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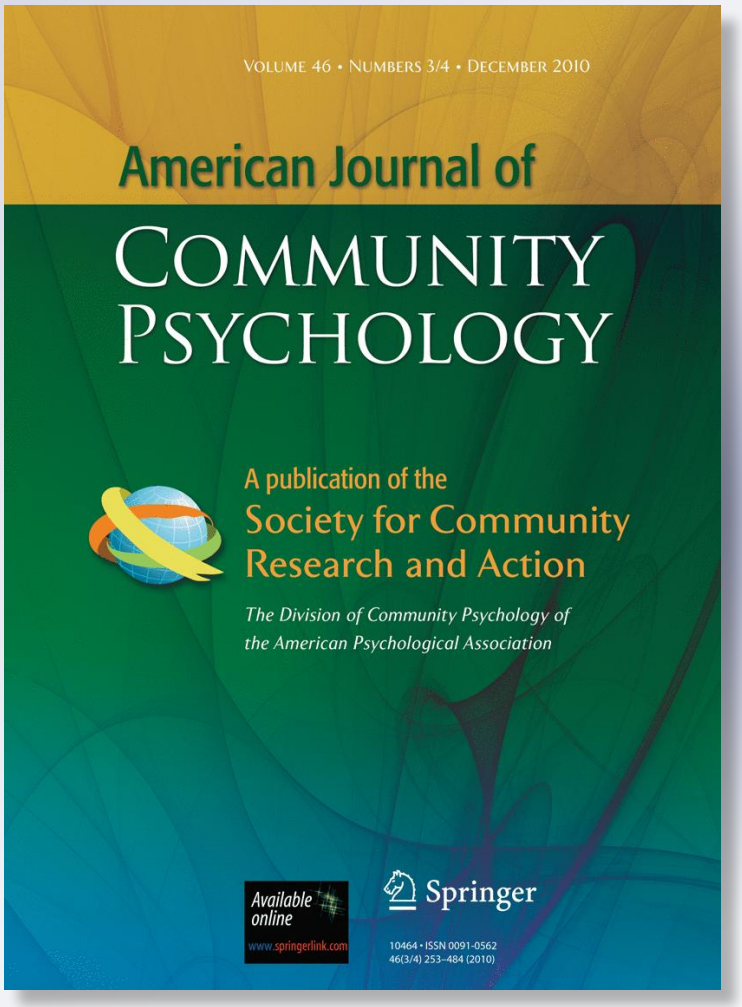

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ORIGINAL PAPER

Using Ecological Theory to Evaluate the Effectiveness of an Indigenous Community Intervention: A Study of Sexual Assault Nurse Examiner (SANE) Programs

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Abstract In recent years, there has been renewed interest among community psychologists in indigenous interventions, which are programs created by local practitioners (rather than researchers) already rooted in their communities. Indigenous interventions have strong ecological validity, but their effectiveness is often unknown because so few are rigorously evaluated. The goal of this project was to use Kelly and Trickett's ecological theory as a conceptual framework for evaluating an indigenous intervention and its mediating mechanisms of effectiveness. The focal intervention was a midwestern Sexual Assault Nurse Examiner (SANE) program, which provides post-assault medical care, crisis intervention, and medical forensic exams for sexual assault survivors. Prior studies of SANE programs have suggested that these interventions may help increase sexual assault prosecution rates. In this case example, we used a mixed methods design to determine if this program contributed to increased prosecution rates, and if so, why. Based on qualitative interviews with key stakeholders, we found substantial evidence for the Principle of Interdependence such that the SANE program strengthened the interconnections between the legal and medical systems, which contributed to increased prosecution. The intervention was effective in these outcomes because it promoted Cycling of Resources throughout the systems and fostered Adaptation of new roles for legal and medical personnel. Moving beyond this specific case example, this paper also examines cross-cutting advantages and struggles of using an ecological approach in the evaluation of indigenous community interventions.

Keywords Ecological theory · Intervention evaluation · Sexual assault · Rape · Sexual Assault Nurse Examiner

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In his 1971 paper "The Quest for Valid Preventive Interventions," Kelly noted that:

> Social change is not a consequence of discrete man-made interventions, but rather the change that occurs as a result of the evolution of the functions in a society. The goal for community development is to create opportunities for a community to plan its own change (reprinted in Kelly 2006, pg. 83).

Validity must be viewed ecologically—interventions that have no roots in the community have little-to-no hope of long-term sustainability (at best) or positive impact (at worst). Kelly emphasized that communities know their needs and continually develop their own solutions to address their needs. Fast forward thirty years to the well-documented and much-lamented "science-practice gap:" researcher-instigated interventions are not routinely implemented in community practice (see Glasgow et al. 2003; Kazdin 2008; Wandersman 2003; Wandersman and Florin 2003 for reviews). What can be done to close this gap and create wide-spread evidence-based practice? Miller and Shinn (2005) encouraged close scrutiny of this question because "in many fields, the success of evidence-based practices pales in comparison to what individuals and communities have accomplished on their own" (p. 174). This pro-innovation bias privileges evidence-based practices and their presumed benefits over indigenous practices

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that have not been studied and indeed may prove effective if studied (Mayer and Davidson 2000; Rogers 2003). Instead, Green (2001, 2006) challenged us to ask: What can we learn from "practice-based evidence?" What can researchers learn from practitioners and the wisdom they accumulate working with their communities over time? As Kelly noted decades ago, communities create their own change and the quest for valid interventions must start in the community.

Pursuing this idea of practice-based evidence, Miller and Shinn (2005) advocated for "learning from communities" by studying indigenous interventions: programs created by local practitioners already rooted in their communities. Indigenous interventions have strong ecological validity as such programs are already congruent with the values of the communities (at least in some sectors) and are typically manageable for the setting to operate—two features that many researcher-initiated interventions often struggle to achieve (Castro et al. 2004; Glasgow et al. 2003). But, the key concern about indigenous interventions has been their effectiveness; as Miller and Shinn (2005) noted: "local origins are no guarantee of program success and local values may sometimes merit change" (p. 180). Therefore, Miller and Shinn argued that: "community psychologists should identify promising programs that are already functioning in communities, study them to determine their effectiveness, and disseminate those that work" (p. 176).

