

A Cross-Level Analysis of the Relationship Between Organizational Culture and Technology Use Among Homeless-Services Providers

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Abstract

This study explored how homeless-services providers are implementing homeless management information systems (HMIS) using an integrated theory base of innovation diffusion, sociotechnical systems, and organizational culture. Data were collected in 2 states from 24 homeless-services providers and 142 staff members. Cross-level relationships were analyzed using generalized hierarchical linear modeling. Results revealed striking disparities in HMIS use. In some organizations, many staff members accessed the system regularly, while in others, very few ever used the HMIS. The study found an association between organizational culture and HMIS use, which was moderated by gender. In organizations reporting higher levels of organizational proficiency, male staff members showed increased use of HMIS. Moreover, the homeless-services providers in this sample reported higher levels of organizational rigidity and resistance compared with a national normed sample of children's mental health providers. The current study's findings suggest that organizational context is critical to successful technology innovation diffusion. The study recommends that policymakers make efforts to alter both the organizational context and the technology to maximize the success of resources like HMIS.

Introduction

Technology plays an increasingly critical and diverse role in the human services. Service providers keep electronic records about clients' health care (Poon et al., 2004); administer cognitive behavioral therapy over the Internet (Andersson, 2009); coordinate services electronically (Fitch, 2009); and engage in online community organizing and political activism (McNutt and Menon, 2008). Specific public policy efforts have encouraged innovation in the homeless-services sector. In 1999, the U.S. Department of Housing and Urban Development (HUD) introduced homeless management information systems (HMIS) to service providers. HMIS are designed to facilitate the migration from paper-based to electronic work systems with a two-fold goal of improving (1) data collection and (2) the effectiveness of homeless programs (HUD, 2007). As of 2008, 222 homeless-services provider communities reported that they were collecting client-level data in an HMIS (HUD, 2009). This study explores the extent to which these providers are implementing this technology and what factors are related to the process.

The nature of homelessness makes it difficult to provide consistent services and track outcomes, because many members of the homeless population live itinerantly, suffer from concurrent disabilities, have limited if any social and familial connections, and frequently eschew traditional social services (Wright, Rubin, and Devine, 1998). As early as 1986, researchers were developing a tracking tool for monitoring homeless services (Nichols, Wright, and Murphy, 1986). In implementing the HMIS program, HUD expected that systematic data collection methods would improve the accuracy of prevalence counts and knowledge of the population's characteristics, which would, in turn, enhance the efficiency of resource allocation and service effectiveness.

Previous studies of innovation diffusion have suggested that the process of adopting and implementing new technologies is as much a social process as it is a technical process. Indeed, the culture of organizations, or the degree to which they encourage innovation and invite change, is related to successful innovation implementation (Carrilio, Packard, and Clapp, 2003; Glisson and James, 2002). Despite the substantial HUD funding and training efforts devoted to HMIS implementation, the process has been challenging and not always successful (Cronley and Patterson, 2010; Gutierrez and Friedman, 2005). Homeless-services providers are often small organizations that rely heavily on volunteers and former clients for staffing, a factor that may discourage the rapid uptake of new technologies (Corder, 2003). Case managers often provide services outdoors and off site, where access to digital technology is difficult.

This study applied theories of innovation diffusion to a model of organizational culture in an exploratory evaluation of the degree to which service providers are using HMIS. It is based on a pilot study of organizational culture and HMIS implementation (Cronley and Patterson, 2010). The study suggests that technology implementation within homeless services is an erratic and long-term process. It is necessary that HUD focus continued funding on coordinating implementation efforts across multiple systems—human, technological, and organizational.

Homeless Management Information Systems

The movement toward computer-based operations derives from HUD's efforts to improve data collection and accountability among homeless-services providers. In 1993, the federal government passed the Government Performance and Results Act,¹ which requires federal agencies to set performance goals and measure outcomes. Partly in response to this requirement, HUD began requiring homeless-services providers to implement HMIS in 1999 and, in 2001, began providing grants to service providers for purchasing the software, training staff members, and hiring people to manage the systems (HUD, 2007). All federally funded homeless-services providers, however, must implement HMIS to maintain additional HUD funding. Most organizations began implementing technology innovations less than 5 years ago, and HUD continues to push for expanded implementation and improved data quality.

HMIS typically link multiple service providers through secure, central homeless information databases, using encrypted Internet communication technology. It is common for organizations using HMIS to store client records electronically on the database and coordinate client care through real-time, shared access to the database. HMIS also integrate information and retrieval systems into databases, thereby facilitating resource referrals. Successful transformation from a paper-based to a computer-based system requires that organizations sustain HMIS utilization after they have installed the software. This utilization means that employees must consistently enter new client information into the system and recording services delivered. Challenges to sustained use include persuading service providers that client data collection procedures are necessary and training them to implement the technology as designed. For an organization to overcome these challenges, theory and research suggest the organizational social context must support technology (Pasmore et al., 1982; Trist and Bamforth, 1951). How members of the leadership team communicate the value of innovation and whether staff members have the flexibility in their work systems to adapt to new systems are critical to successful technology implementation.

Technology Use in Human Services

A general understanding exists that using new technologies will improve human services. Benefits include (1) increasing the speed of service provision (Schoech, 1999) and (2) improving the quality, volume, and flow of information among agencies (Burt and Taylor, 2003; Fitch, 2009; McCoy and Vila, 2002) and between agencies and clients (Schoech, 1999). Much of the evidence supporting this position is qualitative, however, and relies on case studies (for example, Fitch, 2009) and self-reports from small numbers of participants (for example, Gomez et al., 2010). Although these findings are valuable, they fail to provide evidence that the benefits of technologies in specific settings can be generalized across social service sectors. Besides the lack of empirical evidence about the benefits of technology use in the human services, a lack of understanding exists about the extent to which organizations use these new technologies and why certain organizations choose to implement them and others do not. Substantial evidence suggests that many organizations choose not to or fail in their efforts to implement new technologies (Carillio, 2007; 2005; 2003; Fitch, 2005; Herie and Martin, 2002; McCoy and Vila, 2002).

¹ PL. 103–162.

