

Channels of Change: Contrasting Network Mechanisms in the Use of Interventions

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Abstract This study informs community science, and seeks to narrow the research-to-practice gap, by examining how the interpersonal networks within a setting influence individuals' use of interventions. More specifically, it explores the role of two network mechanisms—cohesion and structural similarity—in urban elementary school teachers' use of interventions designed to improve academic and behavioral outcomes for students. Lagged regression models examine how position in advice giving networks influenced weekly use of the daily report card and peer assisted learning by kindergarten through fourth grade teachers in three schools. Results indicate that intervention use spreads among teachers with similar patterns of advice-giving relationships (i.e., via structural similarity), rather than from teachers who are sources of advice (i.e., via cohesion). These results are consistent with findings in other settings, and suggest that researchers wishing to increase the use of an intervention should select change agents based on their patterns of their relationships, rather than on their direct connections.

Keywords Social networks · Diffusion · Implementation · Schools · Interventions

Introduction

The successful dissemination and implementation of community-based interventions is an issue of high importance to researchers interested in social change. Models and standards of prevention science have heavily emphasized a linear progression from efficacy trials under controlled conditions to effectiveness trials in the field, with more limited attention to processes of dissemination and implementation that occur after these trials have ended (e.g., Mrazek and Haggerty 1994; Flay et al. 2005). Critics argue that this inadequate emphasis on dissemination and implementation has led to a research-to-practice gap where evidence-based interventions articulated in university studies fail to translate into real-world use (Glasgow et al. 2003; Wandersman 2003).

Wandersman (2003) has urged community psychologists to address the research-to-practice gap through their contributions to the development of community science. Characterized by an interdisciplinary focus on community processes that influence intervention, community science seeks to “improve the quality of the practice of treatment, prevention, health promotion, and education” (Wandersman 2003, p. 236; Kloos 2005). Community science is informed by conceptual frameworks that highlight exposure, adoption, and implementation of interventions as distinct processes guided by different individual, organizational, and community level factors (Simpson 2002; Wandersman et al. 2008). The notion of interpersonal networks lurks just below the surface of many of the organizational characteristics (e.g., access to information, communication, staff cohesion)

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discussed as critical to the implementation of interventions, and indeed Luke (2005) recommends social network analysis as a promising method for examining the role of context in community science. Nonetheless, empirical research on the influence of interpersonal networks on the implementation phase of interventions remains underdeveloped.

This paper aims to advance community science by clarifying how the interpersonal networks present in a community can influence the use of interventions. In particular, we focus on intervention implementation in the context of schools, which are frequent targets of social change efforts in the area of children's well-being and mental health (e.g., Cappella et al. 2008; Flaspohler et al. 2006; Helm and Flaspohler 2008). Identifying how interpersonal networks shape diffusion processes will contribute to improved models of intervention implementation that fit the community context.

Theories of Diffusion

Diffusion theories from sociology suggest that the dissemination and implementation of community-based interventions occurs within existing interpersonal networks. Interpersonal networks are critical in facilitating the adoption of interventions because they provide an infrastructure for the exchange of ideas about, and reinforcement of, new practices (Dearing 2008; Rogers 1995; Strang and Soule 1998). Consider the example network illustrated in Fig. 1, which depicts advice-giving relationships among three individuals. Mapping the pattern of relationships in a community in this way, theories of diffusion seek to answer the question: Upon whose behavior does the behavior of the target individual depend? That is, does the target individual's use of an intervention depend on its use by person A, person B, or some combination of them? Two

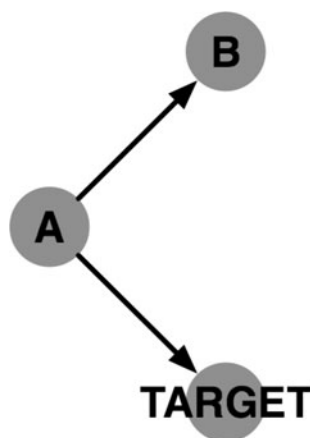


Fig. 1 Example network illustrating cohesion and structural similarity

theories of diffusion—cohesion and structural similarity—identify different mechanisms for behavior influence through networks and thus offer different answers (see Strang and Soule 1998; Friedkin 1998 for reviews).

