

A PROPOSED MODEL FOR INTEGRATING MEDICAL AND BEHAVIORAL PRACTICES*

ISAAC D. MONTOYA, PH.D., CLS, CMC

Affiliated Systems Corporation and University of Houston

DAVID C. BELL, PH.D.

Affiliated Systems Corporation

ABSTRACT

Background: To present four treatment models and evaluate their effectiveness in reducing HIV risk for high-risk patients. *Methods:* Four models are described: 1) Traditional Medical Practice Model; 2) Physician Management Model; 3) Integrated Provider-Patient Management Model; and 4) Integrated Network Treatment Model. Data from a study of 168 drug user and nonuser social networks are used to simulate the effects of each practice model on HIV transmission and seroconversion. Survey respondents described sexual and injection risk behaviors and partners for the last 30 days. An HIV risk index was computed for each individual, combining reported risk behaviors, HIV prevalence rates for partners and HIV transmission probabilities for each risk behavior. To evaluate the 4 models, 1 person from each network was selected as a "patient" and a simulation was performed to estimate the number of network members who would seroconvert to HIV over a 10-year period as affected by prevention efforts within each model. *Results:* The simulation projected that 99.7 persons in the social networks studied would seroconvert over 10 years without any intervention. The Integrated Network Treatment Model produced the greatest reduction in risk, producing 12.6 fewer seroconversions over 10 years. *Conclusions:* The greater the patient involvement in prevention-oriented interventions, the greater the effect. The most pronounced effect occurs when a patient's unique social network is included in the prevention effort.

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INTRODUCTION

In a traditional medical practice model, physicians assume full responsibility for diagnosing, treating, and providing other needed medical services to their patients. This model, although effective for acute patient care, is less effective in today's managed health environment where the focus is on maintenance and chronic care (Feldman, Ploof, & Cohen, 1999). The need to re-engineer our nation's healthcare system is increasingly clear in light of continued rising healthcare costs, provider shortages, globalization, and rapid advances in technology (Noon, 2003; Parsons & Murdaugh, 1998). There are also humanitarian reasons to continue to re-tool America's healthcare system: continuing unmet need, growing populations in need of specialized care, and an increasing number of uninsured patients. Widespread awareness of these problems has resulted in different attempts to improve patient care through alterations to the traditional medical practice model, while some organizations have explored the effectiveness of entirely different models designed to improve patient health while lowering costs; these different attempts to improve patient care each have something to offer a plan for creating a new means of best serving patients and the community.

A joint practice model is one promising way in which practitioners have altered the traditional medical practice model in order to more effectively meet the needs of patients in light of the constraints placed on them in a managed care environment. The joint practice model is an interdisciplinary approach to coordinating and integrating the services of medical and behavioral healthcare providers in the primary care setting and ensuring that not only is a patient's physical health maintained, his or her mental health is provided for and the connection between mental and physical health is taken into account. Patients who visit a physician for their physical health needs have the opportunity to be referred to a behavioral specialist who is on site and who, thanks to the input of the physician, is familiar with the patient's health and particular needs.

A 2000 meeting convened by the U.S. Surgeon General David Satcher examined the importance of integrating mental health services in primary medical care (U.S. Department of Health and Human Services, 2001) leading toward greater scientific exploration on the topic. A study of the Improving Mood-Promoting Access to Collaborative Treatment or IMPACT Model, which incorporated a depression care manager into primary care services found that patients in the study reported less impairment of day-to-day function, less depression, and improvements in their quality of life (Unutzer, 2002). Having a mental health professional on-site with the primary care physician can also increase treatment utilization and adherence to the physicians's referral (Apostoleris, 2000; Blount, 2003; Lambert, Bird, Hartley, & Genova, 2004; Slay & McLeod, 1997). Due in part to the easy access that patients have both to physicians and to specialists who are prepared to help them make necessary lifestyle changes; the joint practice model places an emphasis on disease management through behavioral intervention.