A study of technology trends in the U.S. healthcare industry showed that only 10 to 15 percent of U.S. hospitals use computerized physician order entry forms, although their use has been shown to reduce the incidence of serious medication errors by 55 percent (Poon et al., 2004). A qualitative study of substance-abuse services showed that many social workers who were interviewed lacked technical proficiency to use a computerized referral system (Drum, McCoy, and Lemon, 2004). Glisson and Schoenwald (2005) contend that when the technology is disseminated, the adopting organizations change the technology to such a degree that they render it useless. The problem is referred to as technology transfer—the space between the clinical development of the innovation and its practical application in the community (Becker et al., 2000; McGovern et al., 2003; Miller et al., 2006).

One common cause of unsuccessful technology implementation is an overemphasis on technical factors rather than on organizational and personal factors (Cybluski, Zantinge, and Abbott-McNeil, 2006; Dhillon and Backhouse, 1996; Greenhalgh et al., 2004; Herie and Martin, 2002; Keddie and Jones, 2005; Lorenzi and Riley, 2003; Lorenzi and Riley, 2000). Dhillon and Backhouse describe technology utilization as a continual interplay among three systems: the technical process, the formal structure, and the informal structure. They argue that technical processes and formal structure are embedded in the informal structure, where meaning is created and values are stored. Failure to intervene at the informal level and to maintain integrity among the three systems impedes technology utilization. Glisson (1992) describes this misplaced emphasis as the technical imperative by which project planners view utilization as a solely technical process in which the success or failure rests exclusively on the technical components (for example, hardware and software) of the innovation.

Organizational culture is a factor that may influence technology implementation. Organizational culture is defined as the values, beliefs, and expectations that guide employee behavior (Schein, 1992); it encompasses decisionmaking systems, leadership, and work processes. For example, lack of leadership support for innovation has been shown to hinder technology implementation (Corder, 2003; Poon et al., 2004) because of poor project planning and management (2003). Failure to provide logistical support (Mutschler and Hoefler, 1990) and organizational resistance to change (Drum et al., 2003; Lorenzi and Riley, 2000, 2003) are also associated with unsuccessful technology implementation. This culture of resistance may stem from a belief that technology interferes with client interactions (Carillio, 2005; Semke and Nurius, 1991) or from the opinion among human services workers that their work activities are not as easily automated and, thus, are less amenable to technology utilization (O’Looney, 2005).

A pilot study of the relationship that exists between organizational culture and the use of the information management software among homeless-services providers found that two characteristics of organizational culture—rigidity and proficiency—are positively related to individual staff members’ technology use (Cronley and Patterson, 2010). Organizational rigidity is defined as the degree to which organizations expect staff members to follow uniform policies and procedures for work practices; organizational proficiency is defined as the degree to which organizations emphasize competency, provide training and professional development opportunities for staff members, and expect them to provide the highest quality of services (Glisson et al., 2008). It is possible that staff members in organizations with clearly defined policies and procedures are more accustomed to learning new software that requires fairly systematic operation. Moreover, it is logical that in

organizations that value staff competency, the culture better supports the use of new technologies than those that do not value competency as much.

Diffusion of Innovations and Organizational Change

Everett Rogers (1962) developed the theory of diffusion of innovations (DOI) to explain how new ideas spread among people and social networks. Its central point is that any technology is embedded in a larger social system that influences its implementation. Diffusion is “the process by which an innovation is communicated through certain channels over time among members of a social system” (Rogers, 2003: 5), and innovation is “an idea, practice, or object that is perceived of as new by the individual or other unit of adoption” (Rogers, 2003: 11). Examples of DOI’s application in the social sciences include discussion of evidence-based practices (Carboneau, 2005; Herie and Martin, 2002), public health campaigns (Dearing, 2004; Haider and Kreps, 2004); and substance-abuse treatment (Oser and Rowman, 2007). Although useful as a starting point for understanding technology diffusion, DOI applies largely to individuals rather than to organizations or groups as the adopting unit, and it focuses more on the process of spreading ideas than on sustaining behavioral change. Because homeless-services providers are adopting HMIS, and because the goal is to implement and sustain the technology use, an improved model of DOI is necessary.

The theories of sociotechnical systems and organizational culture enhance the applicability of DOI to organizations. Although DOI was the first to identify the role of social systems in the spread of new ideas, sociotechnical theory (Trist and Bamforth, 1951) relates this concept to organizations and explains how new ideas may operate in this setting. At its most basic level, the sociotechnical system contains two components: the technical system and the social system (Rosseau, 1977). The organization consists of technical productions, including equipment and operations; the individuals who use and operate the technologies; and the work structure that coordinates interaction between workers and technologies, including the management and job responsibilities and allocations (Trist and Bamforth, 1951). Trist and Bamforth conceptualized organizations as “complex, dynamic structures in symbiotic relationships with their environments” (Trist and Bamforth, 1951: 476). Sociotechnical theory seeks to understand the interdependency between the social system and the technical system. Behavior in one part of the organization affects other parts of the environment; thus, organizational activity is viewed through the lens of interaction effects.

It is common for innovations to change as they are adopted and implemented. These changes can be interpreted on a continuum from the technology to the organization. Technological determinists often explain post adoption changes in innovations as the result of flawed design—an “engineer’s fallacy” that assumes that the technology itself is the problem. Sociotechnical theory offers alternative explanations to the engineer’s fallacy through a social constructionist perspective that contends that the social system largely shapes use of technology. Some experts argue that the technical system and the social system both are shaped by their interactions, while others suggest that the technology is shaped by the social system, and a technology’s function and use change according to the social system in which they are applied (Sawyer and Tapia, 2005). According to this perspective, alterations or misuses of technology are functions of the user or the context in which the technology is implemented.

Sociotechnical theory aims to resolve the conflicts between the technical system and the social system by achieving joint optimization, by making the social structure and the technical structure complement and support each other and the environment (Pasmore et al., 1982). Cooper and Foster (1971: 472) describe this optimization as an organizational choice, meaning “that there is an element of choice in designing effective work systems and that this choice must take into account the mutual de-pendence of the social and technical systems.” Margulies and Coleflesh (1982) report that failure to account for this mutual dependence causes misfits between the social system and the technical system, ultimately resulting in increased production costs and misuse or rejection of technology. If an organization requires staff members to devote work time toward learning and using a new technology, without decreasing other responsibilities, levels of stress and frustration among these individuals may rise. These individuals may react by refusing to learn the technology or altering its design or intended use to better match their work environments.

