (β_{00}) represents the average wave 1 outcome score for the referent region. Comparison region analytic results were omitted from the table, but are available upon request. T-ratios were omitted from the table as well, but were calculated as the quotient of the β coefficient divided by the SE. Degrees of freedom were omitted from the table, but were consistent across all models and are available upon request.

Table 6

Wave 2 Supervisor Implementation Climate Predicting Change in Supervisor Implementation Leadership

	Outcome														
	Total IL			Proactive			Knowledge			Perseverant			Supportive		
Model Term	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*
Total IC															
Intercept	2.597	0.177	0.000	2.334	0.187	0.000	2.662	0.174	0.000	2.670	0.181	0.000	2.818	0.174	0.000
Main effect	-0.045	0.119	0.704	-0.028	0.128	0.825	-0.221	0.119	0.068	0.005	0.121	0.968	-0.020	0.117	0.862
Wave 2	-0.166	0.101	0.105	-0.130	0.114	0.257	-0.189	0.105	0.078	-0.127	0.099	0.205	-0.140	0.097	0.158
Interaction	0.232	0.119	0.055	0.216	0.134	0.113	0.307	0.124	0.017	0.224	0.116	0.060	0.199	0.115	0.088
Focus															
Intercept	2.650	0.172	0.000	2.390	0.182	0.000	2.670	0.167	0.000	2.734	0.177	0.000	2.867	0.170	0.000
Main effect	-0.075	0.096	0.436	-0.067	0.103	0.515	-0.175	0.094	0.068	-0.030	0.098	0.763	-0.043	0.094	0.652
Wave 2	-0.161	0.104	0.127	-0.116	0.117	0.328	-0.191	0.109	0.084	-0.115	0.102	0.264	-0.136	0.100	0.181
Interaction	0.145	0.095	0.132	0.112	0.107	0.302	0.223	0.099	0.029	0.124	0.093	0.191	0.125	0.091	0.177
Edu support															
Intercept	2.631	0.159	0.000	2.368	0.171	0.000	2.657	0.167	0.000	2.719	0.167	0.000	2.860	0.153	0.000
Main effect	-0.081	0.094	0.391	-0.061	0.102	0.554	-0.175	0.100	0.083	-0.053	0.097	0.586	-0.072	0.090	0.431
Wave 2	-0.089	0.102	0.384	-0.051	0.115	0.658	-0.140	0.111	0.209	-0.059	0.100	0.557	-0.076	0.097	0.437
Interaction	0.037	0.010	0.714	0.020	0.113	0.860	0.127	0.108	0.248	0.046	0.098	0.641	0.041	0.095	0.669
Recognition															
Intercept	2.688	0.168	0.000	2.437	0.182	0.000	2.704	0.180	0.000	2.754	0.173	0.000	2.893	0.162	0.000
Main effect	-0.046	0.087	0.600	-0.031	0.096	0.747	-0.130	0.093	0.166	-0.001	0.088	0.987	-0.026	0.084	0.755
Wave 2	-0.088	0.101	0.387	-0.056	0.118	0.635	-0.152	0.106	0.157	-0.015	0.096	0.875	-0.037	0.095	0.703
Interaction	0.108	0.089	0.234	0.091	0.104	0.384	0.215	0.093	0.026	0.068	0.085	0.425	0.048	0.084	0.566

Continued

Table 6 (Continued)

Rewards															
Intercept	2.640	0.161	0.000	2.364	0.175	0.000	2.658	0.173	0.000	2.732	0.165	0.000	2.871	0.153	0.000
Main effect	-0.037	0.079	0.643	-0.013	0.086	0.882	-0.115	0.085	0.178	-0.019	0.080	0.818	-0.024	0.074	0.752
Wave 2	-0.131	0.089	0.149	-0.102	0.104	0.328	-0.159	0.099	0.115	-0.097	0.089	0.277	-0.103	0.082	0.218
Interaction	0.038	0.078	0.625	0.054	0.090	0.554	0.117	0.087	0.182	0.030	0.077	0.699	-0.003	0.072	0.970
EBP select															
Intercept	2.763	0.159	0.000	2.538	0.168	0.000	2.787	0.169	0.000	2.847	0.164	0.000	2.947	0.158	0.000
Main effect	-0.191	0.090	0.038	-0.192	0.097	0.052	-0.293	0.096	0.003	-0.156	0.092	0.096	-0.142	0.089	0.114
Wave 2	-0.105	0.090	0.251	-0.074	0.106	0.488	-0.118	0.097	0.228	-0.052	0.087	0.548	-0.067	..085	0.436
Interaction	0.179	0.090	0.053	0.139	0.106	0.199	0.228	0.097	0.023	0.148	0.087	0.094	0.137	0.086	0.115
Openness															
Intercept	2.643	0.161	0.000	2.387	0.171	0.000	2.648	0.171	0.000	2.724	0.168	0.000	2.881	0.156	0.000
Main effect	-0.103	0.091	0.259	-0.111	0.097	0.256	-0.132	0.097	0.178	-0.085	0.094	0.365	-0.113	0.088	0.204
Wave 2	-0.095	0.097	0.331	-0.067	0.109	0.541	-0.114	0.106	0.290	-0.073	0.095	0.445	-0.090	0.093	0.336
Interaction	0.095	0.093	0.314	0.115	0.104	0.277	0.117	0.102	0.256	0.124	0.091	0.179	0.109	0.089	0.227

Note. The intercept (β_{00}) represents the average wave 1 outcome score for the referent region. Comparison region analytic results were omitted from the table, but are available upon request. T-ratios were omitted from the table as well, but were calculated as the quotient of the β coefficient divided by the SE. Degrees of freedom were omitted from the table, but were consistent across all models and are available upon request.

Table 7

Supervisor Implementation Climate Predicting Change in Supervisor Fidelity

	Outcome					
	Fidelity					
	Predictor at wave 1			Predictor at wave 2		
Model Term	*β*	*SE*	*p*	*β*	*SE*	*p*
Total IC						
Intercept	58.076	1.764	0.000	59.220	1.864	0.000
Main effect	1.152	1.417	0.419	-1.915	1.492	0.204
Wave 2	2.048	0.168	0.000	2.033	0.190	0.000
Interaction	-0.006	0.238	0.979	-0.142	0.217	0.516
Focus						
Intercept	58.182	1.814	0.000	59.548	1.902	0.000
Main effect	0.140	1.082	0.898	-1.837	1.223	0.138
Wave 2	2.069	0.174	0.000	1.876	0.192	0.000
Interaction	-0.061	0.181	0.738	0.194	0.178	0.280
Edu support						
Intercept	58.238	1.774	0.000	59.127	1.983	0.000
Main effect	-0.048	1.011	0.962	-0.456	1.285	0.724
Wave 2	2.030	0.162	0.000	1.985	0.189	0.000
Interaction	0.061	0.161	0.704	-0.004	0.186	0.983
Recognition						
Intercept	58.567	1.749	0.000	58.781	1.982	0.000
Main effect	-0.569	1.107	0.609	-0.595	1.166	0.612
Wave 2	1.971	0.170	0.000	1.996	0.210	0.000
Interaction	0.106	0.183	0.565	-0.014	0.179	0.937
Rewards						
Intercept	59.025	1.819	0.000	58.871	1.993	0.000
Main effect	1.385	1.196	0.251	-1.251	1.110	0.264
Wave 2	2.051	0.161	0.000	2.036	0.184	0.000
Interaction	-0.072	0.181	0.693	-0.268	0.154	0.087
EBP select						
Intercept	58.171	1.694	0.000	59.317	1.891	0.000
Main effect	0.174	1.026	0.866	-2.709	1.285	0.039
Wave 2	2.041	0.165	0.000	2.082	0.191	0.000
Interaction	-0.002	0.172	0.990	-0.240	0.191	0.212

Continued

Table 7 (Continued)

Openness						
Intercept	58.179	1.735	0.000	58.709	1.866	0.000
Main effect	0.021	1.012	0.983	-0.849	1.248	0.499
Wave 2	2.025	0.169	0.000	2.127	0.187	0.000
Interaction	0.049	0.168	0.769	-0.252	0.180	0.166

Note. The intercept (β_{00}) represents the average wave 1 outcome score for the referent region. Comparison region analytic results were omitted from the table, but are available upon request. T-ratios were omitted from the table as well, but were calculated as the quotient of the β coefficient divided by the SE. Degrees of freedom were omitted from the table, but were consistent across all models and are available upon request.