In these collaborative evaluation projects, it is important to identify not only whether an intervention is effective, but also how and why it is successful. Kazdin (2008) noted that intervention research has not has not paid nearly enough attention to understanding the mediating mechanisms by which programs work. This is unfortunate because understanding how, why, and under what circumstances interventions produce desired effects helps identify critical ingredients of change. That kind of information may be even more impactful as it promotes the adoption of "evidence-based *mechanisms*" (Kazdin 2008, emphases original) and the dissemination of "powerful ideas" (Miller and Shinn 2005) rather than packaged interventions that may or may not fit with local context.

In a quest for valid interventions, studying indigenous interventions and their underlying mechanisms of impact is a worthy ecological expedition (Kelly 1999, 2006). Kelly and Trickett's ecological framework is perhaps best known for its guidance on the *process* of community research (Kelly 1966, 1968, 1971, 1979; Trickett et al. 1985), but recently Espino and Trickett (2008) reminded the field that the ecological analogy "carrie[s] with it a spirit *as well as set of specified goals*" (p. 60, emphasis added). Of particular interest for the evaluation of interventions, this theory offers a framework for pursuing more nuanced conceptualizations of effectiveness (see Bond and Pyle 1998). Kelly's (1968) original four ecological principles—Interdependence, Cycling of Resources, Adaptation, and Succession—can be useful sensitizing concepts to guide the assessment of an intervention's effectiveness. Building on these ideas, this paper presents an evaluation of an indigenous intervention in which we used an ecological framework to uncover mediating mechanisms. We will begin with a brief overview of the intervention itself and then a description of how Kelly and Trickett's model shaped the evaluation.

Intervention Context

What is the Problem This Intervention Seeks to Address?

Sexual assault is a pervasive social problem that has been linked to multiple long-term negative outcomes, such as psychological distress, repeated sexual victimization, physical health problems, and difficulties in life functioning (Campbell et al. 2009; Koss et al. 2003). When rape survivors seek community help after an assault, they are most likely to be directed to the medical system, specifically hospital emergency departments (ED; Resnick et al. 2000). Although most victims are not physically injured to the point of needing emergency health care (Ledray 1996), survivors are sent to the hospital anyway, primarily for forensic evidence collection (Martin 2005). The survivor's body is a crime scene and due to the invasive nature of sexual assault, a medical professional, rather than a crime scene technician, is needed to collect the evidence. The "rape exam" or "rape kit" usually involves plucking head and pubic hairs; collecting loose hairs by combing the head and pubis; swabbing the vagina, anus, and/or mouth to collect semen, blood, or saliva; and obtaining fingernail clippings and scrapings in the event the victim scratched the assailant. Blood samples may also be collected for DNA, toxicology, and ethanol testing (Martin 2005).

For decades, both researchers and rape victim advocates have noted numerous problems with this hospital ED-based approach to post-assault care (Campbell 2008; Campbell and Bybee 1997; Campbell and Martin 2001; Martin 2005). Many ED physicians are reluctant to perform the rape exam, which results in long wait times for survivors, who spend on average four to 10 hours in the ED before they are examined (Littel 2001; Martin 2005). During this wait, victims are not allowed to eat, drink, or urinate so as not to destroy physical evidence of the assault (Littel 2001; Taylor 2002). Most ED personnel lack training specifically in forensic evidence collection, and as a result, many rape kits collected by ED doctors are done incorrectly and/or

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incompletely. Even ED physicians with forensic training usually do not perform forensic exams frequently enough to maintain their proficiency (Littel 2001). In addition to these problems with evidence quality, many rape victims are not offered emergency contraception or preventive antibiotics to treat any sexually transmitted diseases that may have been contracted through the assault (Campbell 2008). As a result of their contact with ED doctors and nurses, most rape survivors leave the hospital feeling more depressed, anxious, blamed, and reluctant to seek further help (Campbell 2005, 2006; Campbell et al. 2001; Campbell and Raja 1999, 2005; Campbell et al. 1999).

If victims try to pursue criminal prosecution, their experiences with the legal system are not markedly better. Only 14–18% of all reported sexual assaults are successfully prosecuted (see Campbell 2008 and Spohn 2008 for reviews). Medical forensic evidence could be instrumental in getting more cases prosecuted because injury and DNA evidence can carry substantial weight with legal system personnel (Spohn et al. 2001) but due to lack of communication and coordination between the legal and medical systems, police and prosecutors rarely receive medical evidence exam findings in time to affect the outcome of a case (Human Rights Watch 2009). And, as already noted, the quality of hospital ED exams is mixed at best, so even when legal personnel receive the medical report (which could take weeks or months), the information therein may be of limited value to the case. In the worst-case scenario (which is not atypical), rape survivors endure an invasive, traumatizing medical exam that has no bearing on their legal case.

What Are the Defining Elements of the Intervention?

For many years, there has been wide-spread agreement among community practitioners that a new approach to post-assault care is needed, one that would attend to victims' forensic legal issues as well as their psychological and medical needs. In response, the nursing profession created Sexual Assault Nurse Examiner (SANE) Programs (Ledray 1999; Littel 2001). SANE programs were created by front-line nurses and grounded in their day-to-day experiences and frustrations with traditional hospital ED care. In these programs, specially trained nurses, rather than doctors, provide 24-h care to sexual assault victims in either hospital or non-hospital clinic settings (see Campbell et al. 2005 for a review). Many SANE programs work with their local rape crisis centers so that rape victim advocates can also be present for the exam to provide crisis intervention and emotional support. For victims' physical health needs, SANE programs also routinely offer emergency contraception and prophylactic antibiotics for STDs. With respect to the forensic evidence collection itself, SANEs conduct a comprehensive head-to-toe examination of the survivor's body to check, document, and treat any injuries. Most SANE programs utilize specialized forensic equipment that is not often used in traditional hospital EDs, such as a colposcope, which allows for the detection of anogenital microlacerations, bruises, and other injuries. The forensic evidence collected by the SANEs is typically sent to the state crime lab for analysis and the results are forwarded to the police and prosecutors. If a case is prosecuted, the SANE may provide expert witness testimony in the trial to explain the medical forensic findings to the judge or jury.

What Do We Know About the Effectiveness of this Intervention?