The cohesion perspective on diffusion emphasizes connectivity between individuals in a setting. This is perhaps the most intuitive understanding of diffusion, suggesting that ideas, much like the common cold, pass from person to person through their direct (or short, indirect) ties to one another (Coleman et al. 1957, 1966; Marsden and Friedkin 1994; Friedkin 1993, 1998). This process may be driven by two related mechanisms. First, such linkages facilitate the brisk and directed flow of information, thus implying that interventions diffuse through a community along specific paths rather than at random. Second, because these linkages not only objectively reflect the transmission of information like telephone wires, but also reflect the subjective feelings that accompany interpersonal relationships, they provide social pressure toward uniformity in opinions and behavior. In the example network, the cohesion perspective suggests that the target individual's use of an intervention depends on the intervention's use by person A, who is a source of advice and social pressure.

While the cohesion perspective stresses connectivity, structural similarity focuses on individuals' roles within the setting, and suggests that ideas (e.g., about an intervention) spread among individuals who occupy the same or similar roles (Burt 1987; Friedkin 1993, 1998). Again, this process may be driven by two related mechanisms. First, individuals who occupy the same roles in a social setting are subject to common resource and normative contexts, and thus may seek to retain their status by adopting the same interventions as their potential competitors (competitive isomorphism: Hawley 1968; Burt 1987). Second, a cooperation mechanism may be at work, wherein individuals faced with uncertainty about what to do in a given situation look to others in similar situations for a solution (mimetic isomorphism: DiMaggio and Powell 1983). In the example network, the target individual and person B are viewed as occupying the same role because, while not directly connected to one another, they have the same pattern of relationships: both receive advice from person A. Such a pattern might be observed if the target individual and person B are both newcomers to the setting, and thus both occupy the role of 'advice receiver' rather than 'advice giver.' Thus, in this case, the structural similarity perspective suggests that the target individual's use of an intervention depends on the intervention's use by person B, who occupies a similar role and thus serves as a potential competitor to 'outdo' or a potential partner to imitate.

To summarize, the cohesion perspective predicts that the target individual's behavior depends on the behavior of person A, while the structural similarity perspective

predicts that it depends on the behavior of person B. Past research has simultaneously tested these competing predictions in the diffusion of medical innovations among doctors (Burt 1987), evaluations of non-profit organizations by corporate officers (Galaskiewicz and Burt 1991), and political ideologies among lobbyists (Heinz et al. 1993). Despite differences in these contexts, these studies have yielded surprisingly consistent results: diffusion processes are primarily influenced by mechanisms of structural similarity, not cohesion.

Seeking to reconcile this finding with the intuitive appeal of the cohesion perspective, Burt (1999) has suggested that diffusion unfolds as a two-step process. First, information is spread via cohesion, and later adoption and use is spread via structural similarity. Returning to the example network, this would suggest that the target individual learns of an intervention from person A, but decides to use the intervention from observing person B's behavior. Because spreading the use of interventions, and not merely information about them, is the heart of the research-to-practice gap, we focus on this second step in the process, but seek to extend prior findings from other contexts to the case of diffusion in schools.

The Case of Diffusion in Schools

This study focuses on the diffusion of use of new intervention practices in schools. Schools are significant settings in children's lives, and thus are often targets of social change efforts, especially in the area of children's mental health and well-being (Flaspohler et al. 2006; Helm and Flaspohler 2008). For children in poverty, schools may be particularly important venues for intervention because they provide access to, and have the potential to connect, other important settings in children's lives such as families and neighborhoods (Cappella et al. 2008; Boyd and Shouse 1997). Compared to traditional clinic-based interventions, placing mental health interventions in the context of schools improves children's access to services and is especially effective in reaching disadvantaged minority populations (Armbruster and Lichtman 1999; Atkins et al. 2003; Weist et al. 1999). However, the impact of school-based interventions on childhood outcomes depends, in part, upon variations in implementation (Rones and Hoagwood 2000). Thus, efforts to improve the effectiveness of school-based interventions demand attention to factors that facilitate or constrain use.