Table 8

Supervisor Fidelity Predicting Change in Supervisor Implementation Leadership

	Outcome														
	Total IL			Proactive			Knowledge			Perseverant			Supportive		
Model Term	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*
W1 Fidelity															
Intercept	2.705	0.138	0.000	2.450	0.141	0.000	2.632	0.137	0.000	2.793	0.142	0.000	2.933	0.141	0.000
Main effect	0.012	0.007	0.108	0.016	0.008	0.043	0.016	0.007	0.033	0.010	0.007	0.188	0.005	0.007	0.494
Wave 2	0.109	0.112	0.335	0.126	0.123	0.310	0.082	0.121	0.499	0.114	0.110	0.302	0.080	0.107	0.460
Interaction	-0.021	0.009	0.019	-0.019	0.009	0.051	-0.017	0.009	0.066	-0.016	0.008	0.070	-0.014	0.008	0.098
Model Term															
W2 Fidelity															
Intercept	2.628	0.114	0.000	2.396	0.117	0.000	2.632	0.123	0.000	2.701	0.122	0.000	2.852	0.112	0.000
Main effect	0.015	0.006	0.013	0.016	0.006	0.011	0.013	0.006	0.050	0.016	0.006	0.014	0.013	0.006	0.031
Wave 2	0.032	0.106	0.760	0.070	0.112	0.536	-0.056	0.120	0.644	0.066	0.106	0.537	0.043	0.103	0.677
Interaction	-0.010	0.007	0.185	-0.009	0.008	0.235	-0.003	0.008	0.707	-0.009	0.007	0.214	-0.009	0.007	0.197

Note. The intercept (β_{00}) represents the average wave 1 outcome score for the referent region. Comparison region analytic results were omitted from the table, but are available upon request. T-ratios were omitted from the table as well, but were calculated as the quotient of the β coefficient divided by the SE. Degrees of freedom were omitted from the table, but were consistent across all models and are available upon request.

Table 9

Supervisor Implementation Leadership Predicting Change in Supervisor Fidelity

	Outcome					
	Fidelity					
	Predictor at wave 1			Predictor at wave 2		
Model Term	*β*	*SE*	*p*	*β*	*SE*	*p*
Total IL						
Intercept	51.839	1.664	0.000	55.793	1.957	0.000
Main effect	7.861	1.651	0.000	-0.443	1.457	0.762
Time term	1.960	0.206	0.000	1.686	0.193	0.000
Interaction	0.178	0.279	0.524	0.385	0.210	0.071
Proactive						
Intercept	52.337	1.619	0.000	55.542	1.948	0.000
Main effect	7.840	1.570	0.000	0.299	1.391	0.830
Time term	1.999	0.198	0.000	1.733	0.188	0.000
Interaction	0.102	0.271	0.708	0.319	0.201	0.116
Knowledge						
Intercept	52.426	1.642	0.000	55.590	1.951	0.000
Main effect	7.600	1.579	0.000	0.345	1.405	0.807
Time term	2.029	0.203	0.000	1.708	0.188	0.000
Interaction	0.026	0.267	0.923	0.354	0.191	0.068
Perseverance						
Intercept	51.995	1.719	0.000	55.542	1.960	0.000
Main effect	6.607	1.582	0.000	0.338	1.440	0.815
Time term	1.968	0.203	0.000	1.727	0.195	0.000
Interaction	0.151	0.151	0.563	0.303	0.208	0.149
Support						
Intercept	51.953	1.788	0.000	55.854	1.972	0.000
Main effect	6.057	1.678	0.001	-0.564	1.560	0.719
Time term	1.927	0.206	0.000	1.665	0.205	0.000
Interaction	0.230	0.264	0.387	0.396	0.231	0.090

Note. The intercept (β_{00}) represents the average wave 1 outcome score for the referent region. Comparison region analytic results were omitted from the table, but are available upon request. T-ratios were omitted from the table as well, but were calculated as the quotient of the β coefficient divided by the SE. Degrees of freedom were omitted from the table, but were consistent across all models and are available upon request.

Table 10

Supervisor Fidelity Predicting Change in Caseworker Implementation Climate

	Outcome																			
	Total IC			Focus			Education support			Recognition			Rewards			EBP selection			Openness		
Model Term	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*
W1 Fidelity																					
Intercept	2.364	0.119	0.000	2.856	0.118	0.000	2.451	0.125	0.000	2.620	0.136	0.000	1.423	0.175	0.000	2.585	0.142	0.000	2.633	0.121	0.000
Main effect	0.004	0.006	0.482	0.008	0.006	0.190	0.011	0.007	0.100	0.002	0.007	0.736	-0.003	0.009	0.759	0.001	0.007	0.937	0.005	0.007	0.459
Wave 2	0.212	0.079	0.010	0.099	0.102	0.333	0.512	0.103	0.000	0.148	0.101	0.149	0.495	0.133	0.000	-0.231	0.113	0.045	0.120	0.108	0.270
Interaction	-0.006	0.006	0.321	-0.009	0.008	0.240	-0.007	0.008	0.361	-0.005	0.008	0.513	0.000	0.010	0.971	0.004	0.009	0.643	-0.003	0.008	0.700
Model Term																					
W2 Fidelity																					
Intercept	2.283	0.101	0.000	2.784	0.108	0.000	2.416	0.114	0.000	2.527	0.121	0.000	1.233	0.156	0.000	2.496	0.126	0.000	2.549	0.110	0.000
Main effect	0.009	0.005	0.077	0.008	0.006	0.162	0.006	0.006	0.281	0.009	0.006	0.165	0.010	0.008	0.183	0.006	0.006	0.391	0.006	0.006	0.328
Wave 2	0.143	0.077	0.068	0.033	0.098	0.738	0.443	0.099	0.000	0.070	0.099	0.485	0.424	0.122	0.001	-0.250	0.110	0.027	0.074	0.105	0.484
Interaction	0.001	0.005	0.871	-0.001	0.007	0.910	0.001	0.007	0.955	0.002	0.007	0.743	0.004	0.008	0.651	0.003	0.007	0.674	-0.001	0.007	0.892

Note. The intercept (β_{00}) represents the average wave 1 outcome score for the referent region. Comparison region analytic results were omitted from the table, but are available upon request. T-ratios were omitted from the table as well, but were calculated as the quotient of the β coefficient divided by the SE. Degrees of freedom were omitted from the table, but were consistent across all models and are available upon request.

Table 11

Wave 1 Supervisor Implementation Leadership Predicting Change in Caseworker Implementation Climate

	Outcome																				
	Total IC			Focus			Education support			Recognition			Rewards			EBP selection			Openness		
Model Term	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*
Total IL																					
Intercept	2.194	0.088	0.000	2.672	0.103	0.000	2.309	0.110	0.000	2.422	0.114	0.000	1.137	0.153	0.000	2.340	0.118	0.000	2.427	0.107	0.000
Main effect	0.504	0.083	0.000	0.592	0.106	0.000	0.568	0.113	0.000	0.582	0.120	0.000	0.457	0.154	0.004	0.546	0.122	0.000	0.557	0.112	0.000
Wave 2	0.228	0.103	0.030	0.185	0.106	0.085	0.562	0.110	0.000	0.199	0.108	0.071	0.533	0.135	0.000	-0.152	0.124	0.224	0.178	0.119	0.141
Interaction	-0.157	0.131	0.234	-0.345	0.136	0.014	-0.294	0.142	0.042	-0.228	0.140	0.110	-0.139	0.174	0.427	-0.134	0.160	0.406	-0.259	0.154	0.098
Proactive																					
Intercept	2.218	0.090	0.000	2.705	0.101	0.000	2.330	0.105	0.000	2.461	0.113	0.000	1.147	0.147	0.000	2.415	0.113	0.000	2.454	0.105	0.000
Main effect	0.511	0.091	0.000	0.577	0.103	0.000	0.598	0.107	0.000	0.570	0.118	0.000	0.504	0.148	0.001	0.577	0.117	0.000	0.557	0.109	0.000
Wave 2	0.246	0.079	0.003	0.194	0.099	0.055	0.564	0.104	0.000	0.207	0.102	0.047	0.550	0.128	0.000	-0.133	0.117	0.260	0.205	0.111	0.071
Interaction	-0.203	0.104	0.056	-0.383	0.130	0.005	-0.320	0.137	0.023	-0.261	0.136	0.059	-0.184	0.169	0.281	-0.179	0.154	0.250	-0.328	0.147	0.029
Knowledge																					
Intercept	2.245	0.095	0.000	2.724	0.104	0.000	2.353	0.111	0.000	2.491	0.119	0.000	1.192	0.153	0.000	2.431	0.118	0.000	2.471	0.107	0.000
Main effect	0.422	0.093	0.000	0.513	0.103	0.000	0.506	0.110	0.000	0.423	0.120	0.001	0.337	0.150	0.028	0.512	0.118	0.000	0.499	0.108	0.000
Wave 2	0.220	0.083	0.010	0.162	0.104	0.127	0.562	0.107	0.000	0.188	0.106	0.082	0.531	0.132	0.000	-0.130	0.120	0.283	0.181	0.116	0.123
Interaction	-0.135	0.103	0.194	-0.290	0.130	0.029	-0.288	0.133	0.034	-0.191	0.132	0.154	-0.134	0.164	0.415	-0.167	0.149	0.266	-0.256	0.144	0.081
Perseverance																					
Intercept	2.212	0.096	0.000	2.701	0.105	0.000	2.334	0.113	0.000	2.435	0.117	0.000	1.150	0.154	0.000	2.426	0.122	0.000	2.450	0.110	0.000
Main effect	0.416	0.091	0.000	0.484	0.101	0.000	0.464	0.108	0.000	0.492	0.113	0.000	0.383	0.198	0.010	0.425	0.117	0.001	0.446	0.107	0.000
Wave 2	0.220	0.084	0.011	0.135	0.107	0.213	0.539	0.109	0.000	0.189	0.107	0.084	0.530	0.146	0.000	-0.174	0.123	0.161	0.152	0.119	0.205
Interaction	-0.138	0.103	0.184	-0.243	0.131	0.069	-0.246	0.134	0.072	-0.200	0.132	0.135	-0.133	0.164	0.419	-0.085	0.151	0.577	-0.203	0.146	0.169
Support																					
Intercept	2.183	0.096	0.000	2.644	0.105	0.000	2.316	0.115	0.000	2.383	0.115	0.000	1.154	0.158	0.000	2.405	0.124	0.000	2.427	0.110	0.000
Main effect	0.454	0.092	0.000	0.570	0.103	0.000	0.475	0.112	0.000	0.575	0.113	0.000	0.342	0.152	0.027	0.439	0.121	0.001	0.481	0.109	0.000
Wave 2	0.209	0.087	0.019	0.190	0.108	0.083	0.521	0.114	0.000	0.199	0.111	0.077	0.515	0.139	0.000	-0.181	0.127	0.159	0.127	0.124	0.307
Interaction	-0.116	0.107	0.285	-0.335	0.133	0.014	-0.203	0.141	0.155	-0.220	0.136	0.113	-0.101	0.171	0.558	-0.070	0.157	0.655	-0.157	0.152	0.308

Note. The intercept (β_{00}) represents the average wave 1 outcome score for the referent region. Comparison region analytic results were omitted from the table, but are available upon request. T-ratios were omitted from the table as well, but were calculated as the quotient of the β coefficient divided by the SE. Degrees of freedom were omitted from the table, but were consistent across all models and are available upon request.