Thus, to support the adoption and implementation of technologies, organizations often have to change aspects of their work processes. According to organizational culture theory (Schein, 1992), this change in process occurs by first altering the values, beliefs, and expectations about behavior in the work environment. Schein drew upon open systems theory when articulating his idea of organizational culture. Open systems theory views organizations from a biological model, where they exist within changing and unpredictable environments, with constant interactions between the two (Emery and Trist, 1965). Organizations that survive are those that successfully adapt to the changing environment.

Culture incorporates both structure, such as size and levels of authority, and ideology, such as openness to change. Organizational culture describes how the work is done in an organization and is measured as the behavioral expectations reported by members of the organization. These expectations guide the way employees approach work and socialize new employees in the priorities of the organization (for example, rigidity and proficiency). Organizational culture is often described as layers, with behavioral expectations representing an outer layer and values or assumptions representing an inner layer (Homburg and Pflesser, 2000; Schein, 1992). Stated another way, Hofstede (1998) described behavior as the visible part of culture and values as the invisible part. Schein identified three parts to organizational culture: artifacts, values and beliefs, and underlying assumptions. The artifacts and articulated values and beliefs are the explicit manifestations of the implicit assumptions. Because of this nested relationship, culture is sometimes described as a “deep” construct. Studying only the cultural artifacts (for example, organizational charts or surveys) of an organization can be misleading if they are misinterpreted. Just as an archeologist may misrepresent a piece of pottery from a civilization with which they are unfamiliar, a social theorist may interpret official manuals, charts, or accounts of responsibility inaccurately. Staff members will state values and beliefs and say that they guide behavior and expectations in the organization, but the values and beliefs may not translate into action. For example, underlying assumptions may cause staff members to follow instructions from a peer who is regarded as the expert in a certain area rather than from an official supervisor. These underlying assumptions define the foundations of an organizational culture, but because they are mostly unstated, or even unconscious, they are also the most difficult to examine. Studying organizational culture requires piecing together all components and identifying consistencies and patterns that suggest specific values, norms, and behavior.

Recently, however, studies have suggested that culture is transmitted among employees more through behavioral expectations than through deeper values or assumptions (Ashkanasy, Broadfoot, and Falkus, 2000; Hofstede, 1998; Hofstede et al., 1990). This transmission occurs because individuals in an organization can comply with behavioral expectations without necessarily internalizing the values and assumptions that contribute to those expectations. Expectations can also be determined by the demands that workers face on the job, regardless of the values of top management (Hemmelgarn, Glisson, and Dukes, 2001). For instance, official safety measures may be relaxed in the face of tight deadlines.

A recent study that examined the relationship between organizational culture and organizational performance, specifically among nonprofit organizations, is Jaskyte and Dressler's (2005) study of organizational culture and innovativeness. The study was based on survey results from 20 organizations and tested the model that cultural consensus and values affect innovativeness concurrently with organizational size and transformational leadership. Results showed that cultural consensus was negatively associated with innovativeness.

In summary, organizational change occurs through a dynamic process of communication and activity among interrelated social networks; the external environment, such as funders and policymakers; and the internal environment of the organization. The key components of this change are social systems or networks, the external and internal environments, and interactions. DOI theory (Rogers, 2003) identifies the role of social systems in the spread of new ideas, while sociotechnical theory (Trist and Bamforth, 1951) explains how social systems facilitate diffusion in organizations. Both theories argue that interaction between the social system and the technical system determines the "fit" of the technology in the organization. To optimize this fit between the social and technical systems, however, we need to examine those components of the culture that guide behavior, values, beliefs, and unconscious assumptions, as described in organizational culture theory (Schein, 1992). This study, then, explores the relationship between organizational culture and implementation of an HMIS among homeless-services providers. The study first hypothesizes that characteristics of organizational culture are related to staff members' use of an HMIS within an organization. The study then predicts that individual characteristics interact with organizational culture to affect staff members' use.

Methodology

The study is a multilevel analysis of organizational culture and staff members' behavior, meaning that it examines hierarchical relationships between two groups. It is an exploratory analysis intended to consider if and how organizational culture may affect individual behavior. The study was also designed to assess the use of technology in the homeless services. Organizational culture characteristics were captured at one point in time to predict the frequency of HMIS use by staff members during the previous year.

Sample

The study employed a purposive sample drawn from two sampling frames: (1) the East Tennessee Coalition to End Homelessness (ETCEH) and (2) the Michigan Coalition Against Homelessness

(MICAH). ETCEH is a coalition of multiple homeless-services providers, defined by HUD as a Continuum of Care (CoC). The ETCEH CoC, in partnership with the University of Tennessee, operates its own HMIS, independent of other CoC in the state. Of the 8 organizations in the ETCEH, 7 participated in the present study. MICAH is a statewide coalition that administers a single HMIS used by multiple CoCs; 3 CoCs chose to participate in the study, one rural and two urban. In the rural CoC, 8 out of the 9 organizations using the HMIS participated. In the first urban CoC, 5 out of the 11 organizations using the HMIS participated in the study; in the second, 6 out of the 14 participated. Organizations chose not to participate for various reasons. In the rural CoC, a single organization that serves domestic violence victims declined to participate based on privacy concerns for its clients. Other organizations stated that their staff members were too busy or had only one or two staff members, making it impossible to measure their organizational culture. Finally, several organizations did not respond to repeated phone calls and e-mails.

In the final sample, level one included 142 staff members (77 percent female; 36 percent from Tennessee). Staff members were nested in 24 organizations (7 in Tennessee) at level two. These organizations were divided among emergency shelters ($n = 3$), transitional housing ($n = 6$), permanent housing ($n = 7$), and ancillary services ($n = 10$). Organizations were nested in four CoCs (the ETCEH and three from MICAH).