Some have argued that interpersonal networks are key forces in shaping teachers' normative values and opinions (e.g., Bidwell 2001; Bidwell and Yasamoto 1999; Friedkin 1993; Stevenson and Bartunek 1996), prompting exploration of how interpersonal networks influence the use of new practices in schools. For example, one series of studies

found that teachers' use of computers in the classroom was positively associated with their social capital, as measured by their frequency of contact with others who have expertise in computer use (Frank et al. 2004, Zhao and Frank 2003). Similarly, another study found that teachers' use of strategies for students with attention deficit and hyperactivity disorder (ADHD) was positively associated with the strategies' endorsement by other teachers identified as common sources of advice (Atkins et al. 2008a).

These studies recognized that influential teachers are critical for the use of new practices (i.e., computers, strategies for student with ADHD). But, what constitutes a teacher's influence in schools? To date, researchers have assumed a cohesion perspective that emphasizes teachers' connectivity with their colleagues as a driving force for diffusion. That is, teachers' connections to tech-savvy peers were linked to more computer use, and endorsements from teachers who provided the most advice to colleagues were linked to more use of strategies for students with ADHD. While these studies suggest that cohesion may be an important factor for diffusion in schools, they did not consider structural similarity as an alternative form of teacher influence. Research on diffusion in other contexts suggests that the effects of cohesion are minimal, especially after controlling for the effects of structural similarity (Burt 1987; Galaskiewicz and Burt 1991; Heinz et al. 1993). Thus, it is important to examine whether this finding—the importance of structural similarity over cohesion—extends to the context of schools.

Study Aims and Hypotheses

Broadly, this study informs community science by examining how the pattern of relationships within a setting influences individuals' use of interventions. More specifically, this study explores the role of network mechanisms in urban elementary school teachers' use of interventions designed to improve academic and behavioral outcomes for students. Informed by the literature on diffusion, we compare two hypotheses regarding the influence of networks on teachers' use of an intervention. The **Cohesion Hypothesis** predicts that teachers will use an intervention more frequently if it is used frequently by colleagues to whom they are connected. In contrast, the **Structural Similarity Hypothesis** predicts that teachers will use an intervention more frequently if it is used frequently by colleagues with whom they share similar patterns of relationships. By testing these hypotheses simultaneously, we can assess whether cohesion, structural similarity, or a combination facilitates intervention use in schools. Consistent with prior research in non-school contexts, we anticipate that we will find support for the **Structural Similarity Hypothesis**, but not the **Cohesion Hypothesis**.

Method

The Intervention

Data for the current study were collected within the context of a school-based intervention trial, *Links to Learning* (Atkins et al. 2008b). This trial compares the effectiveness of an experimental, school-based model and a comparison, clinic-based model of mental health service delivery for urban children in kindergarten through fourth grade with disruptive behavior disorders (Cappella et al. 2008; Neal et al. 2008). The school-based model seeks to unite mental health providers, teachers, and parents around the goal of improving children's learning and behavior. A key component of this model is consultation to teachers in three experimental schools, initiated with a professional development series about effective instructional practices, classroom management, and family outreach. This study focuses on two intervention strategies introduced through the professional development series—the daily report card and peer-assisted learning—to examine the influence of teacher advice networks on their frequency of use during the baseline year of the trial.¹ Examining teachers' use of these two strategies allows us to determine whether network influences differ for interventions with varying content and at different levels (i.e., targeted versus class-wide).