Table 12

Wave 2 Supervisor Implementation Leadership Predicting Change in Caseworker Implementation Climate

	Outcome																				
	Total IC			Focus			Education support			Recognition			Rewards			EBP selection			Openness		
Model Term	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*
Total IL																					
Intercept	2.329	0.119	0.000	2.777	0.121	0.000	2.465	0.124	0.000	2.513	0.135	0.000	1.336	0.191	0.000	2.465	0.151	0.000	2.615	0.131	0.000
Main effect	0.138	0.090	0.130	0.121	0.098	0.223	0.048	0.106	0.635	0.149	0.110	0.180	0.152	0.153	0.324	0.078	0.123	0.527	0.027	0.108	0.806
Wave 2	-0.024	0.078	0.759	-0.088	0.102	0.392	0.237	0.101	0.022	0.016	0.108	0.883	0.478	0.139	0.001	-0.329	0.120	0.008	-0.140	0.112	0.214
Interaction	0.308	0.083	0.000	0.277	0.106	0.012	0.357	0.107	0.001	0.171	0.112	0.132	-0.028	0.147	0.849	0.258	0.128	0.048	0.414	0.118	0.001
Proactive																					
Intercept	2.320	0.114	0.000	2.755	0.118	0.000	2.426	0.121	0.000	2.494	0.132	0.000	1.374	0.189	0.000	2.457	0.147	0.000	2.598	0.128	0.000
Main effect	0.111	0.085	0.200	0.135	0.094	0.157	0.110	0.096	0.259	0.176	0.104	0.096	0.103	0.146	0.482	0.098	0.116	0.400	0.036	0.103	0.730
Wave 2	0.004	0.075	0.955	-0.049	0.010	0.626	0.289	0.099	0.005	0.043	0.103	0.678	0.417	0.133	0.003	-0.326	0.115	0.006	-0.112	0.108	0.301
Interaction	0.282	0.079	0.001	0.231	0.104	0.030	0.290	0.104	0.007	0.133	0.108	0.225	0.080	0.140	0.567	0.269	0.121	0.030	0.388	0.113	0.001
Knowledge																					
Intercept	2.320	0.116	0.000	2.784	0.120	0.000	2.463	0.123	0.000	2.514	0.135	0.000	1.337	0.189	0.000	2.455	0.150	0.000	2.597	0.132	0.000
Main effect	0.062	0.084	0.466	0.099	0.090	0.279	0.041	0.092	0.658	0.121	0.010	0.228	0.126	0.138	0.363	0.067	0.112	0.547	0.021	0.099	0.835
Wave 2	0.038	0.078	0.627	-0.079	0.101	0.434	0.258	0.098	0.011	0.037	0.103	0.725	0.493	0.134	0.001	-0.292	0.118	0.016	-0.086	0.112	0.443
Interaction	0.209	0.077	0.008	0.255	0.099	0.013	0.315	0.096	0.002	0.133	0.101	0.195	-0.052	0.132	0.693	0.190	0.116	0.106	0.314	0.110	0.006
Perseverance																					
Intercept	2.305	0.115	0.000	2.749	0.120	0.000	2.445	0.124	0.000	2.489	0.133	0.000	1.316	0.190	0.000	2.442	0.149	0.000	2.587	0.128	0.000
Main effect	0.146	0.087	0.099	0.143	0.096	0.142	0.075	0.099	0.450	0.192	0.106	0.074	0.202	0.149	0.179	0.128	0.119	0.285	0.077	0.104	0.457
Wave 2	-0.003	0.079	0.968	-0.064	0.104	0.541	0.242	0.102	0.021	0.019	0.106	0.859	0.476	0.139	0.001	-0.330	0.121	0.008	-0.136	0.112	0.231
Interaction	0.272	0.082	0.002	0.237	0.107	0.031	0.342	0.106	0.002	0.162	0.111	0.148	-0.021	0.145	0.884	0.253	0.126	0.049	0.398	0.117	0.001
Support																					
Intercept	2.322	0.122	0.000	2.763	0.128	0.000	2.467	0.130	0.000	2.502	0.140	0.000	1.319	0.197	0.000	2.436	0.156	0.000	2.609	0.136	0.000
Main effect	0.171	0.102	0.097	0.144	0.113	0.206	0.060	0.116	0.604	0.176	0.124	0.161	0.192	0.173	0.270	0.146	0.139	0.298	0.061	0.122	0.621
Wave 2	-0.038	0.086	0.658	-0.086	0.112	0.445	0.219	0.111	0.052	0.008	0.115	0.946	0.478	0.151	0.002	-0.314	0.132	0.021	-0.160	0.122	0.193
Interaction	0.316	0.095	0.001	0.260	0.122	0.037	0.370	0.122	0.004	0.178	0.127	0.165	-0.023	0.166	0.891	0.224	0.146	0.131	0.429	0.135	0.002

Note. The intercept (β_{00}) represents the average wave 1 outcome score for the referent region. Comparison region analytic results were omitted from the table, but are available upon request. T-ratios were omitted from the table as well, but were calculated as the quotient of the β coefficient divided by the SE. Degrees of freedom were omitted from the table, but were consistent across all models and are available upon request.

Chapter 5: Discussion

There is a continued need to study strategies to improve EBI implementation within public health-related systems. Namely, a better understanding of how organizational antecedents relate to implementation success is necessary to improve population health outcomes. Implementation climate is the most proximal organization-level predictor associated with implementation success (Williams et al., 2020; Aarons et al., 2017). Improving the implementation climate of frontline staff directly relates to more positive attitudes and increased motivation towards delivering a new EBI (Aarons et al., 2012). Positive attitudes and increased motivation, in turn, are directly related to frontline staff uptake and successful delivery of new EBIs (Aarons et al., 2012). While the field has advanced its understanding of the organizational factors known to impact implementation climate, gaps exists in connecting such antecedents.

Although it is well known that leadership plays a pivotal role during implementation, more research is needed to understand specific strategies to improve leadership, as well as, the influence leadership behaviors have on other organizational factors (e.g., supervision & implementation climate). This dissertation advances implementation science by developing and empirically examining a middle-range theory that re-conceptualizes the role of first-level supervisors in shaping the implementation climate of caseworkers within the CWS. Specifically, this study assessed the role of first-level supervisors within the CWS and how their supervision and leadership during a period of EBI implementation impacted the implementation climate of their caseworkers.

Results from this study support the hypothesis that first-level supervisors who exhibit effective supervision and implementation leadership behaviors strengthen the implementation climate of their staff regardless of their own perceptions of implementation climate within the

system. In a system such as the highly centralized, vertically-structured CWS, decision-making generally is at the system-level with little input or control from first-level supervisors. Yet it is the first-level supervisors who are responsible in overseeing caseworkers and ensuring the effective use of EBIs. Thus, it is important to understand how investment in first-level supervisors (e.g., R^3) can improve implementation outcomes. Supporting first-level supervisors may lead to uptake of evidence-based behaviors that become institutionalized within a system. Therefore, it is possible that first-level supervisors are able to shield frontline staff from organizational factors known to impede implementation success (e.g., shift in system-level support for an EBI) through effective supervision and leadership behaviors.

Examination of the Dual Role of First-Level Supervisors During EBI Implementation

The results of all path analyses in this study reveal important findings. First, implementation climate as a theoretical construct should be reconceptualized relative to organizational structure. That is, a better understand of the mechanisms in which implementation climate of organizational members at different levels (e.g., first-level supervisors & frontline staff) might be influenced can lead to more effective implementation strategies. Second, training and ongoing support are critical for first-level supervisors during implementation. Training first-level supervisors in both supervision and leadership prior to EBI implementation, and supporting first-level supervisors during implementation, might be effective strategies for implementation success.

Reconceptualizing implementation climate. The proposed middle-range theory examined in this dissertation amplified Aaron et al.'s (2012) model of organizational factors that influence implementation success, focusing on the most proximal and salient level of influence on frontline staff (i.e., first-level supervisors). Within the CWS, first-level supervisors directly

support groups of caseworkers. Thus, first-level supervisors are most influential in shaping the implementation climate of their caseworkers. Results from this dissertation support this conceptualization. Yet, the question of *how* first-level supervisors are, themselves, influenced, remains unclear.