Data Collection

The study relied on HMIS archival data to measure HMIS use during two multiple-month periods (March 1, 2007, through December 31, 2007, for ETCEH; January 1, 2008, through December 31, 2008, for MICAH). HMIS software assigns a unique identifier to all staff members who use the system. Each time a staff member logs on, the software records the date and the user's activities, such as new clients added and services recorded. An HMIS report was created that included HMIS use among staff members, organizational affiliation, CoC, and gender. HMIS data from ETCEH and MICAH were collapsed into one data set.

Surveying staff members at participating organizations collected organizational culture data, using the Organizational Social Context (OSC) questionnaire (Glisson et al., 2008), described below. Culture data were collected once at each organization (during January or February 2008 for ETCEH and during April or May 2009 for MICAH). Staff members completed the OSC questionnaire independently, and no supervisors were present during the testing. Organizations did not see staff members' individual responses. Again, data from both ETCEH and MICAH were collapsed into the level-two data set.

Measurement

The staff members' use of an HMIS was measured according to the number of times each staff member logged on over the multiple-month period. Alternative measures of use that were considered include number of new clients entered, number of services provided, and number of case notes recorded. The total of logon attempts was considered the most appropriate, however, because it captured all staff members' interactions with the HMIS. All staff members must log on to the HMIS every time they use it. The alternatives reflect job-specific HMIS interactions. For example, some

staff members do not enter new clients; they only update existing client records or run reports. Measuring clients entered, therefore, would exclude these staff members' use of the HMIS.

In some organizations, only a single individual used the HMIS during the year of data collection. These individuals and their organizations were still included in the multilevel analysis, which accounts for uneven designs when higher order groups have different numbers of cases than the lower order groups (Raudenbush and Bryk, 2002). An exposure variable, the number of months that a staff member had any registered activity for the HMIS, was measured to account for the opportunity, or amount of time, that an individual had to use the system. The study included gender as a level-one predictor to control for gender differences in perceptions of the work environment (Kanter, 1977), such as stressors (Arrington, 2008; Coffey, Dugdill, and Tattersall, 2009) and job competencies (Frame et al., 2010). Unfortunately, the small sample size and limited degrees of freedom made it impossible to add more covariates to the model.

The study measured the level-two predictor—organizational culture—using the OSC questionnaire (Glisson et al., 2008). The OSC questionnaire consists of 105 items and measures three dimensions: (1) culture, (2) climate, and (3) work attitudes (Glisson and James, 2002). Analysis was limited to the culture scale and its corresponding subscales: (1) rigidity (14 items, $\alpha_1^2 = 0.79$, $\alpha_2^3 = 0.74$), which is the degree of order and flexibility in work habits and procedures; (2) proficiency (15 items, $\alpha_1 = 0.86$, $\alpha_2 = 0.85$), defined as the degree to which staff members are expected to be knowledgeable about and capable of providing optimal services; and (3) resistance (13 items, $\alpha_1 = 0.79$, $\alpha_2 = 0.70$), which is the ability of the environment to change work habits and procedures. Disproportionate data entry was added as a level-two covariate. Data entry among staff members was considered disproportionate if a single individual accounts for 75 percent or more of logon attempts within an organization.

Data Analysis

The analysis used a two-level hierarchical generalized linear model (HGLM) (Gelman and Hill, 2007; Raudenbush and Bryk, 2002) with a negative binomial log-link function to consider the cross-level relationship between staff members' HMIS use and organizational culture. Although the model included three levels, only a two-level model was used, because the small number of CoCs in the third level ($n = 4$) made it impossible to test for variation. The negative binomial model accounted for the overdispersion ($\chi^2 = 447.92$, $p = .00$) in the data (Orme and Combs-Orme, 2009). In addition, the multilevel model accounted for the clustering in the data (Nair, Czaja, and Sharit, 2007; Raudenbush and Bryk, 2002). The analysis estimated a rate of HMIS logon attempts for staff members based on the number of times they attempted to log on (the outcome variable), adjusted for the number of months they had used the system (the exposure variable). Restricted maximum likelihood estimation was used rather than full maximum likelihood estimation, because the former is considered less biased than the latter with small samples (Nair, Czaja, and Sharit, 2007). A test of the null model, including only the outcome and exposure variables, indicated that random variation existed among organizations in frequency of HMIS logon attempts ($\chi^2 = 89.93$, $p = .00$).

² Refers to the ETCEH sample.

³ Refers to the MICAH sample.

The full model included (1) number of months of use (exposure variable), (2) proficiency and rigidity at level two,⁴ (3) gender at level one, and (4) the cross-level interactions by gender (that is proficiencyXgender and rigidityXgender). The interaction between rigidity and gender was not statistically significant and did not improve the model fit. Consequently, it was not included in the final model. The full model is specified as shown in equation (1) below.

$$\eta_{ij} = \gamma_{00} + \gamma_{01}(\text{dd}) + \gamma_{02}(\text{proficiency}) + \gamma_{03}(\text{rigidity}) + \gamma_{10}(\text{gender}) + \gamma_{11}(\text{proficiencyXgender}) + \mu_{0j} + r_{ij} \quad (1)$$

where η_{ij} is the log of the monthly rate of HMIS logon attempts for staff member i in organization j . γ_{00} is the average rate of client entries for a staff member. $\gamma_{01}(\text{dd})$ is the difference in HMIS logon attempts between organizations with a disproportionate data entry system and those without. $\gamma_{02}(\text{proficiency})$ is the 1-point change in HMIS entry for every 1-point increase in organizational proficiency. $\gamma_{03}(\text{rigidity})$ is the 1-point change in HMIS entry for every 1-point increase in organizational rigidity. $\gamma_{10}(\text{gender})$ is the difference in logon attempts for males and females. $\gamma_{11}(\text{proficiencyXgender})$ is the 1-point change in the rate of HMIS logon attempts as a function of the interaction between organizational proficiency and gender. μ_0 is the random variation among organizations, and r_{ij} is the random variation among staff members.