This intervention model spread quite quickly, growing from a handful of SANE programs in the 1970s and 1980s to nearly 500 programs currently in existence (IAFN 2008). This diffusion occurred despite *very* minimal evaluative data on the effectiveness of SANE programs, as is often the case with indigenous interventions (Miller 2001; Miller and Shinn 2005). Because the work of SANE programs is multi-faceted, addressing psychological, medical, and legal concerns, defining and measuring "success" or "effectiveness" of this intervention is complex. There is debate within the SANE nursing community regarding the extent to which patient care outcomes (e.g., psychological and medical care) should have primacy over legal outcomes (e.g., the extent to which the medical forensic evidence provided by the SANEs contributes to successful prosecution; see Campbell et al. 2005a, b for a review). This debate notwithstanding, the few empirical studies that have examined the effectiveness of SANE programs have mostly focused on legal outcomes (see Campbell et al. 2008 for exceptions). Several case studies have found that SANE programs increase arrest and prosecution rates because the quality of the forensic evidence provided by the nurses is so compelling to judges and juries (see Littel 2001 for reviews). Only *one* study had used a quasi-experimental pre-post design to determine whether the implementation of a SANE program can lead to increased prosecution. In that project, Crandall and Helitzer (2003) found that post-SANE, rates of successful prosecutions significantly increased. Such findings are very promising, but merit replication to determine whether such successes can be duplicated in other community contexts. Furthermore, it is important to understand *why* there may be positive changes in the legal system as a result of this intervention. How and why does an intervention in the medical system cross-over to challenge the long-standing pattern of under-prosecution in the legal system?

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Ecological Theory and Intervention Evaluation

Kelly and Trickett's ecological analogy provides a useful model for exploring mediating mechanisms of effectiveness because of its focus on resource definition and utilization within settings:

> To think ecologically is to consider how persons, settings, and events can become resources for the positive development of communities; to consider how these resources can be managed and conserved; and to approach research so that the effort expended will be helpful to the preservation and enhancement of community resources (Trickett et al. 1985; pp. 283–284).

"Persons" are those who control access to the setting and key opinion leaders within a system whose views and opinions are highly valued and influential to other stakeholders. In SANE programs, the forensic nurses are the key persons—they are well-trained and highly knowledgeable about how to work with survivors, how to collect medical forensic evidence, and how to explain the significance of that evidence to police, prosecutors, judges, and juries. "Settings" include both existing formal and informal places in which persons come together, as well as potential settings that may be created by stakeholders within the system for other interactions. The SANE program, whether housed in a hospital or community clinic, becomes a setting for survivors to receive care, but also a place for interactions between members of the legal and medical communities. Police bring survivors to the program for their exams, and return to pick up the evidence and consult with the nurses about the findings. "Events" refer to planned and unplanned opportunities that bring together persons and settings. Trials are events that bring together the nurses, police, prosecutors, and survivors. In addition, many SANE programs offer trainings for the legal community on sexual assault medical forensic evidence to educate and open up lines of communication between the systems.

Ecological theory suggests that interventions' effectiveness hinges on how persons, settings, and events are offered as new resources, tools for re-purposing existing resources, and/or means for altering the flow of resources. The ecological principles introduced by Kelly (1968) and then expanded upon with Trickett et al. (1985) can be used to guide an assessment of systemic resource flow. First, the Principle of Interdependence states that components within a social system are interdependent and changes in one component of a system will produce changes in another. Because there may be expected and unexpected changes, evaluation outcome assessments must be conducted not only with the target population or setting, but also with extended persons/settings who have direct or secondary contact with those targets. In the context of this project, the Interdependence Principle suggests that although many SANE programs do not have a stated goal of increasing prosecution rates (because their emphasis is first and foremost on patient care), we should in fact look for positive cross-system impact. For a case to be prosecuted, it is undoubtedly helpful if there is medical forensic evidence, which makes the legal system dependent upon the medical system. To conduct a medical forensic exam, medical personnel must establish trust and rapport with the survivor, which makes both systems dependent upon the survivor and the information she chooses to share. In the end, a strong legal case can emerge only through the joint efforts of the survivor, medical personnel, and law enforcement. This interdependence means that evaluations must capture the perspectives of all major stakeholders, not just immediate program staff.

Second, the Principle of Cycling Resources stipulates that systems can be understood by examining how resources are defined, used, created, conserved, transformed, and recycled. Before attempting to intervene by adding new resources into a system, we need to understand existing resources and explore potential for re-distribution of existing resources. In intervention evaluations, resources should be broadly conceptualized as including (but not limited to) labor, time, expertise, money, materials, connections, and services, and there should be assessments of quantity, quality, and utility of these resources. SANE programs transformed a vital service resource—the availability and quality of medical forensic exams. The training and on-going case consultation provided by many SANE programs also introduces new expertise into the system as well. The Cycling Principle challenges us to track down how these resources are used by the legal system and how they may alter the flow of other resources.

Third, the Principle of Adaptation concerns person-environment fit and how individuals cope with the constraints and demands of an environment using the resources available to them. Interventions must pursue ways to promote adaptability within individuals and how to make social environments more flexible to allow for easier adaptation. Therefore, evaluations must be designed to capture the extent to which interventions alter opportunity role structures within given settings. SANE programs created new roles for nurses as primary caregivers to sexual assault survivors and educators/consultants to the legal community. Prior to the advent of SANE programs, these roles were either unfilled or reluctantly filled by other hospital ED personnel. As such, this Principles suggests that we should examine how different stakeholders in the community draw upon the persons in these new roles, and how these relationships affect how individuals re-approach their own roles.

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Finally, the Principle of Succession focuses on how ecologies change over time and long-term modifications within the system. This Principle is somewhat different from the other three in that Interdependence, Cycling, and Adaptation could be understood as processes or mechanisms that lead to Succession. As such, Succession may not be salient in evaluation data, particularly if assessment is done before there is opportunity for long-term systemic change to occur. In the context of this project, it would be premature to expect evidence of Succession given the relatively infancy of this intervention model in the focal community, but it could be a useful sensitizing concept in other evaluation contexts.

The Current Study

Building on Espino and Trickett's efforts to concretize the elements of ecological theory into research practice, this paper presents an empirical case study of how Kelly and Trickett's Principles of Interdependence, Cycling of Resources, and Adaptation could guide the evaluation of an indigenous intervention and its mediating mechanisms of effectiveness. We began with extensive ecological reconnaissance work to learn the history of the focal SANE program, which is located in geographically diverse county in the Midwest that includes urban, suburban, and rural areas (Campbell et al. 2008). Then we used a sequential explanatory mixed methods design (Creswell et al. 2003) to evaluate how the implementation of this SANE program affected adult sexual assault prosecution rates in this large midwestern county. This design is characterized by the collection and analysis of quantitative data followed by qualitative data. Typically, primacy is given to the quantitative data, although Creswell et al. note that both methods can be equal components, which is how we implemented this design in our project. A mixed methods paradigm is also an excellent fit with ecological theory's mandate for pluralistic inquiry (Kelly 2003).