In another attempt to better meet patients' needs, entirely new programs have been developed as alternatives to the traditional medical practice model. Group treatment models, where patients who have similar mental health needs meet together under the direction of a single mental health practitioner, have been successful in helping many patients. Group therapy has been known to provide psychological support, improve communication skills, and alleviate feelings of loneliness, isolation, and hopelessness (Rollin, 2000).

Previously, these groups existed for people in need of mental health support, but the program's basic format makes it ideal for simultaneously treating several patients whose physical health could be affected by similar behavioral changes. Programs aimed at teaching patients preventative health techniques in a group composed of individuals with similar risks result in participants who experience better health and require less medical attention (Cummings, 1997). Spiegel and Cordova (2001) found that breast cancer patients who participated in group therapy reported lower mood disturbance, anxiety, and pain after 1 year. At a 10-year follow-up, patients involved in group treatment lived an average of 18 months longer than those who participated in a control group (Spiegel & Cordova, 2001). A series of recent studies have found that group treatment is effective among individuals with communication disorders such as stroke-related aphasia (Avent, 2004; Graham & Avent, 2004).

Each of these methods has shown promise: the group treatment model helps patients to improve their health while working with others, and the joint practice model helps patients to meet their physical and behavioral health needs in one setting. The next logical step is to integrate these two plans in order to meet the behavioral needs of a large group of people. While the increased exposure to practitioners of different disciplines probably plays a large part in aiding patients in these models, the greatest contribution to these programs' success may be through change in ongoing social interactions as a result of seeing patients in groups along with their family members. The role that social embeddedness plays in the health behaviors of the individual is being increasingly demonstrated by research studies (Langford, Bowsher, Maloney, & Lillis, 1997; Murphy, Marelich, Hoffman, & Steers, 2004; Snowden, 2001; Treharne, Lyons, & Kitas, 2004; Williams, 2002), and including people from the patient's social system offers an opportunity to active social support for the good of the patient.

Koopman and Lynch (1999) observes that when patterns of linkages among people influence their health outcomes they are acting as a "population" or disease *system* rather than as a group of individuals (Koopman & Lynch, 1999). Programs that provide interventions to groups demonstrate the effectiveness of treating "illness systems" rather than collections of individuals; studies that detail group attempts to help people meet specific health objectives including increasing breast self-examinations (Audrain et al., 1999) reducing obesity (Gortmaker et al., 1999), increasing exercise (Pereira & Schmitz, 1999), and reducing stress related health conditions (Williams, 2002) reveal the immense potential for utilizing both the

people in a patient's life and people who are experiencing the same health problems in order to more effectively treat the patient. Studies such as these add to the mounting evidence that being "embedded" in a social network strongly enhances quality of life and longevity for the individual and that these connections to others can be tools for improving medical treatment for the benefit of the patient.

While family involvement is definitely important for the effective treatment of some patients, other patients will gain the most benefit from a model that focuses on their work or social network. Both intervention programs and support groups capitalize on the idea that health related behaviors occur among systems of interacting individuals and strive to meet the participants' particular needs in a relevant way. From this information comes the knowledge that providers cannot assume to know what constitutes a patient's social network; for example, patients whose lifestyles are destructive or dangerous may not be interacting with an extended family, but may instead confine their social interactions to other individuals whose lifestyles compliment their own. Among out-of-treatment drug users who are at high risk for HIV, hepatitis, and other STDs, the intent of such programs is to increase knowledge about disease transmission and reduce sexual and drug related risk behaviors for the entire group.

Patient expectations have increased as greater availability of appointments and resources, shorter waits in treatment programs, and quicker results are at a higher demand (Noon, 2003). This is occurring at a time in which cost-cutting is a primary goal among healthcare providers due to constraints resulting from limited funding (Noon, 2003). Healthcare managers seeking greater efficiency may look to utilize new models in treatment care in order to appease patient demand and increase positive health outcomes. Beyond the current models for disease management, there is an opportunity to approach prevention and other healthcare issues in a new way by considering the social network of a patient. Healthcare providers first must communicate with members of a patient's social network and develop intervention methods that will enable those network members to help patients manage their illness, while potentially learning how to improve their own health as well. By these means, the provider can intervene with the patient's social environment and create an atmosphere that is more conducive to disease management and prevention. This theoretical model can perhaps be an effective way of modifying the traditional medical practice model for the benefit of patients who have special health needs, especially when providers take into account that different patients have different social networks.