Results

HMIS use was measured at the individual level and results are reported in univariate form by individuals, in the aggregate form by organizations, and in the bivariate form by looking at the relationship between the concept and continuum-of-care (CoC) membership. Results from the multivariate analysis follow the bivariate results. Two of the organizations surveyed did not use HMIS during the year of data collection. For this reason, they were excluded from the multilevel model.

Univariate

Exhibit 1 shows individual use of the HMIS, as measured by the number of times a staff member logged on to the system during the time period. The kurtosis value for use indicates a strong positive skew in the data, so medians are interpreted rather than means. Usage ranged from 2 to 719, with a median of 47.5 times. These results suggest that most staff members did not log on frequently, but a small percentage of the users were outliers who logged on far more than the others. Months using the system show a more normal distribution, with a range from 1 to 10 and a median of 9 months for CoC 2-4, and with a range of 1 to 12 and a median of 8 months for CoC 2-4.

Results at the aggregate organizational level, also shown in exhibit 1, suggest that a wide variation exists in how frequently the organizations use the HMIS. Total logon attempts by staff members ranged from 5 to 3,688 ($M = 660.92$, $s.d. = 952.1$) per organization. The maximum time that a staff member at an organization had used the system ranged from 1 to 12 months ($M = 9.33$, $s.d. = 3.36$). The mean number of staff members using the HMIS at an organization was 8 ($s.d. = 9.93$), ranging from 1 to 35 users. The mode is one, however, suggesting that many of the organizations only have

⁴ Resistance was not included in the final model because of its high correlation with rigidity ($r = 0.603$, $p < 0.001$).

one person using the HMIS. The total number of clients entered into the system ranged from 9 to 20,000 (M = 4,900.41, s.d. = 6,335.11).

Exhibit 1

Univariate HMIS Logon Attempts

	Mean	s.d.	Median	Min	Max
Level one—individual (n = 142)					
Total logon attempts	111.7	140.35	47	2	719
Months using the HMIS	6.59	3.79	7	1	12
Level two—organization (n = 24)					
Aggregate logon attempts	660.92	952.1	255	5	3,688
Staff	8	9.93	4.5	1	35
Clients	4,900	6,335.11	2,000	9	20,000

s.d. = standard deviation.

Bivariate

Individual comparisons of HMIS logon attempts, across CoC, service provider type, and gender also showed variability. The total number of times that staff members in each CoC attempted to log on to the system ranged from 616 for CoC 1 to 6,106 times for CoC 4. This distribution in logon attempts is reflected in the distribution of HMIS users. CoC 1 accounted for 9.15 percent of the users and CoC 4 accounted for 35.9 percent.

The relationship between the number of HMIS logon attempts and the type of service provider, showed similar disparities. The mean number of logon attempts ranged from 28 for staff members in emergency shelters to 90 in transitional housing. Men reported a higher level of use with a median number of logon attempts equaling 66 compared with 46 for women.

Results continued to suggest variability at the organizational level. Exhibit 2 displays comparisons of HMIS use, aggregated to the organizational level, and compared across CoC. Aggregated HMIS logon attempts ranged from a median of 33 for organizations in CoC 2 to 220 in CoC 4. Also, the number of clients entered into the HMIS ranges from an organizational mean of 608.33 (s.d. = 417.63) for CoC 4 to 1,038.07 (s.d. = 578.02) for CoC 3. Almost no variation existed in the number of months that staff members in each of the CoC used the system, with means ranging between 6.53 (s.d. = 3.48) and 6.74 (s.d. = 3.77).

Multilevel Model

Hypothesis One

Main Organizational Effects. Exhibit 3 reports the results of the multilevel model. The model did not support the hypothesis that culture characteristics affected HMIS use. When controlling for the other variables in the model, rigidity was not statistically significant (B = -0.036, ERR = 0.964 (0.939, 0.991), p = .011). Similarly, when controlling for the other variables in the model, proficiency was not statistically significant.

Exhibit 2

Aggregated Organizational HMIS Logon Attempts Compared Across CoC (n = 24)

	Mean	s.d.	Median	Min	Max
Total logon attempts					
CoC 1 (n = 5)	218.75	171.92	163	80	469
CoC 2 (n = 8)	636.50	1,267.31	33	5	3,688
CoC 3 (n = 4)	300.53	67.01	337	103	1,660
CoC 4 (n = 7)	731.43	1,072.02	220	50	3,011
Months using the HMIS					
CoC 1 (n = 5)	6.59	3.79	7.0	1	12
CoC 2 (n = 8)	6.53	3.48	6.0	2	12
CoC 3 (n = 4)	6.74	3.77	5.5	1	12
CoC 4 (n = 7)	6.36	4.23	5.5	1	12
Staff members using the HMIS					
CoC 1 (n = 5)	16.54	14.05	7	1	35
CoC 2 (n = 8)	6.12	7.41	4	1	35
CoC 3 (n = 4)	8.20	3.50	8	1	20
CoC 4 (n = 7)	8.41	2.80	9	1	11
Clients entered into the HMIS					
CoC 1 (n = 5)	973.85	1,429.54	350	20	4,000
CoC 2 (n = 8)	830.88	466.74	900	74	2,000
CoC 3 (n = 4)	1,038.07	578.02	1,000	175	4,000
CoC 4 (n = 7)	608.33	417.63	436	3	1,284

CoC = Continuum or Care. HMIS = homeless management information systems. s.d. = standard deviation.

Exhibit 3

**Negative Binomial Hierarchical Generalized Linear Model
Level one (n = 142), Level two (n = 24)**

Null model						
Fixed effect (unit-specific model with model-based standard errors)						
	B	SE	T-ratio	df	ERR	C.I.
Intercept	2.459	0.14	17.592**	23	11.697	8.969, 15.733
Estimation of variance components						
Random effect	s.d.	Variance	df	χ^2	p-value	
Intercept	0.496	0.246	23	89.927	0	
Level one	8.928	79.712				
Full model						
	B	SE	T-ratio	df	ERR	C.I.
Level two						
Intercept	1.795	1.826	0.983	21	6.017	0.136, 266.746
Proficiency	0.005	0.023	0.229	21	1.005	0.959, 1.054
Rigidity	0.006	0.021	0.289	19	1.006	0.962, 1.052
Level one						
Gender	- 4.962	2.129	- 2.331*	137	0.007	0.000, 1.467
GenderXproficiency	0.080	0.034	2.331*	137	1.082	1.016, 1.158
Estimation of variance components						
Random effect	s.d.	Variance	df	χ^2		
Intercept	0.531	0.282	21	91.577**		
Level one	8.988	80.7889				

* significant at $p < 0.05$. ** significant at $p < 0.01$.