Results support an association between baseline first-level supervisor implementation climate and an increase in fidelity over time. However, the level of implementation climate did not influence baseline fidelity, nor a different rate of change in fidelity over time. Thus, it is difficult to draw conclusions based on these findings. Additionally, results indicate that first-level supervisor implementation climate did not have an impact in changing their implementation leadership. There are two potential explanations as to why implementation leadership did not change from wave 1 to wave 2 based on emerging research in the field of implementation science. First, Williams et al. (2018) found that establishing a positive and cohesive implementation climate for frontline staff is more likely when organizational members also perceive the molar climate (see Chapter 2) to be positive. Given what is known regarding the state of the CWS (see Chapter 2), it is possible that preconceived perceptions of the molar climate influenced perceptions of implementation climate. The fact that findings support first-level supervisors having an influence on caseworker climate suggests that first-level supervisors can be influenced by another entity (e.g., external coaching), other than system-level leadership.

A second potential explanation is that system-level leadership has a more direct relationship with first-level supervisor implementation leadership. There is evidence demonstrating that system-level transformational leadership during implementation can influence implementation leadership behaviors of first-level supervisors (e.g.,). It is possible that first-level supervisor implementation climate mediates this relationship, but further research is needed

to explore the relationships between these constructs. Thus, first-level supervisor perceptions of implementation climate may not be the mechanism that directly influences implementation leadership.

The finding that supervisor perceptions of implementation climate did not correlate with the implementation climate of caseworkers whom they supervised reveals distinct differences in perceptions of implementation climate exist between the two levels within the CWS. A plausible explanation for this phenomenon, and taking the non-association between supervisor implementation climate and implementation leadership into account, might relate to the context in which R^3 was implemented. While there was strong support for the implementation of R^3, initially, there was a shift in system-level leadership at the end of the training phase of the study, leading to opposition towards the EBI. Simultaneously during this phase, however, was the intensive coaching effort that was a component of the program developer's implementation strategy. It is possible that the coaching effort during the training phase provided first-level supervisors with the necessary support to deliver R^3 effectively to their caseworkers during group supervision sessions. Further, R^3 reinforcement behaviors may have begun to be institutionalized within the CWS. Thus, first-level supervisors may have been in a position to experience a change in support for R^3 at the system-level, but were able to shield their own caseworkers by continuing to deliver the program. Research is needed to examine whether efforts to support first-level supervisors within the CWS help institutionalize evidence-based practices, regardless of perceptions of implementation climate (see Future Directions below).

Based on the finding that perceptions of implementation climate vary between first-level supervisors and their caseworkers, it may be more relevant to conceptualize implementation climate across organizational levels in vertical systems such as the CWS. First-level supervisor

collective perceptions of implementation climate are likely to have an indirect effect on implementation compared to perceptions of frontline staff (Weiner et al., 2011). An assessment of implementation climate across first-level supervisors, for example, would provide insight into the collective perceptions of individuals within a system known to have the strongest impact on frontline staff. It is the first-level supervisors who are first exposed to the implementation policies and practices of system-level leaders. Further, the implementation climate across first-level supervisors may be more predictive of implementation leadership behaviors which are demonstrated to impact frontline implementation climate. In the main R^3 study, first-level supervisors received coaching in groups on a monthly basis during the training phase. Therefore, assessing climate as an aggregate group-level score across first-level supervisors might be the most appropriate measure of implementation climate, and, the most predictive of implementation leadership.

Supporting first-level supervisors as a key objective for EBI implementation. Current theories in implementation science related to the role of first-level supervisors indicate that first-level supervisor leadership behaviors are influenced by the leadership behaviors of individuals at the top of an organization (Birken et al., 2012; Birken et al., 2015; Aarons et al., 2012). The policies and practices around a new EBI implementation influence how first-level supervisors and other middle managers demonstrate their support and commitment to implementation to their staff (Birken et al., 2012). Aarons et al. (2012) detail specific leadership behaviors that are important during the implementation process. Namely, that transformational leadership at the highest level within an organization is thought to influence implementation leadership behaviors in lower level positions, such as middle managers or first-level supervisors (Aarons et al., 2012). Thus, transformational leadership behaviors convey support for EBI

implementation to first-level supervisors, who then act to ensure proper implementation on the frontlines through the use of implementation leadership behaviors.

Findings from this dissertation align with other research in the field demonstrating the critical role first-level supervisors have in exhibiting implementation leadership behaviors to improve implementation climate (e.g., Williams et al., 2020). Although system-level leadership should convey the importance of implementing a new EBI through policies and practices, investing in training initiatives to strengthen implementation leadership behaviors of first-level supervisors is likely to contribute to implementation success. Yet, leadership training for first-level supervisors is not common practice during implementation. It should not be assumed that first-level supervisors are able to take on strategic leadership behaviors (i.e., implementation leadership) in the absence of training support to strengthen their skillset. Recent research indicates that such training efforts are worthy of investment, but studies are either exploratory (Proctor et al., 2019), or, do not offer a definite conclusion as to the effectiveness of such trainings (Richter et al., 2020). Thus, more research is needed to build and test implementation leadership training programs for first-level supervisors. An efficient strategy would be to combine training for implementation leadership with training for supervision (see Future Directions below).

In addition to implementation leadership training, training for supervision is also necessary during implementation processes. This study found a positive association between first-level supervisor fidelity and change in caseworker implementation climate, which is a novel contribution to the field. The R^3 implementation team utilized an intensive coaching effort consistent with best practices in initial training (e.g., active learning strategies; Dolcini et al., 2019; Lyon et al., 2011), and consistent observation and feedback over a year-long training

phase, which are considered best practices for delivering EBIs with high fidelity (Dolcini et al., 2019). Additionally, coaching strategies involved modeling R^3 behaviors to first-level supervisors throughout coaching sessions. That R^3 fidelity and implementation leadership both impact caseworker implementation climate points to new approaches in training first-level supervisors.

Although results did not support the hypothesis that fidelity would be positively associated with implementation leadership, additional analyses examining an alternative path support an association between the two variables. That is, wave 1 implementation leadership was positively associated with a change in first-level supervisor fidelity over time. In addition, a higher level of implementation leadership was associated with higher baseline fidelity, and, higher fidelity at the end of the training phase. This finding may be explained by some supervisors having a more natural ability to lead during implementation, and that these first-level supervisors, are more apt to change their behaviors related to supervision when a new program (i.e., R^3) is introduced. This finding also reveals a potential point of intervention to improve early fidelity. Assessing strategies to strengthen initial training efforts for implementation leadership is an avenue for future research. Further, there is evidence to suggest that performance drops following an initial training (Lyon et al., 2011). Intensive support immediately after a training may facilitate early higher fidelity delivery of a new EBI.

In addition to the findings for fidelity predictors modeled at wave 1, first-level supervisors, who were rated by their caseworkers as stronger leaders during implementation at wave 2, had similar baseline fidelity scores as other first-level supervisors, yet were able to increase fidelity to R^3 somewhat more substantially (i.e., interaction effect was marginally significant at $p = .071$). Thus, first-level supervisors with higher levels of implementation

leadership at wave 2 might be the individuals who are able to increase fidelity most substantially over time. Findings from both analyses provide further support for the theorized dual role of first-level supervisors during implementation.

Future implementation efforts may benefit from an approach that includes a combined first-level supervisor training in supervision and implementation leadership. The results of this study suggest that the investment in building the skills of first-level supervisors in both supervision and implementation leadership may contribute to a stronger, more positive implementation climate for frontline staff, implementation success, and ultimately, improved health outcomes.

Limitations

I was unable to take full advantage of the 4-wave study due to the inability to accurately link caseworkers to supervisors past wave 2. The research questions made this link necessary, however, due to changes in support for R^3 at the system-level, numerous supervisors ceased R^3 participation. At wave 3, only 30% of all caseworkers participating in the assessments could be confidently linked to a single supervisor at that timepoint. Two timepoints, however, allowed me to assess changes in each outcome over a one-year period beginning at baseline, which is a strength of this dissertation.

While this dissertation analyzed the outcome as a change in time, this change was based on a single timepoint predictor at wave 1 or wave 2. Therefore, I cannot make causal inferences for any of the paths analyzed in support of the middle-range theory. Although there was evidence that predictor variables changed over time, modeling a longitudinal process was not practical due to missing data. The decision to model two different predictors for each path, however, enabled

me to make use of all available data at each wave of the study, while still being able to answer the research questions I proposed.

Conclusions in comparing the rate of change in outcomes across varying levels of each predictor was limited to planned contrasts. Further analyses were beyond the scope of this dissertation. However, future examination of the differences between having a higher or lower level of each predictor is warranted. For example, graphs depicting wave 2 implementation leadership predicting change in implementation climate reveal visually contrasting rates of change between an average level of the predictor, and the one standard deviation higher or lower level of the predictor. Tests, such as simple slopes, could be used to determine the level (i.e., predictor score) at which the rate of change for an outcome becomes statistically significant. Such analyses could identify specific first-level supervisors to target during implementation to improve outcomes.

Finally, there is significant variation in how public health organizations are structured (e.g., vertical vs. horizontal, big vs. small, centralized vs. decentralized, community-based vs. government-run). The utility of this theory across such entities is unknown. It is possible that use of this theory can benefit other similarly structured organizational systems (e.g., Veterans Health Administration, departments of public health), but more research is needed to examine its relevance across such public health domains. Yet, I assert that more precise models such as this are needed in order to effectively improve implementation success.