METHODS

Simulating Prevention

In order to explore the potential effectiveness of different ways of organizing treatment, we simulated both the traditional medical practice model and several

enhanced treatment models by modeling new strategies that might benefit patients with special health needs; these new strategies are successively included so as to produce different models of treatment that are the basis for this simulation study. The first model is a traditional medical practice model, and each subsequent model adds additional levels of provider responsibility and behavioral management strategies. The simulation culminates in a model that incorporates an awareness of each patient's unique social network and the need for prevention intervention for each member.

- *Model 1: The Traditional Medical Practice Model.* The physician narrowly limits his or her focus to the patient's presenting problem(s). The physician is directive toward the patient, who is expected to respond by acquiescing to the physician's suggestions.
- *Model 2: The Physician Management Model.* Along with the characteristics of Model 1, the physician preventively intervenes to create an awareness of behaviors that contribute to the underlying problem(s) and suggests how the patient may alter those behaviors in order to more rapidly effect positive changes in his or her health.
- *Model 3: The Integrated Provider/Patient Management Model.* In addition to the characteristics of Model 2, various healthcare providers (i.e., physicians, behavioral health practitioners, nurses, pharmacists) are present in the primary care setting and train the patient to actively manage and modify his or her behaviors and environment. Here, the patient is expected to modify his or her behavior and environment to some degree.
- *Model 4: The Integrated Network Treatment Model.* Along with the characteristics of Model 3, the healthcare providers directly intervene with the patient's social network. This creates a 3-way collaboration between physical and behavioral health providers, patient, and network to actively manage and modify the patient's network environment.

The simulation model does not attempt to study the medical outcome of treatment. Instead it examines the non-medical social consequences of the treatment experience. It explores in a highly detailed way the potential social consequences physician's non-medical preventative interventions.

To conduct the simulation study, we assumed that the past 30-day risk behaviors described by each simulated patient would continue unchanged for 10 years, except as modified by providers' prevention intervention. That is, we assumed for the purpose of this simulation that neither the behaviors of the simulated patients nor of their partners, who comprise the social networks, would spontaneously change over the simulation period. This, of course, is not a realistic assumption for any specific relationship. This procedure punctuates the current relationship and assumes that it will be representative of future relationships or behaviors, thus allowing for the examination of the long-term potential of these behaviors.

Based on a prior study with a short one-time HIV prevention intervention (Bell, 1996; Montoya & Atkinson, 1996), the parameter quantifying the effectiveness of prevention efforts was set at 18%; that is, patients who were the object of a healthcare practitioner's intervention would on average reduce their own risk behaviors by 18%. We additionally estimated that when a person was engaged in direct prevention efforts toward his or her sexual/drug partners, this intervention would be about half as effective as the practitioner-originated intervention, or 9%.

In this simulation we focus on the effects of risk behavior reduction on HIV transmission; in doing this, we are aware that we may be underestimating the actual benefits that are expected to occur. Reduction in needle sharing, for example, will reduce hepatitis transmission as well as HIV transmission, while increases in condom use will reduce STD transmission as well as HIV transmission. Thus, our simulated projections of the effects of provider prevention interventions may be considered underestimations of the actual benefits that are possible if the methods proposed in this study were to be used in helping real patients.

Conducting the Simulation

To conduct the simulation, we used data collected in an NIH/NIDA network study of HIV transmission behaviors. The sample was collected as part of a study of the sexual and drug injection behaviors of drug users and nonusers. "Approximately random" methods were used to select respondents (random walk, peer recruitment) because drug users generally are a 'hidden population', thus special procedures were required to identify and recruit them (Allard, 1990a; Bell, Montoya, & Atkinson, 2000).