B = unstandardized beta. C.I. = 95% confidence interval. df = degrees of freedom. ERR = event rate ratio. s.d. = standard deviation. SE = standard error.

Hypothesis Two

Interaction Effects. Results supported the second hypothesis that an interaction between organizational-level and individual-level characteristics would affect HMIS use. The interaction between proficiency and gender ($B = .033$, $ERR = 1.085$, $p = .016$) was statistically significant. Because proficiency is a T-score,⁵ the event rate ratio (ERR) lacks intrinsic meaning. The ERR, which is the unstandardized beta coefficient exponentiated, quantifies the strength and direction of the relationship between independent and dependent variables. To facilitate interpretation, the ERR was transformed by multiplying the coefficient by 10 and exponentiating the value: $\exp(0.033 \times 10)$. Results of this calculation on the ERR for the proficiencyXgender interaction indicate that for every one standard deviation increase (10 points) in organizational proficiency, the rate of logon attempts for men increases by a factor of 1.391 (39 percent). They are more likely to use the HMIS in organizations with higher levels of proficiency.

Discussion

The most important finding in the current study is that the effect on HMIS log attempts of an organizational-level variable—proficiency—is moderated by gender, an individual-level characteristic. This finding confirms research showing that the interaction between individual and organizational attributes can affect service provision (North et al., 2005). The present study showed no effects of organizational culture on women, but men were more likely to attempt to log on in organizations that valued proficiency. Possible explanations for the gender differential include differences in job status and responsibilities. For instance, men may be more likely to hold positions of authority. The individuals in authority and who hold leadership positions are often those responsible for developing policies and procedures, and leadership is partly responsible for creating and maintaining the organizational culture (Schein, 1992). If men are holding leadership positions, they may be largely involved in the shaping of a culture that values innovation and competency. In this study, however, men and women were relatively equally likely to hold authority positions (23.3 and 25.8 percent, respectively).

Alternatively, women may be affected similarly, but this relationship was not observed due to limited statistical power. The pilot study showed, however, that gender acted as a moderator on the effect of organizational culture for both men and women. It is also important to note that the effects for men did not become apparent until organizations reached very high levels of proficiency. Further research is necessary to completely understand the interactions between gender and organizational culture.

Unlike in the pilot study (Cronley and Patterson, 2010), the present study did not show a relationship between rigidity and HMIS use, perhaps because the studies used different outcome measures. The pilot study examined HMIS use as measured by the number of new clients a staff member entered into the system. The current study examined HMIS as measured by the number of times

⁵ T-scores differ from the T-test values reported in Exhibit 3. The T-test values are based on Student's T distribution and indicate how far the sample deviates from this distribution. The T-scores discussed here are the standardized values of the organization's culture scores (based on rigidity, proficiency, and resistance). T-scores have a mean value of 50 and standard deviation of 10, thus, a score of 60 indicates that the value is one standard deviation above the mean.

a staff member logged on to the system (for reasons discussed earlier in Measures and subsequently in Limitations). It may be that the entry new clients was a better indicator of HMIS use. Logon attempts serve as a skeletal indicator of HMIS use—an indicator that does not portray substantive interaction with the system. Because the primary purpose of using an HMIS is to collect data about the homeless, records of new client entries may offer a clearer picture of the system's use.

The lack of statistical significance in the current study may be related to limited use of the system as well. The study suggested that sampled organizations are not using the HMIS to its full capacity. In many organizations, very few numbers of staff members were attempting to log on sporadically throughout the year. This system of use is contrary to the purpose of information management systems, which are designed to create a virtual network of providers who maintain up-to-date information on the clients served and services available. It may be that HMIS use among the sampled organizations is not yet at a point where usage can be evaluated. Because this study did not use a random sample, it is not possible to generalize the limited use found in this study to other communities and organizations using HMIS. In this sample, however, results suggest that implementation studies might yield more complete data when larger numbers of people in more organizations are using the HMIS.

The most important finding in the univariate and bivariate analyses was the variability in HMIS use among organizations. This finding is particularly interesting, given the stated purposes of the technology. HMIS are intended to capture most client interactions so that the providers can maintain counts of homeless and services and can provide online referrals and manage cases (HUD, 2009). This intention requires staff members to have access to the system to use it regularly. In organizations with 30 staff members where 20 of them provide direct client care, it is expected that most of the staff members would have HMIS licenses. Moreover, if the 20 direct-care staff members are working with clients daily, it is expected that each of those staff members would log on to the HMIS daily. This assumption means that client services are being recorded immediately in the HMIS. The information is available in the database for other organizations to view, and the organization providing the service has a current count of its clients.

The study revealed several organizations using the HMIS daily. In these organizations, large numbers of staff members were licensed to use the HMIS, and they logged on to the system multiple times a month throughout the year. Other organizations showed markedly different use patterns. These organizations had similarly large client volumes and provided the same types of services, but the study found that only two or three staff members had logged on to the HMIS during the year, and they had done so only once or twice. A third type of organization evident in the study's findings had a very small client base and a single HMIS user who logged on infrequently.

One possible explanation for the difference in use may have been a difference in services provided. It is logical that organizations providing emergency shelter might interact with the HMIS differently than organizations providing permanent housing or ancillary services. Emergency shelter providers have large nightly client caseloads, as many as 200 per night, and provide short-term basic services, such as temporary shelter, food, and clothing. Permanent housing facilities may have smaller caseloads and provide more long-term, comprehensive services, such as mental and physical health care and substance-abuse counseling. The study, however, did not show statistically significant differences in use among the different types of homeless services. Instead,

differences in use were statistically significant based on the CoC. This finding reinforces the study's theoretical argument that HMIS use is partly a function of community norms, which may be a function of organizational culture.