Future Directions

As stated in Chapter 1, organizational factors influence frontline staff, who, in turn, react accordingly. Frontline staff behaviors then influence the greater organizational context (Aarons et al., 2012). Therefore, relationships between organizational factors and the individual

characteristics are seldomly unidirectional. As such, it is important to consider the effect any change at the frontlines in terms of how implementation behavior might affect the organization as a whole. Thus, next steps should include analyzing pathways of the middle-range model in the reverse direction.

Additional examination of this theory is needed in different public health contexts to understand the range in which it can be used. This study examined the theoretical model in the context of a supervisor-targeted intervention intended to instill the use of evidence-based practices into everyday interactions between the CWS workforce (e.g., first-level supervisors and caseworkers), and, between caseworkers and the families they serve. Thus, the R^3 model was designed to improve both supervision to support caseworkers, and, caseworker practice on the frontlines. Further testing of this theory on EBIs designed solely for the intended use of frontline staff for delivery to the population they serve is needed to understand how effective supervision relates to first-level supervisor leadership and frontline staff implementation climate.

Future studies should consider training for supervision and implementation leadership. Based on the results of this study, an additional component of R^3 training to include strategies to improve implementation leadership for first-level supervisors may be fruitful. A randomized trial between future R^3 implementation sites, for example, would allow for comparison between standard R^3 training and an added implementation leadership component.

There is sufficient evidence in the field of public health to suggest the impact of transformational leadership at the system-level influences the implementation leadership of first-level supervisors. Results from this dissertation, however, provide insight into the impact of first-level supervisor perceptions of implementation climate. Because no association was found between implementation climate and implementation leadership, future studies involving

implementation leadership should consider assessing first-level supervisor implementation climate as a mediator between system-level transformational leadership and first-level supervisor implementation leadership, and as having a direct relationship between system-level leadership and first-level supervisor leadership. Supervisor implementation climate may also mediate the relationship between system-level leadership and fidelity.

Finally, the R^3 study was implemented successfully, but not sustained due to system-level decisions. Yet, R^3 may have become institutionalized (Rogers, 2003) into the everyday practices of first-level supervisors within the CWS. R^3 involves training first-level supervisors to interact with their caseworkers in a strength-based manner. It is conceivable that first-level supervisors can continue to interact with their caseworkers using R^3 strategies, no matter how policies or practices change within the system. Therefore, it is also possible that R^3 practices are sustained within the system, especially through supervisors who responded positively to delivering R^3. Further research is needed to gauge whether this phenomenon holds true.

Chapter 6: Conclusion

This study proposed and examined a novel middle-range theoretical model conceptualizing first-level supervisors as having a dual role in establishing an implementation climate for their frontline staff. The theory posits that during periods of EBI implementation, first-level supervisors who effectively supervise through the use of evidence-base practices, and who exhibit a high level of implementation leadership, will improve the implementation climate of frontline staff. Implementation climate is important to study, because it is the most proximal and significant organizational factor known to influence frontline staff attitudes, motivation, and uptake of EBIs. Results from this dissertation have an important impact on the fields of public health and implementation science.

Public Health & Implementation Science Impact

Results from this study support the hypotheses that both supervision and implementation leadership influence implementation climate. In addition, first-level supervisor implementation leadership behaviors were associated with an increase in supervisor fidelity over time. Affirming the original hypothesis, as well as confirming this link between the two constructs (i.e., supervision & implementation leadership) provides a better understanding of the role first-level supervisors have during implementation. Additional findings reveal that first-level supervisors may be able to positively impact the implementation climate of their caseworkers, regardless of their own perceptions. This potential shielding effect, along with results from the path analyses, impact the fields of implementation science and public health by offering novel explanations of the role of first-level supervisors.

Results from this study demonstrate the importance of middle-range theory development in implementation science. In addition, it is also important to test new theories with the most

rigorous methods possible. This includes multilevel modeling strategies appropriate for studies within organizational settings, along with longitudinal analyses that can detect change over time. A strength of this dissertation was the ability to model outcomes longitudinally. There are a limited number of studies that examine the proposed pathways of this theoretical model. One exception is implementation leadership predicting implementation climate. Among studies that examine this path, and to the best of my knowledge, only one presents a longitudinal analysis (i.e., Williams et al., 2020).

The research findings also demonstrate that focused training efforts for first-level supervisors are warranted. Training remains an understudied component of implementation science. Conceptualization of training as a long-term process, initially supported by expert consultants (e.g., training institutions, program developers), but sustained through support from system-level leadership may move the field forward in strengthening supervision. Training to build skills necessary for effective supervision and implementation leadership may provide the most benefit to first-level supervisors. Further, a focus on implementation climate of frontline staff, and, targeting the most proximal level of frontline staff oversight (i.e., first-level supervisors) may be the most efficient strategy for implementation success. However, the long-term success of such efforts is likely dependent on system-level leadership. Supportive systems that demonstrate a strong commitment to a new EBI are more likely to establish a higher level of climate throughout the organization.

In certain organizations or public health systems, it may be futile to expect sweeping changes to policies or practices. Chapter 2 of this dissertation detailed the numerous organizational challenges within the CWS that ultimately lead to poorer outcomes for vulnerable children and families. Improving communication, particularly around support for EBIs,

throughout the hierarchy, placing more decision-making power in the hands of leaders further down the chain, or tackling issues of system-level leader turnover may all strengthen the CWS. However, institutionalizing evidence-based practices may be a more practical strategy to improve health-related outcomes. Changing systems through institutionalizing practices is an understudied area of implementation science that deserves more attention.

The development of R^3, along with the findings from this dissertation, demonstrates a strategy in which institutionalization is possible. That is, investing in first-level supervisors is key, and, the components of the program have utility across interactions. The reinforcement components of R^3 can be delivered during group supervision sessions between first-level supervisors and caseworkers, during caseworker interactions with parents, and, between parents and children within the system. Further, the reinforcement strategies can be used to support the implementation of other CWS EBIs. Institutionalizing R^3 practices may result in the CWS evolving into a more strength-based system, and in doing so, improve organizational practices as well as outcomes for children and families.

References

Aarons, G.A. (2006). Transformational and transactional leadership: Association with attitudes toward evidence-based practice. *Psychiatric Services,* 57(8), 1162–1169.

Aarons, G. A., & Sawitzky, A. C. (2006). Organizational climate partially mediates the effect of culture on work attitudes and staff turnover in mental health services. *Administration and Policy in Mental Health and Mental Health Services*, 33, 289–301.

Aarons, G. A., Horowitz, J. D., Dlugosz, L. R., & Ehrhart, M. G. (2012). The role of organizational processes in dissemination and implementation research. In R. C. Brownson, G.A. Colditz, & E. K. Proctor (Eds.), *Dissemination and implementation research in health: Translating science to practice* (pp. 128–153). New York, NY: Oxford University Press.

Aarons, G. A. & Sommerfield, D. H. (2012). Leadership, innovation climate, and attitudes toward evidence-based practice during a statewide implementation. *Journal of the American Academy of Child & Adolescent Psychiatry,* 51(4).

Aarons, G.A., Ehrhart, M.G., & Farahnak, L.R. (2014). The implementation leadership scale (ILS): Development of a brief measure of unit level implementation leadership. *Implementation Science,* 9(45).

Aarons, G. A., Ehrhart, M. G., Farahnak, L. R., & Sklar, M. (2014). Aligning leadership across systems and organizations to develop a strategic climate evidence-based practice implementation. *Annual Review of Public Health,* 35, 255-274.

Aarons, G. A., Ehrhart, M. G., Moullin, J. C., Torres, E. M., & Green, A. C. (2017). Testing the leadership and organizational change for implementation (LOCI) intervention in substance abuse treatment: A cluster randomized trial study protocol. *Implementation Science*, 29(12).

Allen, J. D., Linnan, L. A., & Emmons, K. M. (2012). Fidelity and its relationship to implementation effectiveness, adaptation, and dissemination. In Brownson, R. C., Colditz, G. A., & Proctor, E. K. (eds.), *Dissemination and implementation research in health: Translating science into practice* (pp. 281-304). New York, NY: Oxford.

Altman, J. C. (2008). Engaging families in child welfare services: Worker versus client perspectives. *Child Welfare*, 87(3), 41-61.

Balas, E. A., & Boren, S. A. (2000). Managing clinical knowledge for health care improvement. In: Bemmel, J., & McCray, A. (Eds.). *Yearbook of medical informatics 2000: Patient-centered systems* (pp. 65–70). Stuttgart, Germany: Schattauer.

Bandura, A. (1971). Vicarious and self-reinforcement processes. In R. Glaser (Ed.), *The nature of reinforcement* (pp. 228–278). New York: Academic Press.

Bandura, A., & National Institute of Mental Health. (1986). *Prentice-Hall series in social learning theory. Social foundations of thought and action: A social cognitive theory.* Prentice-Hall, Inc.

Bass, B. M., & Avolio, B. J. (1999). *Training full range leadership*. Menlo Park, CA: Mind Garden.

Bearman, S. K., Schneiderman, R. L., & Zoloth, E. (2017). Building an evidence base for effective supervision practices: An analogue experiment of supervision to increase EBT fidelity. *Administration and Policy in Mental Health and Mental Health Services,* 44(2), 293-307.