In the quantitative component, we used a longitudinal quasi-experimental design to compare prosecution rates pre-post SANE implementation. Using multi-level ordinal regression, we found a statistically significant increase in prosecution rates post-SANE, accounting for department-level and county-level effects in this community over the 12 years examined in this study (see Campbell, Patterson, and Bybee (in press) for more details on the quantitative component of the project). In this paper, we will present the findings from the qualitative sequence, which sought to identify the mediating mechanisms of the SANE program's effectiveness. The Interdependence Principle highlights the importance of collecting data from all major stakeholders in a system, so we conducted in-depth qualitative interviews with police, prosecutors, rape survivors, and forensic nurses (and rape victim advocates participated as member checks). However, to keep the scope of this paper manageable, we will focus exclusively on the data from police and prosecutors. Using the ecological principles as a conceptual guide, we explored how police and prosecutors used the new resources introduced by the SANE program and how they transformed the process of rape investigation and prosecution. The data from the other stakeholder groups are consistent with the core findings from the legal participants regarding the mechanisms by which the SANE program had a positive impact on prosecution outcomes.

Methods

Sample

We had two target samples in this component of the project: police (specifically detectives because they have far more contact with victims and SANE professionals than patrol officers) and prosecutors. For the police sample, we wanted to interview two representatives from each of the five largest law enforcement agencies within the focal county—a detective unit supervisor and the lead detective in that agency who had the most experience with rape cases. We used a key informant approach to sampling by asking the director of the focal SANE program to develop a list of the detective supervisors in agency based on her knowledge of the police departments' organizational structure. A research assistant contacted the supervisors to confirm whether they did in fact supervise the detectives handling sexual assault cases (100% confirmation), and then requested their participation in an interview. In addition, the supervisors were asked to nominate the detective in their department who has the most experience investigating rape cases. The research assistant contacted the detectives directly to explain the study and request an interview. Nine law enforcement participants were interviewed: four detective supervisors and five detectives. One law enforcement supervisor did not participate in the study due to schedule conflicts, despite repeated efforts to try to arrange an interview (90% participation).

Seven of the law enforcement participants were male, two were female. Their average age was 41 years old, with a range of 34–49 years old. All law enforcement participants were white. The highest level of education varied: 11% had 1 year of college, 44% had an associate's degree, 34% had a bachelor's degree, and 11% had a master's degree. The average years of experience in law enforcement was 18 years, ranging from 12 to 24 years, and all participants had worked in their respective police departments prior to the implementation of the SANE program.

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The average number of adult rape cases handled by the law enforcement participants over their careers was 65, with a range of 10–112 cases.

The second target sample for this component of the project was the prosecutors in the focal county's sex crimes unit. The prosecutors in this unit have the sole responsibility of making the decision whether to prosecute a sexual assault case, and all have direct, daily contact with the detectives who investigate rape cases. All prosecutors who currently had a position in the sex crimes unit (n = 5; or recently held such a position, n = 1) were asked to participate in the interviews (100% participation rate, N = 6). The average age of the prosecutors was 36 years old, with a range of 28–41 years old. All prosecutors were female and five were white. The average years of practicing law was 9 years, ranging from 2.5 to 13 years. Most (5 of 6) had experience prosecuting sexual assault cases prior to the implementation of the SANE program. The average number of adult rape cases these prosecutors had charged (i.e., prosecuted) was 70 (over their career), with a range of 20–240 cases.

Procedures

The police and prosecutor interviews were conducted in-person by the PI or a research assistant in private meeting space at the participants' office/department. Both interviewers had extensive prior experience conducting qualitative interviews. The length of the police interviews ranged from 50 to 110 min (M = 65 min). The prosecutor interviews ranged from 45 to 135 min (M = 90 min). The interviews were tape recorded with permission and transcribed.

Measures

The semi-structured qualitative interviews with police and prosecutors explored four main topics: (1) whether they perceived a change in the investigation and prosecution of adult sexual assault cases since the implementation of the SANE program; (2) their assessment of the quality and utility of the forensic evidence provided by the SANEs; (3) their perceptions regarding whether inter-agency training has affected the quality of police investigations and reports post-SANE; and (4) their perceptions regarding if and how the SANE program impacted communication and collaboration among legal and medical personnel, and if such changes have influenced law enforcement investigational practices or prosecutor charging decisions. Both interviewers probed the participants' initial responses to clarify how and why the SANE program was (or was not) a resource with respect to evidence, training, enhancing collaboration, etc. The interviewers pursued each topic/line of questioning until they felt the process by which SANE program services were (or were not) utilized by police and prosecutors had been articulated.

Analytic Plan

We selected analytic induction as our method of analysis because of its emphasis on identifying explanations from the data rather than descriptions (as is more common in phenomenological approaches; see Patton 2002 for a concise review). Analytic induction is similar to grounded theory in that both approaches work "ground up" inductively from the data to develop explanatory models. Grounded theory is ideally suited for theory-building (Charmaz 2006), but given the dearth of prior research on SANE programs and their effectiveness, we felt it was premature to try to develop a *theory* of intervention mechanisms. By contrast, analytic induction's emphasis on identifying and empirically testing qualitative "assertions" (i.e., mechanistic building blocks of a theory) seemed more reasonable for exploratory intervention work (Bogdan and Biklen 2007; Erickson 1986; Robinson 1951).

Data analysis proceeded in a three-phase process. First, consistent with Strauss and Corbin's (1990) method of "open coding" and Miles and Huberman's (1994) concept of "data reduction," two analysts independently read the transcripts and identified a preliminary list of themes mentioned by participants. The analysts compared themes, discussed and clarified the meaning of the thematic codes, and revised the coding framework until there was consensus. Once the coding framework was finalized, the transcripts were independently coded by the two analysts.

In the second phase of data analysis, we used Erickson's (1986) modified analytic induction method, which is an iterative procedure for developing and testing empirical assertions in qualitative research. In this approach, an analyst reviews all of the data multiple times with the goal of arriving at a set of assertions that are substantiated based on a thorough understanding of all of the data. The next task is to establish whether each assertion is warranted by going back to the data and assembling confirming and disconfirming evidence. The analyst must look for five types of evidentiary inadequacy: (1) inadequate amount of evidence; (2) inadequate variety in the kinds of evidence; (3) faulty interpretative status of evidence (i.e., doubts about the accuracy of the data due to social desirability bias); (4) inadequate disconfirming evidence (i.e., no data were collected that could disconfirm a key assertion); and (5) inadequate discrepant case analysis (i.e., no cases exist that are contrary to a key assertion; Erickson 1986, p. 140). Assertions are revised or eliminated based on their evidentiary adequacy until a set of well warranted assertions remain.