A sample of 169 persons and 99 of their partners were interviewed. After omitting one person due to missing data, 168 persons reflected the "simulated patients" used in our models (Figure 1). The racial/ethnic make-up of the sample was as follows: 53% African-American, 24% Hispanic, and 23% Anglo. Each simulated patient was asked to name persons with whom they had used or injected drugs or had sex in the previous 30 days or to whom they were close. Some of the named persons were themselves interviewed. Furthermore, some of the simulated patient's injection and drug partners were interviewed. These interviewed persons were the "simulated partners" used in our modeling. They in turn named their own partners who were not recruited into the study. All of the un-interviewed named persons constitute the "partners' partners" referenced in our models.

In addition to naming his or her own partners, each interviewed person also described the sex and injection relationships among the partners. The patient, the patient's partners, and the partners' partners constitute the patient's network, an example of which is illustrated in Figure 2.

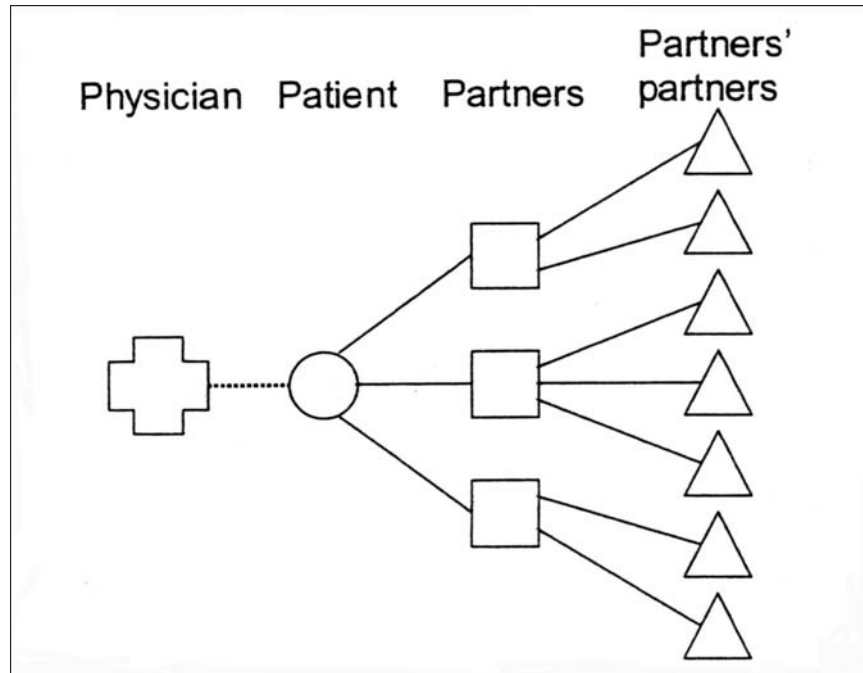


Figure 1. Terminology for simulation of prevention intervention.

Measuring HIV Transmission Behaviors

For each respondent, we collected information about his or her risk behaviors with each partner, as well as risk behaviors between the partners. In particular, respondents described for each partner the number of times they had injected together in the previous 30 days and how often they had shared injection equipment. In addition, they described the number of times they had had sex with each partner in the previous 30 days, what kind of sex, and how often they used a condom. Frequency of 11 risk behaviors in the previous 30 days was measured by self-report; eight of these variables measured the frequency of sexual risk behaviors and three measured the frequency of injection risk behaviors. These behavioral frequencies were determined separately for the relationship to each partner and allowed for the construction of an HIV risk index that included sexual frequency variables: insertive vaginal sex with and without a condom, receptive vaginal sex with and without a condom, insertive anal sex with and without a condom, and receptive anal sex with and without a condom; it also included injection behaviors such as the number of times injecting after the partner using the same syringe (modified by the type of cleaning behavior) and the number of times using the same cooker, cotton or water after the partner.