Beidas, R. S., Edmunds, J. M., Marcus, S. C., & Kendall, P. C. (2012). Training and consultation to promote implementation of an empirically supported treatment: A randomized trial. *Psychiatric Services,* 63(7), 660–665.

Bertram, R. M., Suter, J. C., Bruns, E. J., & O'Rourke, K. E. (2011). Implementing research and wraparound literature: Building a research agenda. *Journal of Child and Family Studies,* 20, 713-725.

Bertram, R. M., Blase, K. A., & Fixsen, D. L. (2015). Improving programs and outcomes: Implementation frameworks and organizational change. *Research on Social Work Practice, 25*(4), 477-487.

Birken, S. A., Lee, S.-Y. D., & Weiner, B. J. (2012). Uncovering middle managers' role in healthcare innovation implementation. *Implementation Science,* 7(28).

Birken, S. A., Lee, S.-Y. D., Weiner, B. J., Chin, M. H., & Schaefer, C. T. (2013). Improving the effectiveness of health care innovation implementation: Middle managers as change agents. Medical Care Research and Review, 70(1), 29–45.

Birken, S. A., Lee, S.-Y. D., Weiner, B. J., Chin, M. H., Chiu, M., & Schaefer, C. T. (2015). From strategy to action: How top managers' support increases middle managers' commitment to innovation implementation in healthcare organizations. *Health Care Management Review,* 40(2), 159-168.

Birken, S. A., DiMartino, L. D., Kirk, M. A., Lee, S.-Y. D., McClellan, M., & Albert, N. (2016). Elaborating on theory with middle managers' experience implementing healthcare innovations in practice. *Implement Sci*ence, (11)2.

Birken, S. A., Clary, A. S., Tabriz, A. A., Turner, K., Mesa, R., Zizzi, A., Larson, M., Walker, J., & Charns, M. (2018). Middle managers' role in implementing evidence-based practices in healthcare; A systematic review. *Implementation Science,* 13(1).

Brownson, R. C., Allen, P., Jacob, R. R., Harris, J. K., Duggan, K., Hipp, P. R., & Erwin, P. C. (2015). Understanding mis-implementation in public health practice. *American Journal of Preventative Medicine,* 48(5), 543-551.

Bryk, A. S., & Raudenbush, S. W. (1992). *Hierarchical linear models: A review.* Newbury Park, CA: Sage.

Bryk, A. S., Raudenbush, S. W., & Condon, R. T. (1996). *HLM: Hierarchical linear and nonlinear modeling with the HLM/2L and HLM/3L programs*. Chicago, IL: Scientific Software.

Burk, L. A. & Hutchins, H. M. (2007). Training transfer: An integrative literature review. *Human Resource Development Review,* 6(3), 263-296.

Bycio, P., Hackett, R. D., & Allen, J. S. (1995). Further assessments of Bass's 1985 conceptualization of transactional and transformational leadership. *Journal of Applied Psychology,* 80*,* 468–78.

Carroll, C., Patterson, M., Wood, S., Booth, A., Rick, J., & Balain, S. (2007). A conceptual framework for implementation fidelity. *Implementation Science,* 2(40).

Casillas, K. L., Fauchier, A., Derkash, B. T., & Garrido, E. F. (2016). Implementation of evidence-based home visiting programs aimed at reducing child maltreatment: A meta-analytic review. *Child Abuse & Neglect,* 53, 64-80.

Chamberlain, P., Brown, C. H., Saldana, L. (2011). Observational measure of implementation progress: The stages of implementation completion (SIC). *Implementation Science,* 6(116).

Colditz, G. A. (2012). The promise and challenges of dissemination and implementation research. In: Brownson, R.C., Colditz, G.A., & Proctor, E.K. (Eds.), *Dissemination and Implementation Research in Health*. New York, New York: Oxford University Press.

Constable, J. F., & Russell, D. W. (1986). The effect of social support and the work environment upon burnout among nurses. *Journal of Human Stress,* 12*,* 20–26.

Corrigan, P. W., Diwan, S., Campion, J., & Rashid, F. (2002). Transformational leadership and the mental health team. *Administration and Policy in Mental Health and Mental Health Services,* 30*,* 97–108.

Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage Publications, Incorporated.

Creswell, J. W., Klassen, A. C., Plano-Clark, V. L., & Smith, K. C. (2013). *Best practices for mixed methods research in the health sciences*. Office of Behavioral and Social Sciences Research.

Damschroder, L. J., Aron, D. C., Keith, R. E., Kirsh, S. R., Alexander, J. A., & Lowery, J. C. (2009). Fostering implementation of health services research findings into practice: A consolidated framework for advancing implementation science. *Implementation Science,* 4(50).

Dolcini, M. M., Davey-Rothwell, M. A., Singh, R. R., Catania, J. A., Gandelman, A. A., Narayanan, V., Harris, J., & McKay, V. R. (2019). Use of effective training and quality assurance strategies is associated with high-fidelity EBI implementation in practice settings: A case analysis. *Translational Behavioral Medicine.*

Dong, L. Y., Neufeld, D. J., & Higgins, C. (2008). Testing Klein and Sorra's innovation implementation model: An empirical examination. *Journal of Engineering and Technology Management,* 25*,* 237-255.

Dorsey, S., Kerns, S. E. U., Lucid, L., Pullmann, M. D., Harrison, J. P., Berliner, L., Thompson, K., & Deblinger, E. (2018). Objective coding of content and techniques in workplace-based supervision of an EBT in public mental health. *Implementation Science,* 13(19).

Durlak, J. A., & Dupre, E. P. (2008). Implementation matters: a review of research on the influence of implementation on program outcomes and the factors affecting implementation. *American Journal of Community Psychology,* 41, 327–350.

Eames, C., Daley, D., Hutchings, J., Hughes, J. C., Jones, K., Martin, P., & Bywater, T. (2008). The Leader Observation Tool: A process skills treatment fidelity measure for the Incredible Years parenting programme. *Child: Care, Health, and Development,* 34(3), 391-400.

Ehrhart, M. G. (2004). Leadership and procedural justice climate as antecedents of unit-level organizational citizenship behavior. *Personnel Psychology,* 57(1), 61-94.

Ehrhart, M. G., Aarons, G. A., & Farahnak, L. R. (2014). Assessing the organizational context for EBP implementation: The development and validity testing of the Implementation Climate Scale (ICS). *Implementation Science,* 9, 157.

Ehrhart, M. G., Schneider, B., & Macey, W. H. (2014). *Organizational climate and culture: An introduction to theory, research, and practice*. New York: Routledge.

Elliott, J. S., O'Loughlin, J., Robinson, K., Eyles, J., Cameron, R., Harvey, R., Raine, K., & Gelskey, R. (2003). Conceptualizing dissemination research and activity: The case of the Canadian Heart Health Initiative. *Health Education & Behavior,* 30(3), 267–282.

Engle, R. L., Lopez, E. R., Gormley, K. E., Chan, J. A., Charns, M. P., & Lukas, C. V. (2017). What roles do middle managers play in implementation of innovative practices? *Health Care Management Review*, 42, 14–27.

Fernandez, M. E., Walker, T. J., Weiner, B. J., Calo, W. A., Liang, S., Risendal, B., Friedman, D. B., Tu, S. P., Williams, R. S., Jacobs, S., Herrmann, K., & Kegler, M. C. (2018). Developing measures to assess constructs from the inner setting domain of the Consolidated Framework for Implementation Research. *Implementation Science,* 13*,* 52.

Fixsen, D. L., Naoom, S. F., Blase, K. A., Friedman, R. M., & Wallace, F. (2005). *Implementation research: A synthesis of the literature*. Tampa, FL: National Implementation Research Network, University of South Florida.

Fixsen, D., Blase, K. A., Naoom, S.F., Wallace, F. (2009). Core implementation components. *Research on Social Work Practice, 19*(5), 531-540.

Flower, C., McDonal, J., & Sumski, M. (2005). *Review of turnover in Milwaukee County private agency child welfare ongoing case management staff.* Milwaukee, WI: Bureau of Milwaukee Child Welfare.

Geyer, A. L. J., & Steyrer, J. M. (1998). Transformational leadership and objective performance in banks. *Applied Psychology: An International Review,* 47*,* 397-420.

Gilson, L. & Schneider, H. (2010). Managing scaling up: What are the key issues? *Health Policy Plan*, 25, 97-98.

Glisson, C., Dukes, D., & Green. (2006). The effects of the ARC organizational intervention on caseworker turnover, climate, and culture in children service systems. *Child Abuse and Neglect,* 30*,* 855-880.

Glisson, C., Landsverk, J., Schoenwald, S., Kelleher, K., Hoagwood, K. E., Mayberg, S., & Green, P.; Research Network on Youth Mental Health (2008). Assessing the organizational social context (OSC) of mental health services: implications for research and practice. *Administration and Policy in Mental Health and Mental Health Services,* 35, 98-113.

Glisson, C., Schoenwald, S. K., Kelleher, K., Landsverk, J., Hoagwood, K. E., Mayberg, S., & Green, P. (2008). Therapist turnover and new program sustainability in mental health clinics as a function of organizational culture, climate, and service structure. *Administration and Policy in Mental Health and Mental Health Services,* 35, 124-133.