The results also support previous studies showing that multisite program evaluations that assess overall effectiveness often mask significant variability between sites (Becker et al., 2000; Seltzer, 1994) and that the influence of organizational attributes varies according to types of service providers (Sosin, 2001). The variability within a CoC may challenge efforts to coordinate service provision. This coordination often requires standardizing certain procedures across organizations, such as using the HMIS for a common intake procedure. Program planners, however, may only achieve standardized data collection and care coordination through adaptive organizational implementation procedures. One example is providing site-specific training that modifies the HMIS to the unique physical environment of each organization, its established business processes, and the unique needs of its users.

Limitations

The study has several limitations that are common among organizational research, including small sample size, measurement ambiguities (Wilderom, Glunk, and Maslowski, 2000), and a nonrandom sample (Poertner, 2006). The small sample limited the study from including more covariates that arguably could have affected technology use, such as years of work experience and age.

In addition, it was challenging to identify one measure of usage that represents all types of interactions with the system, because organizations and staff members use the HMIS differently. This study chose to use logon attempts as a proxy indicator of use to maximally capture user access of the system. In the current study, the concept of HMIS use was developed in consultation with the staff members at the ETCEH. Individually, each alternative measure was ruled too exclusive. Some staff members with HMIS licenses do not enter new client data at all. Other staff members enter only new client assessments and do not record case notes or services provided. Consider the following examples of usage behaviors. Case managers who work intensively with a small number of clients may log on only once or twice a week. When they log on, they may spend a large amount of time writing case notes or completing lengthy assessments about a single client. In contrast, organizations providing emergency shelter often employ overnight staff members. These staff members may be assigned a large number of paper-based client assessments and asked to transfer the information to the HMIS. They will log on nightly and enter 200 client assessments. Finally, some administrators log on once a month to run a report for funders or a board of directors.

The frequency of logon attempts was considered the most inclusive single measure of HMIS use, considering the variety of interaction patterns. Ideally, the study would have triangulated measures to capture usage as fully as possible. This triangulation was not considered possible at the time of the study, though, because of the implementation stage. Ironically, the study was designed to examine HMIS use, but it discovered that usage is so irregular that it poses significant challenges to measurement and study. Many staff members, who are trained to electronically record case notes and services provided, do not and are not required to do so by their organizations. Some organizations still use dual recordkeeping systems on paper and in the HMIS. Staff members record client interactions on paper and then transfer large volumes of paper-based assessments to the HMIS at

a single time. Consequently, adequate data were not available for some of these measures. One organization said it provided services to 2,000 clients annually, but it had entered data for only 10 clients into the HMIS during the previous year. This organization did not provide any reason for this disparity. It may be that this organization only began using the HMIS recently and had not had time to enter all of the clients. In addition, the organization may be overestimating the number of clients served. It is this sort of ambiguity and inaccuracy in data based on self-reported recollections that HMIS are designed to minimize.

Moreover, irregular usage distorts measures of system use. Having basic information for all clients stored in the HMIS does not mean that all staff members are logging on regularly or as required by their job responsibilities. Episodic HMIS data entry does mean that the client information is not consistently available in real-time for different organizations and case managers to access.

Thus, the measure of logon attempts in this study was used with the recognition of its limitations. For instance, reliance on this measure may have overestimated use by some individuals who log on frequently but do not input large amounts of data. In contrast, it may have underestimated use by other individuals who log on infrequently but input large amounts of detailed data, such as case notes and lengthy assessments. The use of this proxy measure of HMIS use may explain why the study failed to find a direct relationship between organizational culture and technology use. For instance, most organizations may be participating at a minimum level, but organizations with specific culture profiles will be more likely to transfer all datakeeping to the electronic system quickly and comprehensively. Thus, a measure of data quality might have demonstrated a stronger relationship between organizational culture and technology use.

In addition, the study's findings cannot be generalized to all homeless-services providers who are using information management systems in the United States. This study, which to date is the largest of its kind, included only 24 organizations in four CoCs across two states. Results may have overestimated overall levels of proficiency while underestimating rigidity and resistance. It seems logical that organizations willing to participate in research compared with those who declined would be more likely to value proficiency but would be less rigid and resistant. In addition, lack of participation by some organizations may have underestimated the variance among organizations in their use of the HMIS. Perhaps those organizations that chose not to participate are the few organizations that are choosing not to use an HMIS.

Finally, the small number of men compared with the number of women in the sample may have influenced the results. This disparity was inevitable, considering that women dominate nonprofit services. In fact, this sample is consistent with a national study of social workers, which found that 80 percent are female (Whitaker and Arrington, 2008). Still, the interaction effect between men and proficiency may have been overestimated due to the small number of men in the sample.

Implications

This study considers the pace of implementation and serves as a template for future studies examining more nuanced questions of quality and substance in use. It offers an empirical glimpse into the reality of how organizations and staff members are using HMIS as a tool of service on a daily basis. Results stress the need for administrators to examine the goodness of fit between organizations and new technologies before implementing them. As Weisman et al. (2002: 63)

argue, "...the utility of technology... is in its day-to-day workability..." in the organizations. This study shows that interactions between individual-level and organizational-level characteristics can complicate implementation of broad-based systems such as HMIS. A formulaic and rigid approach to implementation may be unsuccessful and wasteful. This study confirms the complexity of the process of diffusion of technology, especially in human service organizations. It is the result of dynamic interactions among technology, individuals, and organization; successful implementation efforts must consider the three levels simultaneously.

Communities may have more success with HMIS implementation if they provide custom implementation strategies for organizations. It may be useful to conduct preliminary organizational culture audits such as was done in this study to understand the unique strengths and challenges of each organization. Some organizations will show high levels of proficiency with low levels of resistance to changing work practices. Other organizations will show low levels of proficiency and high levels of resistance. The latter organizations may benefit from more intensive training and support than that provided to the former organizations.

The study also suggests that organizations should reconsider how they are using the HMIS. Those organizations that are using disproportionate data entry systems are creating significant burdens for individual staff members. Moreover, they are not entering client services in the real time. Instead, staff members maintain paper recordkeeping systems, and one or two staff members enter these paper records into an HMIS retroactively. Such a system prevents organizations from using the HMIS as a resource for care coordination. Data in the HMIS must be current so that case managers at different organizations can use the system as a source of information for past services and for current resources available when making decisions about future referrals.