Daily Report Card

The daily report card is a targeted intervention strategy aimed at increasing family outreach by facilitating exchange between teachers and families around targeted goals regarding student academic performance and classroom behavior (Kelley 1990). Although there are many variations on this strategy, in *Links to Learning*, teachers were encouraged to reward students' progress toward their individualized academic and behavioral goals and to communicate progress with family members by sending the daily report card home with students. Research suggests that the daily report card can be effective in improving behavior and academic functioning (see Barth 1979; Kelley 1990 for reviews), but because consistent implementation is often challenging for teachers to maintain, identifying indigenous facilitators within the school setting is important (Owens et al. 2005).

¹ *Links to Learning* introduced two additional intervention strategies to classroom teachers: the Good Behavior Game and the Good News Note. The Good Behavior Game was not included in the current study because Links to Learning research staff played an extensive role in introducing and supporting its use in teachers' classrooms, thus contaminating teachers' implementation. The Good News Note was not included in current study due to its low rate of adoption and use by teachers during the study period.

Peer-Assisted Learning

Peer-assisted learning is a class-wide intervention strategy aimed at improving academic outcomes and social skills through the use of peer-mediated instruction in classrooms (e.g., Fuchs and Fuchs 2005; Ginsburg-Block et al. 2006). Peer-assisted learning is especially relevant in classrooms where student instructional levels deviate widely from grade level because it provides struggling students with increased opportunities for learning. In *Links to Learning*, teachers were encouraged to use peer-assisted learning during reading instruction. Specifically, teachers paired students according to reading fluency, such that the stronger reader in each pair assumed the role of "tutor" and the pair used reading material appropriate to the instructional level of the "tutee". Student pairs received points for their participation that were exchanged for small rewards at the end of the activity. Recent meta-analyses demonstrate that peer-assisted learning strategies improve academic outcomes (Rohrbeck et al. 2003) and social outcomes (Ginsburg-Block et al. 2006), especially for low-income, urban, and minority populations.

Setting and Participants

The setting for this research included three kindergarten through eighth grade Chicago Public Elementary schools participating in the first year of the *Links to Learning* study. All three schools received the experimental, school-based model. Participating schools were randomly selected from the 43 schools meeting initial eligibility criteria: (1) location in one of three high poverty regions on the west or south side of Chicago (2) school enrollment that fell within one standard deviation of the district mean ($M = 606$, $SD = 206$) (3) average reading scores that fell below the 35th percentile on statewide standardized tests (4) student mobility rates that fell below 40% (4) at least 85% African American students (5) at least 85% low income students and (6) within a three mile radius of participating community mental health agencies.

The primary analyses in this paper focus on 29 kindergarten through fourth grade teachers targeted by the *Links to Learning* school-based model of mental health service delivery. These 29 teachers were spread fairly evenly across the three intervention schools ($\chi^2(2, N = 29) < 1$, ns) and grade ($\chi^2(5, N = 29) = 4.72$, ns). Demographic information is included in Table 1.

Procedure

In January 2007, prior to the introduction of the daily report card and peer-assisted learning strategies in each school, self-reported data on social networks were

Table 1 Teacher demographic characteristics ($N = 29$)

Variable	N (%)
School	
1	11 (37.93)
2	8 (27.59)
3	10 (34.48)
Grade	
Kindergarten	6 (20.69)
1st grade	6 (20.69)
2nd grade	5 (17.24)
3rd grade	7 (24.14)
4th grade	4 (13.79)
Special education	1 (3.45)
Sex	
Female	26 (89.66%)
Male	3 (10.34%)
Race	
African American	17 (58.62%)
White	12 (41.38%)
Variable	Median
Years teaching experience	
Total	12
At present school	7

collected from all classroom (pre-kindergarten-eighth grade) and ancillary teachers in each of the three participating schools ($N = 28$, $N = 31$, $N = 28$). Although fifth through eighth grade and ancillary teachers were not a primary focus of this study, they were included in the measurement of social networks because they may have relationships with kindergarten through fourth grade teachers that are critical for the accurate measurement of structural similarity. Research staff collected network data in 10–15 min interviews with each teacher. During the interviews, they asked teachers to identify the teachers in their school with whom they socialized and from whom they received advice in three different areas: behavior management, involving families, and instructional methods. This study used network data generated from the questions about family involvement and instructional method advice, the two areas most relevant to the interventions strategies tested.