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For this study, two analysts worked sequentially through Erickson's method so that the second analyst could provide separate verification of the assertions. The first analyst developed a preliminary set of assertions that were *mechanistic* in nature. In other words, the assertions had to state how and why SANEs may influence the work of police and prosecutors. The first analyst then tested the preliminary assertions against the data, refined, and in some instances eliminated them. Once the first analyst had completed what was in her opinion a well-warranted set of assertions and assembled confirming evidence (i.e., quotes and longer interview excerpts), the second analyst then cross checked those assertions against the data and added more detail and nuance to the assertions. The revised assertions were discussed by both analysts to reach consensus on a final set of assertions that were well-supported by the data.

For the final phase of analysis, the assertions were examined for their conceptual congruence with Kelly and Trickett's Principles of Interdependence, Cycling of Resources, and Adaptation. The data were *not* a priori coded for whether ecological constructs were apparent. The data were analyzed to identify mechanisms of intervention process, and once finalized, those assertions were then cross-checked against the framework. One analyst developed definitions of each of ecological principle and then examined which assertions were consistent with each ecological principle. The analyst then re-organized the assertions (and quotes) around the three ecological principles supported in the data. This framework was reviewed by all analysts to reach consensus.

Results

Interdependence: Cross-Systems Intervention Effects

In the interviews, both police and prosecutors affirmed that there have been significant changes in the investigation and prosecution of adult sexual assault cases since the implementation of the SANE program. Both groups directly stated that they believe prosecution rates have increased post-SANE, and that this effect is attributable to the SANE program; as one prosecutor summarized, "*I think [the increase in prosecution] has everything to do with the SANE program.*" These qualitative findings cross-validate our quantitative results, which also demonstrated a significant intervention effect. Pushing this issue further, our qualitative data can help us understand *why* the intervention was effective—why does an intervention based in one system (medical) cross over to affect outcomes in a different system (legal)?

Medical forensic evidence can be a powerful resource to successful prosecution of rape cases. Injury and DNA evidence carry substantial weight with judges and juries, particularly in rape cases because they can corroborate the victims' statements and move the case beyond a stereotypical "he-said/she-said" dynamic, as one of the prosecutors explained:

> [Evidence] is a huge part and it is a valuable part, it is in and of itself, it is a big part, plus for the most part it will back up what our victim has said happened. It will back up other scientific evidence, so it becomes part of this picture that runs together and backs each other up. And I can say to the jury, 'okay, now this is what she talked about. And let's look at the scientific evidence. And, you know, this is what the nurse said about the injuries and let's look at what was found at the scene'… it is a picture that I can paint for the jury.

As noted previously, the legal system is dependent upon the medical system for this evidence, and SANE programs make this interdependence explicit. For example, one of the prosecutors explained how she uses the SANEs' evidence and why it leads to increased prosecution rates:

> When I get a case on my desk, I'm like, 'oh look, they reported right away, a SANE report, look there is injury'… I'm sitting here thinking to myself, 'I've got a good case. I've got corroboration, I've got medical, I've got a good case,' and I'll use that with talking to the defense attorney. [I can now say to the defense] 'I've got medical, are you kidding me? I've got injuries here, you know I'm offering this one time offer (a plea bargain), if you want to take it, fine; if not, I'll kick your ass at trial…. Again, I think it is the corroboration and the proof. The proof that the jury needs to say that it happened.

Similarly, the law enforcement interviews highlighted how the SANE program is an effective tool for building strong legal cases. Since the implementation of the SANE program, law enforcement can count on more thorough evidence documentation, as one detective supervisor noted:

> We [law enforcement] use the [SANE] examiners like I said, to collect, process evidence and things like that… [it's] another link in the chain of probable cause. I think that the prosecutor's office uses them to put together a much stronger case. The stronger your case, the better your chance of conviction and better conviction rate since implementation of the program in my opinion.

The evidence provided by the SANEs help police develop more complete, fully corroborated investigations. As a result, police are more likely to refer cases to the prosecutors because they feel it is a strong case with good evidence and are invested in its outcome. And

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consequently, what arrives to the prosecutor is indeed a well-developed case that is more likely to be acted upon, and prosecution rates increased. Viewed through an ecological lens, it makes sense that an intervention focused on improving medical forensic exams for survivors had positive effects on the legal system. The intervention works because it taps into, and strengthens, the inherent interdependence of these systems.

Cycling of Resources: Mechanisms of Intervention Effectiveness

Building on these ideas of systemic interdependence, we then examined the data in more detail to identify the mechanisms by which the SANE program contributes to the development of more complete, fully corroborated investigations. What are the specific resources the SANE program introduces into this interdependent system, and how they are cycled to achieve positive intervention effects? Figure 1 depicts the mechanisms supported in our data. First, the *service* provided by the SANEs—medical forensic evidence and accompanying documentation—is of better quality and quantity than that obtained by hospital emergency department personnel. This evidence often provides compelling proof of the assault, and directly contributes to the development of stronger legal cases. Second, the SANE program's evidence collection procedures save law enforcement *time*, which allows the detectives to focus on other aspects of investigating the case, thus producing a more thorough investigation and stronger end case (i.e., an indirect effect). Third, this SANE program shares *information and expertise* through ongoing case consultation and specialized training to law enforcement, which also contribute to increased investigational effort. Each of these findings is described below.