Gonzalez-Roma, V., Peiro, J. M., & Tordera, N. (2002). An examination of the antecedents and moderator influences of climate strength. *Journal of Applied Psychology,* 87*,* 465-473.

Government Accountability Office (2003). *Child welfare: HHS could play a greater role in helping child welfare agencies recruit and retain staff*. Washington, DC: GAO.

Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., & Kyriakidou, O. (2004). Diffusion of innovations in service organizations: Systemic review and recommendations. *Milbank Quarterly,* 82(4), 581-629.

Gunderson, L. M., Willging, C. E., Trott Jaramillo, E. M., Green, A. E., Fettes, D. L., Hect, D. B, & Aarons, G. A. (2018). The good coach: Implementation and sustainment factors that affect coaching as evidence-based intervention fidelity support. *Journal of Children's Services*, 13(1), 1-17.

Heck, R. H., & Thomas, S. L. (2000). *An introduction to multilevel modeling techniques*. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Heifetz, R. A., Linsky, M., & Grashow, A. (2009). *The practice of adaptive leadership: Tools and tactics for changing your organization and the world.* Boston, MA: Harvard Business Press.

Henggeler, S., Schoenwald, S., Borduin, C., Rowland, M., & Cunningham, P. (1998). *Multisystemic treatment of antisocial behavior in children and adolescents*. New York: Guilford Press.

Henggeler, S. W., Schoenwald, S. K., Liao, J. G., Letourneau, E. J., & Edwards, D. L. (2002). Transporting efficacious treatments to field settings: the link between supervisory practices and therapist fidelity in MST programs. *Journal of Clinical Child Adolescent Psychology,* 31, 155-67.

Holahan, P. J., Aronson, Z. H., Jurkat, M. P., & Schoorman, F. D. (2004). Implementing computer technology: A multiorganizational test of Klein and Sorra's model. *Journal of Engineering and Technology Management, 21,* 31-50.

Institute of Medicine. (2014). *New directions in child abuse and neglect research*. Washington, DC: National Academies Press.

James, L. R., Choi, C. C., Ko, C.-H. E., McNeil, P. K., Minton, M.K., Wright, M. A., & Kim, K-i. (2008). Organizational and psychological climate: a review of theory and research. *European Journal of Work and Organizational Psychology,* 17, 5-32.

Johnson-Kozlow, M., Hovell, M. F., Rovniak, L. S., Sirikulvadhana, L., Wahlgreen, D. R., & Zakarian, J. M. (2008). Fidelity issues in secondhand smoking interventions for children. *Nicotine Tobacco Research,* 10(12), 1677–1690.

Klein, K. J., & Sorra, J. S. (1996). The challenge of innovation implementation. *Academy of Management Review,* 21*,* 1055-1080.

Kotter, J. P., & Heskett, J. L. (1992). *Corporate cultural performance.* New York: The Free Press.

Kozlowski, S. W. J., & Doherty, M. L. (1989). Integration of climate and leadership-examination of a neglected issue. *Journal of Applied Psychology,* 74, 546-553.

Kuenzi, M., & Schminke, M. (2009). Assembling fragments into a lens: A review, critique, and proposed research agenda for the organizational work climate literature. *Journal of Management,* 35*,* 634-717.

Leviton, L. C., & Trujillo, M. D. (2017). Interaction of theory and practice to assess external validity. *Evaluation Review,* 41(5), 436-471.

Luria, G. (2008). Climate strength - How leaders form consensus. *Leadership Quarterly,* 19*,* 42-53.

Lyon, A. R., Stirman, S. W., Kerns, S. E. U., & Bruns, E. J. (2011). Developing the mental health workforce: Review and application of training approaches from multiple disciplines. *Administration and Policy in Mental Health and Mental Health Services,* 38, 238-253.

MacKenzie, S. B., Podsakoff, B. M., & Rich, G. A. (2001). Transformational and transactional leadership and salesperson performance. *Journal of Academic Marketing Science,* 29*,* 115-134.

Marsh, J. C., Ryan, J. P., Choi, S., & Testa, M. F. (2014). Integrated services for families with multiple problems: Obstacles to family reunification. *Children and Youth Services Review,* 28*,* 1074-1087.

Michaelis, B., Stegmaier, R., & Sonntag, K. (2009). Affective commitment to change and innovation implementation behavior: The role of charismatic leadership and employees' trust in top management. *Journal of Change Management,* 9*,* 399–417.

Michaelis, B., Stegmaier, R., & Sonntag, K. (2010). Shedding light on followers' innovation implementation behavior: The role of transformational leadership, commitment to change, and climate for initiative. *Journal of Managerial Psychology,* 25*,* 408–29.

National Institute of Health. (September 24, 2017). Dissemination and implementation research: NCCIH interests. Retrieved from https://nccih.nih.gov/grants/disseminationPAR

Newton, R. R., Litrownik, A. J., & Landsverk, J. A. (2000). Children and youth in foster care; disentangling the relationship between problem behaviors and number of placements. *Child Abuse and Neglect,* 24*,* 1363-1374.

Noble, C. H. (1999). The eclectic roots of strategy implementation research. *Journal of Business Research,* 45(2), 119-134.

Ogden, T., & Fixsen, D. L. (2014). Implementation science: A brief overview and a look ahead. *Zeitschrift für Psychologie,* 222(1), 4-11.

O'Reilly, C. A., Caldwell, D. F., Chatman, J. A., Lapiz, M., & Self, W. (2010). How leadership matters: The effects of leaders' alignment on strategy implementation. *The Leadership Quarterly,* 21, 104-113.

Osei-Bryson, K. M., Dong, L. Y., Ngwenyama, O. (2008). Exploring managerial factors affecting ERP implementation: an investigation of the Klein-Sorra model using regression splines. *Information Systems Journal,* 18*,* 499-527.

Palinkas, L. (2018). *Achieving implementation and exchange: The science of delivering evidence-based practices to at-risk youth.* Chicago, IL: The University of Chicago Press.

Patterson, G. R., Reid, J. B., & Dishion, T. J. (1992). A social learning approach. In: *Antisocial boys*. Eugene, OR: Castalia.

Podsakoff, P. M., MacKenzie, S. B., & Bommer, W. H. (1996). Transformational leader behaviors and substitutes for leadership as determinants of employee satisfaction, commitment, trust, and organizational citizenship behaviors. *Journal of Management,* 22, 259–98.

Price, J. M., Chamberlain, P., Landsverk, J., Reid, J., Leve, L. D., & Laurent, H. (2008). Effects of a foster parent training intervention on placement changes of children in foster care. *Child Maltreatment,* 13*,* 64–75.

Priestland, A., & Hanig, R. (2005). Developing first-level leaders. *Harvard Business Review,* 83, 112–120.

Proctor, E., Ramsey, A. T., Brown, M. T., Malone, S., Hooley, C., & McKay, V. (2019). Training in implementation practice leadership (TRIPLE): Evaluation of a novel practice change strategy in behavioral health organizations. *Implementation Science,* 14.

Rabin, B. A., & Brownson, R. C. (2012). Developing the terminology for dissemination and implementation research. In Brownson, R. C., Colditz, G. A., & Proctor, E. K. (eds.), *Dissemination and implementation research in health: translating science into practice* (pp. 23-51). New York, NY: Oxford.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods (2nd Edition)*. Newbury Park, CA: Sage.

Raudenbush, S. W., Bryk, A. S., Cheong, Y. F., Congdon, R. T., & du Toit, M. (2019). HLM 8: Hierarchical Linear and Nonlinear Modeling. Scientific Software International, Inc.

Richter, A., Lornudd, C., von Thiele Schwarz, U., Lundmark, R., Mosson, R., Skoger, U. E., Hivikoski, T., Hasson, H. (2020). Evaluation of iLead, a generic implementation leadership intervention: Mixed-method preintervention-post intervention design. *BMC Open,* 10.

Rodgers, J. L., & Nicewander, W. A. (1988). Thirteen ways to look at the correlation coefficient. *American Statistician,* 42(1), 59-66.

Rogers, E. M. (2003). *Diffusion of innovations* (5th edition). New York, NY: Free Press.

Rubin, D. M., Alessandrini, E. A., Feudner, C., Mandell, D. S., Localio, A. R., & Headley, T. (2004). Placement stability and mental health costs of children in foster care. *Pediatrics,* 113, 1336-1341.

Saldana, L., Chamberlain, P., & Chapman, J. (2016). A supervisor-targeted implementation approach to promote system change: the R^3 model. *Administration and Policy in Mental Health and Mental Health Services,* 43, 879–892.

Saldana, L., Chamberlain, P., Heiblum, N., & Chapman, J. (2019, Dec. 4). *Navigating leadership changes in real-world implementation: Examples from three state child welfare systems* [Conference session] 12th Annual Conference on the Science of Dissemination and Implementation in Health, Arlington, VA.

Schein, E. (2010). *Organizational culture and leadership*. San Francisco, CA: Wiley.

Schein, E. H., & Schein, P. (2017). *Organizational culture and leadership*. Hoboken, NJ: Wiley.

Schoenwald, S. K., Sheidow, A. J., & Letourneau, L. J. (2004). Toward effective quality assurance in evidence-based practice: Links between expert consultation, therapist fidelity, and child outcomes. *Journal of Clinical Child and Adolescent Psychology,* 33(1), 94-104.

Schoenwald, S. K., Sheidow, A. J., & Chapman, J. E. (2009). Clinical supervision in treatment transport: Effects on adherence and outcomes. *Journal of Consulting and Clinical Psychology,* 77*,* 410–421.