Between January and April 2007, teachers were introduced to intervention strategies, including the daily report card and peer-assisted learning, through a professional development series at their school (see Neal et al. 2008 for more details). The professional development session was well-attended by the kindergarten through fourth grade teachers participating in the *Links to Learning* intervention ($N = 29$), with 86.2% attending at least one introductory or

review session on the daily report card and 79.3% attending at least one introductory or review session on peer assisted learning.² Between February and June 2007, these targeted kindergarten through fourth grade teachers used monthly calendars to log the days on which they used the daily report card and peer-assisted learning.

Measures

Frequency of Use of Classroom-Based Strategies

Frequency of use, F_{tsw} , is measured as the number of times teacher t reported using strategy s in week w . The measure ranges from 0 (i.e., a teacher did not report using the strategy) to 5 (i.e., a teacher reported using the strategy daily). This measure was computed for each week after the strategy was introduced through the professional development series in each teacher's school. This yields 355 observations (i.e., one per teacher, per week) observations for the daily report card, and 225 observations for peer-assisted learning, which was introduced later.

Social Networks

To determine whether teachers sought advice on family involvement and instructional methods from the same colleagues, we compared these advice networks within school by calculating Jaccard similarity coefficients using UCINET 6 (Borgatti et al. 2002). Jaccard similarity coefficients indicate proportion of present relationships that are the same across two networks, and thus provide a measure of their similarity that ranges from 0 to 1 (Cheetham and Hazel 1969). Results revealed only modest overlap between the two networks, with Jaccard coefficients ranging from .28 to .36. These results indicate that only about one-third of the advice-giving relationships present in one network were also present in the other. Because these findings suggest that the two advice-giving networks are distinct, we use the network of advice about family involvement when examining the spread of use of the daily report card strategy, which focuses on keeping families informed about students' academic performance and classroom behavior. Similarly, we use the network of advice about instructional methods when examining the spread of peer-assisted learning, which focuses on improving academic outcomes, and specifically

² These attendance rates demonstrate that information about the daily report card and peer assisted learning strategies were conveyed to the majority of teachers at the same time. In this case, because there was an effective formal mechanism for delivering information about each strategy, the influence of interpersonal networks on information delivery was largely irrelevant (Step 1 of Burt's (1999) model). Thus, this study focuses only on the influence of interpersonal networks on strategy use (Step 2 of Burt's (1999) model).

in the case of the *Links to Learning* intervention, reading proficiency outcomes.

Cohesion Expected Use

If strategy use spreads via cohesion, the frequency of a teacher's use of the strategy depends upon the frequency of its use by colleagues from whom the teacher receives advice. Thus, a teacher t 's expected frequency of use as implied by a cohesion view of diffusion, COH_{tsw} , is measured as the mean frequency of use of strategy s in week w by those from whom teacher t receives advice.³

Structural Similarity Expected Use

Conversely, if strategy use spreads via structural similarity, the frequency of a teacher's use of the strategy depends upon the frequency of its use by colleagues who have similar advice-giving relationships. Thus, teacher t 's expected frequency of use as implied by a structural similarity view of diffusion, SS_{tsw} , is measured as the mean frequency of use of strategy s in week w by the three colleagues who have the greatest number of relationships in common with teacher t .