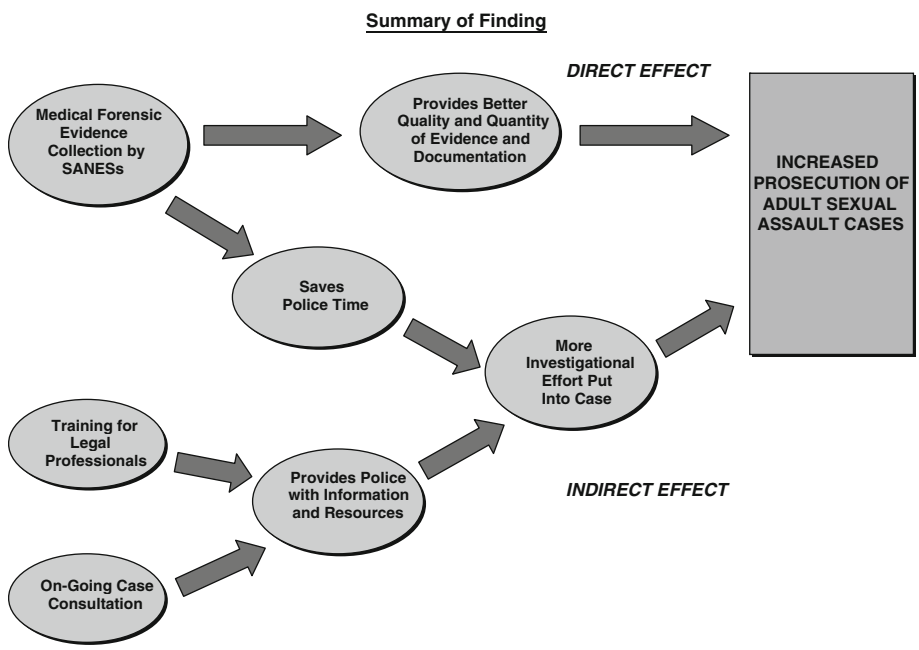
SANE Provides Better Quality and Quantity of Medical Forensic Evidence

Perhaps the most critical resource that the SANE program provides the legal system is *high-quality* medical forensic exams—it's not just that they perform the exams, but the quality and quantity of the resulting evidence. The police and prosecutors emphasized that what they receive from SANE-conducted medical forensic exams is exponentially more useful to them than what had been provided by hospital emergency department staff in the pre-SANE era. In the following example, one of the prosecutors compared the differences of the assault documentation by the SANE program to emergency department personnel:

> My SANE report that I get is like fifteen pages long and the hospital report I get is not even a page and I'm like, 'did you take a history, did you get any statements, did you do all these things?' and they don't, they don't do all those things that the SANE nurses do.

The thoroughness of the SANEs' documentation and evidence collection procedures was consistently praised by police and prosecutors. In this next example, one of the prosecutors explained how meticulous evidence collection by the SANE program can literally make the case. In an assault involving forced oral penetration, a victim was passed out and did not know which of multiple suspects

Fig. 1 Summary of finding



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had raped her, so the forensic nurse used dental floss to identify the correct offender:

> They found DNA evidence on dental floss… it was a girl who was passed out in a hotel room; she knows that there was 3 boys there, but we don't know which one to finger and now we do because we are going to be able to now get a, we were able to get a search warrant so we're able to get the 3 young men's DNA and we will be able to charge this guy with oral penetration. Had we not had SANE, that girl would have never gone - the hospital would have never found that evidence… That type of evidence is unheard of in a hospital. They just don't take the time. They do a [vaginal] scrape; they don't do the, they don't follow the kit the way that it's supposed to be done. They lose all the evidence on the outside of the vaginal area… I'd say 90% of the time, hospital personnel do not do the [rape evidence] kit appropriately.

As this quote explains, if this case had occurred in the pre-SANE era, it very likely would not have been prosecuted because it was so unlikely that hospital emergency department personnel would have correctly collected the kind of evidence that was ultimately needed. The thoroughness of the evidence collection procedures by the SANE program can help identify suspects, create stronger cases, and directly supports increased prosecution. Essentially, a *SANE-conducted* medical forensic exam was a *new* resource to police and prosecutors because the quality and quantity of information now available was unlike anything they had before.

SANE Medical Forensic Evidence Collection Procedures Save Law Enforcement Time

The SANE program not only offered new resources to the legal system, but also recycled existing resources. Time is a very scarce and highly valued resource for law enforcement—they have so many cases to investigate, only so much time. The SANE program saves detectives' time, which allows them to focus on other aspects of the investigation. Prior to the implementation of the SANE program, law enforcement often had to wait at the hospital with victims for hours, but as this detective explained, the 24/7 availability of the SANE program makes it easier to coordinate the early stages of their investigation, a major time-saver:

> If they [the SANEs] weren't available, things would be thrown away. I would have sit around waiting to have the examination done… there are several things we have to do with CSCs [criminal sexual conduct… it is a long drawn out process… For any one of those to be delayed it would throw everything else off… Obviously interviewing the victim takes time, having her examined takes time, and for any one of those things to be put off would throw everything out of order and make the process take even longer.

In addition, in the pre-SANE era, the police had to obtain a search warrant in order to receive the hospital's documentation of the forensic exam. This SANE program instituted a consent form that victims can sign if they choose to release documentation of the medical forensic evidence findings to police. In this next illustration, a detective explains why the SANE procedures of releasing documentation save time:

> SANE is much more organized than the hospital was. And SANE information is received rather quickly, if not the same day the following day you have the information. With the hospital it took time to go through their records to obtain any additional reports which made it difficult for us to proceed with our investigation…. [SANE] Certainly it saves us time. A search warrant takes a lot of time. You know go into the hospital. If they don't readily give us the records we are requesting well then we have to look through all their files… Once you show them the search warrant they usually comply, but it is just another step and another, time is being burned up when it could be used for things that are more beneficial to the investigation.

With less time spent waiting and processing paperwork, the detectives could re-invest those hours into actual investigative work for the case. One of the detectives noted that he can put more time toward obtaining a quality victim and suspect interview because the medical forensic component is in good hands:

> I know that my physical evidence is going to be completely collected [by the SANEs] and its not even a concern, allowing me to focus then my attention more so on the victim and obtaining the statement and then being able to then focus my attention on the suspect and again obtaining the statement there. It just takes the whole worry of the evidence out of the equation and just focus on the people instead of the inanimate things, the evidence.

As illustrated in this example, detectives' time is better utilized in the post-SANE era—more time is available for interviews, scene investigation, collection of other evidence, searching for the suspect, and apprehending the suspect. This effort can contribute to the eventual development of stronger cases.

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Ongoing Case Consultation and Specialized Training to Law Enforcement Provides Information and Shares Expertise

As part of their professional training, police and prosecutors receive minimal instruction on sexual assault (e.g., dynamics of rape, trauma response and its implications for working with victims, types of medical forensic evidence; Koss et al. 2003), which partially explains why this is such an under-investigated and under-prosecuted crime. The SANE program provides new services to the legal community, but without addressing these educational needs, the significance of this resource may not be fully realized. As one of the program nurses stated, *"We had to teach them [the legal community] what to do with what we were giving them. They didn't know what the medical forensic evidence could do for them in building a case."* In other words, a resource can only resourceful if it is acted upon, and this SANE program implemented two mechanisms for educating the legal community: on-going case consultation and specialized training programs. These educational resources vary in frequency and intensity, becoming mutually reinforcing pathways for information exchange.