In addition, the results suggest that organizational environments may be an area for intervention. Glisson et al. (2008) have designed an intervention called ARC (Availability, Responsibility, and Continuity) that aims to improve the culture and climate of human service organizations. The goal is to improve the overall functionality of organizations—reduce employee turnover rates, increase morale, and enhance functionality such as lower resistance and higher proficiency. Results of a national pilot study with this intervention show positive results.

Ultimately, it is essential to understand what organizational culture and technology mean for clients who are receiving housing services. Although the results from the current study are limited, they represent a small component of a larger system, which can be revealed through subsequent research. This study begins to show how organizational culture can affect service provision by demonstrating that one aspect of culture—proficiency—appears to change how men are beginning to use a this service technology among homeless-services providers.

The study has implications for social policy as well as for practice and research. The target of the study—HMIS use—stems from a federal HUD mandate, and much of its funding comes from federal grants. HUD policymakers can use the study's results to determine the degree to which the technology is being used and how organizational culture may affect access. This study begins to show that the homeless-services provider setting has a significant asset regarding HMIS use. In the sample, organizations showed higher than average levels of proficiency; they value competency and invite innovation if it improves client services. Staff members in proficient organizations

expect training that enables them to act knowledgeably and skillfully. Policymakers may consider providing more resources for technology training and for implementation, such as policy and procedure manuals. The study also indicated that HMIS are not being used to their full capacity yet, despite being introduced to homeless-services providers in 1999. This delay in use suggests that the implementation is a long-term process that will require continued support from HUD.

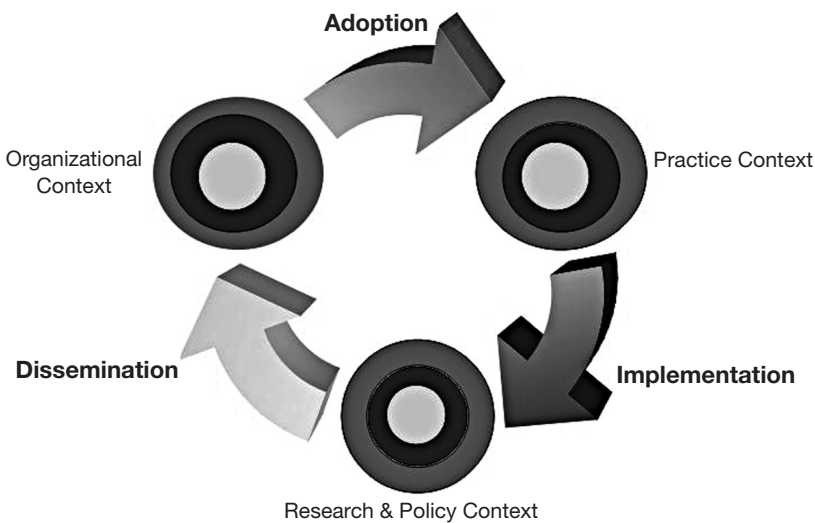
Somewhat related, the variability in use indicates that policymakers would benefit from funding more implementation research. It is problematic to begin using data from HMIS without understanding who is using the systems and how. If not all organizations are using the HMIS in their communities regularly, the data from these HMIS may underestimate homeless counts or present a biased view of the population's characteristics.

In summary, this study recommends to HUD and other homelessness policymakers that they continue their efforts to expand HMIS utilization among service providers. These efforts include providing funding and technical assistance to organizations using HMIS. The study also reveals that in many organizations, staff members still do not log on to their HMIS regularly, or they have designated HMIS use to only one staff member. In these organizations, staff members, and ultimately clients, are not able to benefit from HMIS's full capacity as a tool of service. In these organizations, staff members may be capturing client counts and demographics, but it is unlikely they are maintaining up-to-date counts or coordinating care with other providers when they access the HMIS only once a month or rely on one person's HMIS use.

Exhibit 4 provides a summary model of the dissemination process suggested in this study. It demonstrates how the spread and adoption of new technologies among organizations create a cyclical

Exhibit 4

Dissemination of Innovations Into Organizations



The dynamic, cyclical process by which innovations are designed, adopted, and implemented in organizations. As innovations are disseminated from the research and policy context into the organization, they may be changed according to the unique organizational context. Again, as staff members adopt the new innovations, they alter them to the daily work context. Finally, through implementation, research, and policy, members may decide to alter the original innovations based on evaluation and feedback from users.

process in which there is constant interplay between the organizational social context and the staff members in these organizations, the technology, and the research community that is creating these new tools. In fact, the software company that produces the HMIS software analyzed in this study, ServicePoint, is currently launching a new software version. The updated version will require organizations and staff members to learn and adapt to a new system.

Improving the software is just one aspect of technology diffusion that is necessary for organizations to implement HMIS fully. This study suggests that changing organizational culture and other aspects of the organizational social context may be critical to the long-term utility of HMIS. In addition, the technology may change the culture in ways that then necessitate a change in the technology again. It is a dynamic process that requires perpetual monitoring and maintenance. The efforts, however, may be well worth the benefits HMIS can confer to homeless-services providers and their clients. By providing streamlined care and accessing higher quality data, homeless-services providers will be able to better understand and predict the needs of people who are homeless.

This study has demonstrated that the HMIS is not being used to its full capacity and that substantial variability in use exists among service providers. Policymakers and practitioners using the HMIS as a tool to improve homeless services would benefit from encouraging an integrated and sustained use that is supported by ongoing technical and organizational assistance. Ideally, the system should be accessed regularly to record client services in the real time. Data should reflect accurately the clients served; policymakers and other service providers can then access the data. Use of tools such as ID cards would streamline client assessment procedures and facilitate care. Finally, the homeless-services providers can foster an organizational culture that supports technology use by encouraging proficiency among staff members. In the current environment of increasing technology and innovation, being proficient in the use of an information management system is critical to efficient and effective services for the homeless.

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