In essence, based on the diffusion processes described above, these two measures of expected use (COH_{tsw} and SS_{tsw}) each identify a group of colleagues that potentially influence a teacher's use of a strategy. The colleague group defined by COH_{tsw} includes those who give the teacher advice (i.e., sources of information and social pressure), while the colleague group defined by SS_{tsw} includes those who share similar patterns of advice-giving (i.e., occupants of similar roles in the setting). In each case, these measures are defined as the average use of the strategy by members of these potentially influential colleague groups, thus reflecting the normative pressure exerted by the group on a teacher. If cohesion drives use, then a teacher's actual frequency of use (F_{tsw}) will be positively associated with the frequency of use of his/her cohesion-based colleague group (COH_{tsw}). However, if structural similarity drives use, a teacher's actual frequency of use (F_{tsw}) will be positively associated with the frequency of use of his/her structural similarity-based colleague group (SS_{tsw}).

Results

To test the cohesion and structural similarity hypotheses, we estimate the following fixed-effects regression equation

³ Only frequencies of use of advice-givers are counted in the calculation of COH_{tsw} because information and social pressure are expected to travel in one direction from advice-giver to advice-receiver.

predicting teachers' frequency of use (F), separately for the daily report card and peer-assisted learning strategies:

$$F_{tsw} = D_1 + D_2 + \dots + D_t + COH_{tsw} + COH_{tsw-1} + SS_{tsw} + SS_{tsw-1} + \varepsilon \quad (1)$$

A fixed-effects model estimates a unique intercept for each teacher using a series of 29 dummy variables (D), where D_t is equal to 1 for teacher t and is 0 otherwise. This approach controls for bias introduced because observations of the same teacher are repeated over time, but also has the advantage of controlling for all time-stable teacher characteristics such as age, race, or sex, as well as site characteristics like school size and climate (Gujarati 2003). The estimates of these 29 teacher-specific intercepts, though not relevant to our hypotheses and thus not reported below, capture each teacher's individual average propensity to use the intervention (i.e., the 'fixed-effect' of being a particular person). This model yields similar results to an analogous random-effects model, also sometimes called a mixed-model or hierarchical linear model, but does not make assumptions about the distribution of the teacher-specific intercepts.

The variables measuring cohesion-based and structural similarity-based expected frequencies of use are included both contemporaneously (COH_{tsw} and SS_{tsw}) and with a one-week lag (COH_{tsw-1} and SS_{tsw-1}). This acknowledges that a teacher's behavior in a given week may be influenced by the behavior of colleagues in the same week, but also by colleagues' past behavior. Descriptive statistics are presented in Table 2; coefficient estimates and standard errors are reported in Table 3.

We found no support for the cohesion hypothesis. In models predicting teachers' use of both the daily report card and peer assisted learning strategies, coefficients for COH_{tsw} (contemporaneous) and COH_{tsw-1} (one-week lag) were not significant. This indicates that, after controlling for the influence of a teacher's structurally similar colleagues and individual propensities to use a strategy, the use of a strategy by a teacher's advice-givers did not affect the teacher's own use.

In the case of the daily report card, the coefficients for SS_{tsw} (contemporaneous) and SS_{tsw-1} (one-week lag) are

Table 2 Descriptive statistics for observed frequency of use, cohesion-based expectations of use, and structural similarity-based expectations of use

Variable	Daily report card ($N = 355$)	Peer assisted learning ($N = 225$)
	M (SD)	M (SD)
Frequency	.58 (1.43)	.82 (1.45)
COH	.32 (.63)	.62 (.93)
SS	.44 (1.26)	.65 (1.25)

Table 3 Influence of cohesion-based and structural similarity-based expectations of frequency of use on observed frequency of use

Variable	Daily report card (<i>N</i> = 355)	Peer assisted learning (<i>N</i> = 225)
	B (SE)	B (SE)
COH	−.082 (.101)	.061 (.118)
COH (lagged)	−.184 (.102)	−.036 (.132)
SS	.265 (.059)**	.240 (.096)*
SS (lagged)	.240 (.060)**	.186 (.123)
R ²	.66	.72

Estimates of the 29 teacher-specific dummies (i.e., fixed-effects) are omitted

* $p < .05$, ** $p < .01$

statistically significant, which indicates support for the structural similarity hypothesis. That is, use of this strategy by a teacher's structurally similar colleagues is positively associated with the teacher's own use. Interpreting the magnitude of these coefficients involves examining the contemporaneous effect alone (i.e., the short-run effect) and the sum of the contemporaneous and lagged effects (i.e., the long-run effect). When the average use of the daily report card by a teacher's structurally similar colleagues increases by one, the teacher is expected to use it an additional .265 times *in the same week* ($B = .265$, $se = .059$, $p < .01$). This 'short-run' effect identifies the immediate effect of a teacher's structurally similar colleagues' use on the teacher's own use.