The SANE program provides ongoing consultation to law enforcement for individual cases. Law enforcement may request further information about the victim or case, inquire about the medical forensic evidence findings from the exam, and/or brainstorm with the nurse further investigational leads on the case.

For instance, the detectives noted that these consultations with the nurses can directly influence what they pursue in the law enforcement; as one explained:

> So they [forensic nurses] tell you this looks like an injury caused by a coat hanger. You get the search warrant, you go to the house, low and behold there is a wire hanger that bent.

This example highlights how the medical forensic evidence can work in conjunction with police crime scene evidence to create more complete, fully corroborated cases. In addition to suggesting specific leads to pursue, these consultations provide detectives with opportunities to "think out loud" with other trained professionals, as this detective explained:

> If the detective has a theory about how the event had played out with the offender and the victim, the interaction between the two parties; they may, 'hey, would this fit what you found? Can you give me an informal opinion?' They want to know, is the investigation heading in the right direction? Could this have caused this injury? 'Hey do you think this could have happened during the assault?' It is great to be able to reach out to those people [forensic nurses] and get their opinion. [SANE might say] 'Yeah, it's possible but it could be something else too.' They might give you a new avenue to pursue, something else to look for, which saves time and prevents attacks on the case later on because you closed down, when you can shut down things that are impossible, get them out front, the possible sequence of events; you are better prepared for the attacks [by defense lawyers] that come at court.

As demonstrated by these examples, these on-going, day-to-day consultations with the forensic nurses may lead to the detectives investigating the crime further, creating a more complete case. Further, a thoroughly investigated case is stronger because it is less likely to be weakened by defense lawyers during the legal proceedings.

In addition to on-going case consultation, this SANE program provides an annual four-day multi-disciplinary training, free of charge, to law enforcement, prosecutors, crime lab staff, and advocates from the rape crisis center. During training, the nurses discuss specific ways their medical forensic evidence documentation can assist the law enforcement investigation. In our interviews, the detectives described this training as an incredibly useful resource that helps them understand how to incorporate the medical forensic findings into their reports, which are then presented to the prosecutor. In this next quote, a detective explains how this training has contributed to increased prosecution rates:

> …they [SANE] can better educate the detectives as to the significance of their findings so that the investigative reports that are drafted can go to the prosecutor's office, who is the decision- maker… the report is more complete and the information gathered is put into better perspective and we get better charges then and stronger cases because the prosecutor then has an easier time making sense of the case, determining how to present that to a judge or to a jury…. It helps the investigator to put that into better perspective for the prosecutor because we have the prosecutor's ear. We are the ones presenting the case to him and if we don't fully understand the information that has been gathered and do a poor job of presenting to the prosecutor, we may not get the charges that they should be had on the case… So I think the training provides better understanding for our investigators to take their findings, translating them into their investigative report to present to a prosecutor.

The utility of this training was independently confirmed in our interviews with the prosecutors. The prosecutors noted

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that they have perceived an improvement in the quality of police investigations because of the training. In the next exchange, a prosecutor explains how police work changed post-training:

> I: You also said the training helps law enforcement; it makes them better at how they handle cases? What do you mean by that?
> The more training you go to, the better you are going to get at investigating them. Again, just knowing how to relate to the victim, knowing what they are looking for, knowing what the SANE person is looking for, more familiarity with anything makes you speak more confidently in anything so the more training you have, the more confident they can speak and the more confident they can testify. The more aptly they can do their investigation and they can know what they are looking for. So I guess all those combined makes them a better investigator in a particular case.
> I: Does it help them, does the SANE training help them be more, the only word I can think of is, do more comprehensive investigations?
> Yes, I think that would be a very good word. And this may seem broad but I just feel that I like working with officers that have gone through the training better than officers that don't know what they are doing. They are just better at investigating. I know if I'm dealing with, say, "Andy", he's been through the training, I know he's going to do a good investigation, I know he's going to do a good interview and I can call him and he'll have the answers I am looking for. Whereas, if it is someone who hasn't been through the training, I'm basically telling them, well ask her this, ask her what kind of penetration there was, etc.

As explained by this prosecutor, the training helps law enforcement present a more comprehensive case to prosecutors, which helps them make more informed decisions about charging the case.

Adaptation: New Roles Support Intervention Effectiveness

As an intervention, the SANE program drastically altered the ways in which the medical and legal systems worked together in sexual assault cases. Before SANE, the relationships between doctors, nurses, police, and prosecutors were essentially non-existent, or perhaps worse, when they did exist, they were experienced as frustrating interactions that rarely met given needs. The SANE program created *new roles* for the medical community, specifically forensic nurses, in the process of investigating and prosecuting sexual assault cases. Over time, the forensic nurses and law enforcement developed strong working relationships, and both have seen the benefits of their collective efforts. In our interviews, detectives noted that they have learned they can count on the forensic nurses in their community to be fair, accurate, and objective. They know that if they invest effort in a case, the nurses really will be available to them for further consultation and can be counted on to provide expert testimony should the case proceed through prosecution. This becomes a reinforcing dynamic: law enforcement benefit from the resources provided to them by the SANEs; the forensic nurses reinforce their role as needed experts. One of the detectives explained how working together in case consultation and participating in the SANE training has led to a deeper appreciation of the role of the forensic nurses:

> You begin to appreciate the roles of other disciplines that are involved in these types of cases. Prior to [the SANE training] you would only receive training that was strictly pertinent to the police role in a sexual assault investigation, but when you go to a conference put on by SANE, you get a tremendous amount of the medical side and you come out with a much better understanding of anatomy for a good reason…without that training, you don't understand the significance of injury or lack of injury…I've attended the training [and have heard prosecutors who] get the end product saying what they are gonna do with it and… why it is important for us on the police side to do things in a certain way so that when we get to court that things- all of this work isn't in vain.

The consistent, unwavering accessibility of the SANEs and the quality of their work has fostered tremendous trust of the SANEs by law enforcement. They now depend on the role of the nurses in complicated process of investigating and prosecuting rape, as one detective explained:

> Trust is everything. When you have that level of trust, the information that you receive, you don't have to spend a lot of time considering, well, how…does this individual, do they know what they are doing?… There is less time spent deliberating over the information that is received by either party because of the trust, because of the experience, because of your knowledge of their level of training. Their knowledge of your level of training and experience and reputation with regard to the investigation and evidence collection or documentation, injuries, dealing with the same people.