Schneider, B., Ehrhart, M. G., & Macey, W. A. (2011). Organizational climate research: Achievements and the road ahead. In: Ashkanasy, N. M., Wilderom, C. P. M., & Peterson, M. F. (Eds.), *Handbook of Organizational Culture and Climate.* (pp. 29–49). Newbury Park, CA: Sage.

Shoemaker, P. J., Tankard, J. W., & Lasorsa, D. L. (2004). *How to build social science theories*. Thousand Oaks, CA: Sage.

Supovitz, J. A. & Brennan, R. T. (1997). Mirror, mirror, on the wall, which is the fairest test of all? An examination of the equitability of portfolio assessment relative to standardized tests. *Harvard Educational Review,* 67(3), 472-505.

U.S. Department of Health & Human Services; Child Welfare Information Gateway. (2013). *How the child welfare system works.* Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Health & Human Services; Child Welfare Information Gateway (2019). *Long-term consequences of child abuse and neglect*. Washington, DC.

U.S. Department of Health & Human Services, Administration for Children and Families, Administration on Children, Youth and Families, Children's Bureau. (2020). *Child maltreatment 2018*. Available from https://www.acf.hhs.gov/cb/resource/child-maltreatment-2018 technology/statistics-research/child-maltreatment.

Vedel, I., Le Berre, M., Sourial, N., Arsenault-Lapierre, G., Bergman, H., & Lapointe, L. (2018). Shedding light on conditions for the successful passive dissemination of recommendations in primary care: A mixed methods study. *Implementation Science,* 13(129).

Verbeke, W., Volgering, M., & Hessels, M. (1998). Exploring the conceptual expansion within the field of organizational behaviour: Organizational climate and organizational culture. *Journal of Management Studies,* 35, 303–330.

Walumbwa, F. O., Orwa, B., Wang, P., & Lawler, J. J. (2005). Transformational leadership, organizational commitment, and job satisfaction: A comparative study of Kenyan and U.S. financial firms. *Human Resource Development Quarterly,* 16*,* 235-56.

Weiner, B. J., Belden, C. M., Bergmire, D. M., & Johnston, M. (2011). The meaning and measurement of implementation climate. *Implementation Science*, 6, 78.

Wilderom, C. P. M., Glunk, U., & Maslowski, R. Organizational culture as a predictor of organizational performance (2000). In: Ashkanasy N.M., Wilderom, C.P.M., Peterson, M.F. (Eds.), *Handbook of Organizational Culture and Climate* (pp. 193-209)*.* Thousand Oaks, CA: Sage.

Williams, N. J., Wolk, C. B., Becker-Haimes, E. M., & Beidas, R. S. (2020). Testing a theory of strategic implementation leadership, implementation climate, and clinicians' use of evidence-based practice: A 5-year panel analysis. *Implementation Science,* 15(10).

Wing, C., Simon, K., Bello-Gomez, R. A. (2018). Designing difference in difference studies: Best practices for public health policy research. *Annual Review of Public Health,* 39, 453-469.

Woltman, H. Feldstain, A., MacKay, J. C., & Rocchi, M. (2012). An introduction to hierarchical linear modeling. *Tutorials in quantitative methods for psychology,* 8(1), 52-69.

Zlotnik, J. L., D. DePanfilis, C. Daining, and M. M. Lane. (2005). *Factors influencing recruitment and retention of child welfare workers: A systematic review of research*. Washington, DC: Institute for the Advancement of Social Work Research. http://www.socialworkpolicy.org/wp-content/uploads/2007/06/5-CW-SRR-FinalExecSummary.pdf (accessed January 12, 2019).

Zohar, D. (2002). The effects of leadership dimensions, safety climate, and assigned priorities on minor injuries in work groups. *Journal of Organizational Behavior,* 23, 75-92.

Zohar, D., & Luria, G. (2004). Climate as a social-cognitive construction of supervisory safety practices: Scripts as proxy of behavior patterns. *Journal of Applied Psychology,* 89*,* 322-333.

APPENDIX

The Implementation Climate Scale (ICS)

Scale adapted from Ehrhart et al., 2014

This 18-item measure assesses the degree to which there is a strategic organizational climate supportive of evidence-based practice implementation. Implementation climate is defined as employees' shared perceptions of the policies, practices, procedures, and behaviors that are rewarded, supported, and expected in order to facilitate effective EBP implementation.

Note: This measure can be adapted to study climate for evidence-based practice implementation for teams/work groups or entire organizations. Please choose a single referent point for all of the items (e.g., team or agency).

Instructions: Please indicate the extent to which you agree with each statement.

0 = Not at all; 1 = Slight extent; 2 = Moderate extent, 3 = Great extent; 4 = Very great extent

Focus on Evidence-Based Practice

1. One of this team/agency's main goals is to use evidence-based practices effectively
2. People in this team/agency think that the implementation of evidence-based practices is important
3. Using evidence-based practices is a top priority in this team/agency

Educational Support for Evidence-based Practice

4. This team/agency provides conferences, workshops, or seminars focusing on evidence-based practices
5. This team/agency provides evidence-based practice trainings or in-services
6. This team/agency provides evidence-based practice training materials, journals, etc.

Recognition for Evidence-Based Practice

7. Clinicians in this team/agency who use evidence-based practices are seen as clinical experts
8. Clinicians who use evidence-based practices are held in high esteem in this team/agency
9. Clinicians in this team/agency who use evidence-based practices are more likely to be promoted

Rewards for Evidence-Based Practice

10. This team/agency provides financial incentives for the use of evidence-based practices
11. The better you are at using evidence-based practices, the more likely you are to get a bonus or a raise
12. This team/agency provides the ability to accumulate compensated time for the use of evidence-based practices

Selection for Evidence-Based Practice

13. This team/agency selects staff who have previously used evidence-based practice
14. This team/agency selects staff who have had formal education supporting evidence-based practice
15. This team/agency selects staff who value evidence-based practice

Selection for Openness

16. This team/agency selects staff who are adaptable
17. This team/agency selects staff who are flexible
18. This team/agency selects staff open to new types of interventions

Scores are generated by computing a mean score for each set of items on their respective subscale, then calculating a mean of all subscale scores.

The Implementation Leadership Scale

Adapted from Aarons et al., 2014

The ILS assesses the degree to which a leader is Proactive, Knowledgeable, Supportive, and Perseverant in regard to evidence-based practice implementation. There are two versions of the ILS, one for staff to report about their supervisor/leader, and another for supervisors/leaders to report about themselves.

Instructions: Please indicate the extent to which you agree with each statement.

0 = Not at all; 1 = Slight extent; 2 = Moderate extent, 3 = Great extent; 4 = Very great extent

Proactive

1. [Name of Supervisor] has developed a plan to facilitate implementation of evidence-based practice
2. [Name of Supervisor] has removed obstacles to the implementation of evidence-based practice
3. [Name of Supervisor] has established clear department standards for the implementation of evidence-based practice

Knowledgeable

4. [Name of Supervisor] is knowledgeable about evidence-based practice
5. [Name of Supervisor] is able to answer my questions about evidence-based practice
6. [Name of Supervisor] knows what he or she is talking about when it comes to evidence-based practice

Supportive

7. [Name of Supervisor] recognizes and appreciates employee efforts toward successful implementation of evidence-based practice
8. [Name of Supervisor] supports employee efforts to learn more about evidence-based practice
9. [Name of Supervisor] supports employee efforts to use evidence-based practice

Perseverant

10. [Name of Supervisor] perseveres through the ups and downs of implementing evidence-based practice
11. [Name of Supervisor] carries on through the challenges of implementing evidence-based practice
12. [Name of Supervisor] reacts to critical issues regarding the implementation of evidence-based practice by openly and effectively addressing the problem(s)

Scores are generated by computing a mean score for each set of items on their respective subscale, then calculating a mean of all subscale scores

Fidelity of R^3 Implementation for Supervisors (FRI_S)

Used and adapted with permission from Dr. Saldana (personal communication, May, 4, 2019)

Content
Scoring:
Not at all = 1; Hardly ever = 2; Sometimes = 3; Almost always = 4

1. Discussion included specific information on reinforcing family/client/case efforts
2. Discussion included reinforcing caregiver-child relationships and/or relationships and roles
3. Discussion identified small steps team members took, or will take with, or related to, families/clients/cases
4. Discussion included focus on small steps families/clients/cases took or could take during the next week
5. Discussion included examples of supporting and encouraging families/clients/cases
6. Discussion noted documenting family/case accomplishments
7. Solutions and strategies were discussed in behavioral terms (e.g., observe and reinforce; what did that look like?)
8. Barriers to family/client/case progress were discussed with a focus on how to help overcome them

Process & Structure
Scoring:
Never = 1; Rarely = 2; Sometimes = 3; Almost always = 4

1. Family/client strengths were used in case planning
2. The atmosphere of the meeting was friendly and supportive (e.g., supervisor smiles, uses humor)
3. Supervisor redirected conversation when necessary
4. Supervisor reinforced supervisees for positive efforts on cases with, or related to, families
5. Supervisor managed the meeting time well > 2 cases > 4+
6. Supervisees were reinforced for small steps accomplished on their cases
7. Supervisors ended group well (on time – minimum 45 min. or 30 min. for CM3, encouraging statements)