However, the statistical significance of the coefficient for SS_{tsw-1} indicates that a teacher's structurally similar colleagues' use of the daily report card also has a lingering or 'lagged' effect, which influences the teacher's use in the following week as well ($B = .240$, $se = .06$, $p < .01$). Summing the contemporaneous and lagged influences captures the total or 'long-run' effect of these colleagues use on the teacher's own use ($B = .505$, $F_{2,322} = 37.92$, $p < .01$). This long-run effect suggests that when the average use of the daily report card by a teacher's structurally similar colleagues increases by one, the teacher is expected to use it an additional .505 times *in the current or following week*. To place this value in context, if a teacher's colleagues used this strategy daily (e.g., five times) in a given week, we would expect that the teacher to use the strategy an additional 2.5 times within the next 2 weeks.

A similar picture emerges for the peer-assisted learning strategy. The short-run effect indicates that when the average use of this strategy by a teacher's structurally similar colleagues increases by one, the teacher is expected to use it an additional .240 times *in the same week* ($B = .240$, $se = .096$, $p < .05$). While the lagged effect alone is not significant ($B = .186$, $se = .123$, $p = .13$), the

long-run effect is significant and has a similar magnitude to that observed for the daily report card above ($B = .426$, $F_{2,192} = 5.22$, $p < .01$). Thus, again, if a teacher's colleagues used peer-assisted learning daily (e.g., five times) in a given week, we would expect that the teacher to use the strategy an additional 2.1 times within the next 2 weeks.

Discussion

Contrary to theories of diffusion that emphasize cohesion, teachers were not more likely to use the daily report card or peer-assisted learning more frequently if these strategies were used frequently by colleagues from whom they receive advice. However, consistent with theories of diffusion that emphasize structural similarity, teachers used the daily report card or peer-assisted learning more frequently if these strategies were used frequently by colleagues with whom they shared similar patterns of advice giving relationships. Moreover, structurally similar colleagues' frequency of use had not only an immediate (i.e., short-run) positive influence on teachers' frequency of use, but also a lingering (i.e., lagged by one-week) influence, which together yielded a cumulative (i.e., long-run) influence that dramatically increased teacher's use of these intervention strategies. The short-run and long-run effects of structurally similar colleagues use on a teacher's own use were similar in magnitude for the daily report card and peer-assisted learning, despite differences in strategy content and level of intervention (i.e., targeted versus class-wide).

These results are consistent with prior findings obtained in very different settings among different participants, including doctors (Burt 1987), corporate officers (Galaskiewicz and Burt 1991), and lobbyists (Heinz et al. 1993). That is, the spread of the use of family involvement and instructional intervention strategies in schools by teachers is driven by similar processes to the spread of other types of interventions, in other types of settings, by other types of change agents. This suggests that the two-step process of diffusion whereby intervention use spreads via structural similarity (Burt 1999) is a generic process that cuts across differences in setting and context.

The notion of 'structural similarity' is a potentially abstract concept when it comes to identifying influential change agents. However, while structural similarity formally describes two individuals with similar patterns of relationships, substantively this concept identifies individuals who occupy similar roles in a setting. Returning to the example network in Fig. 1, the target individual and person B might be viewed as occupying the same role because they both receive advice from person A. Person A, in

contrast, occupies a different role because he or she gives advice to the target individual and person B. These results suggest that intervention use is spread among, and encouraged by, such structurally role-based groups: the advice receivers (target and B) influence one another.