But ultimately, the SANE program shifted the relationships between all key stakeholders in the legal community—the forensic nurses, police, and prosecutors. For a case to be

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successfully prosecuted, all of these stakeholders have to work together, a seemingly simple but previously elusive process. One of the prosecutors highlighted how the implementation of the SANE program changed the working relationships in this community and that now, the medical and legal communities can and do work together:

> You have a close working relationship with law enforcement and with the nurses. I think it makes it easier all the way around to prosecute the case from beginning to end. It makes it easier for the victim, it makes it easier for law enforcement and its makes it easier for the prosecutor…to have that direct personal, professional relationship expedites things and makes it easier for people to do their respective jobs.

The forensic nurses fulfilled a needed role for high quality medical forensic medical evidence collection. But the intervention promotes adaptation because the SANE program also fulfilled the missing role coordination, creating professional linkages that were necessary for case to move through the multi-stage complex process of prosecution.

Discussion

Miller and Shinn (2005) challenged community psychologists and allied professionals to take more interest in indigenous interventions and to work collaborative with such programs to study their effectiveness. Indigenous interventions are already high in external/ecological validity—which is often a major stumbling block for researcher-initiated interventions—but little is known about their effectiveness. Kelly and Trickett's ecological model can provide a useful theoretical framework for locating practice-based evidence. From a process perspective, this theory emphasizes taking time to learn about communities, which is critical given that these interventions already exist and were created by practitioners, usually without the involvement of researchers. An ecological framework suggests that the key to an intervention's effectiveness will be the extent to which it taps into and supports the inherent interdependence of system components. Interventions that introduce new or recycled resources into the system, which are truly useful and responsive to system needs, are likely to be effective. Creating opportunity role structures with the system that promote sharing of resources would also contribute to the effectiveness of an intervention.

In this project, we used Kelly and Trickett's ecological model to identify how and why a midwestern SANE program had been instrumental in increasing prosecution rates for adult sexual assault cases. Consistent with the Principle of Interdependence, we found cross-systems intervention effects such that a program developed and operated in the medical system did have a positive effect on legal prosecution rates. The key mechanisms of effectiveness could be explained by the Cycling of Resources and Adaptation Principles. The medical forensic evidence collected by the nurses from victims and suspects was made immediately and easily accessible to law enforcement so that it could be *used* to inform and strengthen their investigation. Our findings also showed that the nurses' new roles of providing on-going education, training, and case consultation were critical components in the development of more complete, fully investigated cases. Over time, the forensic nurses and law enforcement have developed strong working relationships, and both have seen the benefits of their collective efforts. As a result, the cases that were put forward to prosecutors reflected the collective efforts and expertise of law enforcement and the SANEs, and not surprisingly, the cases *were* stronger. Consequently, prosecutors were more inclined to move forward with charging cases, and over time, the prosecution rates did increase.

Interdependence also means that there could be unintended negative consequences of an intervention, and these may be particularly hard to unearth. If there is strong community support for an indigenous program, there may be reluctance to reveal its less-than-stellar aspects due to fears about loss of funding, support from stakeholders, etc. In our case example, this was not particularly problematic as participants noted that the SANE program probably isn't a positive experience for all rape survivors, and many victims still have troubling encounters with the criminal justice system. But, we did encounter another difficultly trying to get at this issue: it may take some time for these problems to develop and the timing of the evaluation may miss them. *After* we finished primary data collection and analysis, we learned that our focal SANE program was working with their local hospitals so that residents-in-training could collaborate with the nurses to learn how to do medical forensic exams (if survivors consent). The program had been so successful in getting sexual assault survivors out of the hospital ED (unless they needed emergent care) that doctors training in this community were not learning how to do these exams. When these doctors went on to practice in other communities—perhaps those without SANE—they would be particularly ill-prepared to care for sexual assault patients. The SANE program had inadvertently exacerbated one of the problems this intervention model was created to remedy: poorly trained hospital ED staff performing exams. Once known, it was straight-forward to address in this community, but we essentially missed it in our evaluation and caught it only because of our continued contact with the program throughout the dissemination, which underscores Kelly and

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Trickett's point that it take time, often lots of time, to understand context.

There are two important limitations and caveats of this project that merit examination. First, our key informant interviews with police tapped the perspectives of the detective supervisor and the most experienced detective from each of the five focal police departments. On the one hand, we obtained more than one informant per site, but we did not hear from less experienced law enforcement personnel. Interviewing less experienced detectives may have been helpful in illuminating the process by which detectives start to draw upon the forensic nurses and their expertise and how trust develops across systems. The most experienced detectives and detective supervisors could identify that these shifts had happened and could, to some extent, rewind to explain how that occurred, but it would have been preferable to interview stakeholders at different levels within each organization.

Second, the focal SANE program selected for study is representative of emerging national norms with respect to size, staffing, number of patients served, services provided, and training/supervision of nurses (Campbell et al. 2005a, b; Logan et al. 2007). However, most SANE programs are not yet able to invest as much organizational attention in training and educating members of the legal community as does this program. This yearly free training program was clearly instrumental in fostering communication and promoting Adaptation (i.e., learning about the nurses' roles and how to access resources offered by the SANE program), which were important mediating mechanisms of the intervention's effectiveness. Because there is substantial heterogeneity across SANE programs with respect to this "critical ingredient," SANE programs cannot be presumed to have universal effectiveness. In other words, other SANE programs may not see the same kinds of success in legal case outcomes as did this particular community's SANE program. This highlights the need for more research on these indigenous interventions to identify if there are cross-cutting "critical ingredients" needed for cross-system impact, or whether there are multiple mechanisms of effectiveness that operate differently in diverse communities.

Our goal in this evaluation was to help establish practice-based evidence for this indigenous intervention. SANE programs address so many of the problems researchers have documented in the community response to rape, so it is perhaps not surprising that an intervention grounded in the real-world experiences of practitioners which is congruent with the extant research literature would be effective. That said, it is important to note that many rape survivors still do not have their cases prosecuted, so there is ample room for improvement, through this intervention or some other effort. Nevertheless, after decades of frustration, it is encouraging to see an intervention model make some headway in the seemingly intractable problem of sexual assault under-prosecution.

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