Implications for Intervention

A research-to-practice gap has posed challenges for interventionists interested in encouraging social change in communities (Wandersman 2003; Wandersman et al. 2008). In part, this gap can be attributed to a limited understanding of the channels through which interventions are disseminated. This study advances this understanding by exploring how interpersonal networks influence intervention use. Results may help narrow the research-to-practice gap by informing interventionists' selection of more effective and efficient community-based change agents to aid in the implementation process.

Community psychologists and others have highlighted the promise of key opinion leader models of diffusion that identify influential individuals in the community and enlist them to persuade others to adopt and use new practices (e.g., Rogers 1995; Valente et al. 2003; Valente 1995). These models are particularly relevant in schools, where the implementation of interventions are challenged by limited resources, multiple stressors, and teachers' suspicion toward outsiders (Atkins et al. 2008a, b, 2006; Boyd and Shouse 1997; Neal et al. 2008). Given the importance of network mechanisms for intervention implementation, it is critical that key opinion leaders are selected based on their position within empirically measured social networks.

Often models of selecting key opinion leaders based on network position rely on the logic of a cohesion theory of diffusion, focusing on those individuals who have the highest number of nominations (e.g., as advice givers) by their peers. If cohesion helps spread information about interventions, selecting key opinion leaders in this manner may help increase awareness. However, the results of this and prior studies imply that such key opinion leaders may have little influence over actual intervention use, and thus cannot help to close the research-to-practice gap. These models may be more effective if they reflect a two-step process (Burt 1999). First, some key opinion leaders, selected based on their direct connections to others, spread information about the intervention (i.e., diffusion via cohesion). In Fig. 1, this might involve enlisting person A to ensure that the target individual is aware of the intervention. Second, potentially different key opinion leaders, selected based on their patterns of connections to others, encourage use of the intervention (i.e., diffusion via structural similarity). In Fig. 1, this might involve enlisting

person B to encourage intervention use by the target individual.

Limitations, Future Research, and Conclusions

Although this study builds on existing theories of diffusion and empirical research by examining how teachers' interpersonal networks influence the implementation of school-based interventions, findings must be interpreted within the context of the limitations of the research design. First, there are potential concerns that the small sample of urban teachers and schools may limit the generalizability of the results. However, these concerns are mitigated because results mirror those found in drastically different populations and settings (Burt 1987, Galaskiewicz and Burt 1991, Heinz et al. 1993). Second, although the current study provides information about the network mechanisms driving teachers' frequency of use of intervention strategies, it provides limited information about the influence of network mechanisms on how teachers use these strategies. Future research is needed to determine whether the influence of structural similarity generalizes beyond frequency of use to other aspects of intervention implementation such as the quality of use. Third, because the self-reported measures used in the current study may be prone to errors of recall or self-presentation bias, future studies should replicate findings using alternative reports of use (e.g., behavioral observations; behavior trace methods). Finally, this study measured interpersonal networks at one time point, treating them as static. However, in reality, networks are dynamic, with relational ties developing and dissolving over time. Future research should examine the stability of networks over time. Specifically, what contextual factors might influence the formation, maintenance, and dissolution of ties, and how might these contextual factors influence implementation processes? Do implementation processes operate differently in settings with stable interpersonal networks (e.g., schools with low teacher turnover) and settings where relationships are constantly in flux (e.g., schools with high teacher turnover)?

Building a field of community science requires researchers to look at the aspects of settings that shape intervention practice (Wandersman 2003). Heeding this call, this study explored how interpersonal networks within a setting can serve as channels of change by facilitating the use of intervention strategies. Results highlight the importance of structural similarity in the diffusion of interventions. Namely, individuals look to others in similar network roles to guide their use of new intervention strategies. This finding can help community psychologists develop better strategies for effectively and efficiently diffusing interventions (e.g., key opinion leader models),

and can serve as a foundation for future research on how networks inform intervention processes.

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