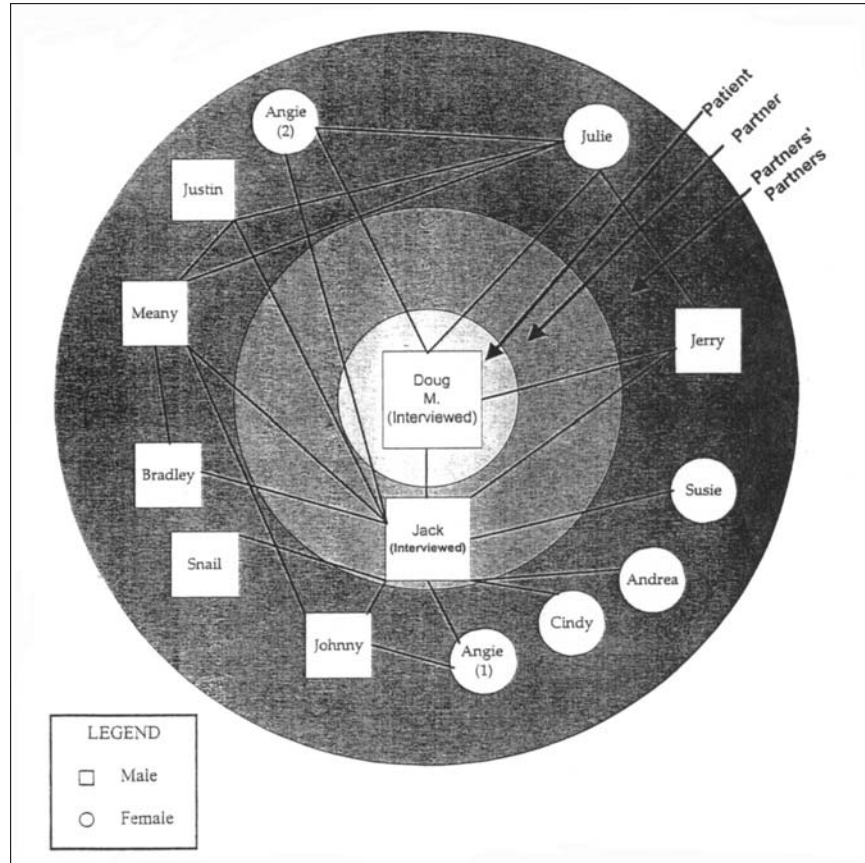


Figure 2. Diagram of simulated patient's network.

Computing an HIV Risk Index

A projected conditional probability estimate of risk was constructed using a standard epidemiological model of risk as summarized by Allard (1990a, 1990b) and Bell & Trevino (1999). In this model, the risk of infection was based on the number of risk-relevant behavioral acts with each partner, as described above, the probability of infection of each act, and the prevalence of infection among the population(s) from which the risk partners were selected. Each HIV transmission risk act was assigned a probability of transmission based on published estimates (Bell & Trevino, 1999). A conditional measure of HIV transmission risk was computed by projecting the probability that the given profile of 30-day risk behaviors would lead to HIV transmission over the following 10 years if the person's partners were HIV+.

Because we are interested in simulating risk in hypothetical patients, we ignore information on the actual HIV status of the respondents and the partners they named. Instead, in order to be sensitive to the gender, ethnic, and age distribution of the sample, each person was assigned a probability of infection based on prevalences observed in a national sample (Bell & Trevino, 1999). In computing projected risks, we computed the probability that each partner would be infected by an HIV+ partner over 10 years, and then projected the probability that each partner would pass on the infection to the partner's partners.

For the various treatment models, the probability of HIV transmission was adjusted according to the hypothesized effects of intervention. The 10-year probability of infection was summed over simulated patients, partners, and partners' partners to estimate the outcomes of each practice model. Projected risks were computed for sexual behaviors and injection behaviors separately, along with an overall projection of risk.

RESULTS

The data chosen to illustrate the potential risk reduction of these practice models was taken from a study designed to explore the role of social networks in HIV transmission. The sample for the simulation consisted of 168 patients, their named partners, and the named partners of those partners. Due to the nature of the study 82% of the sample were drug users, making them representative of an HIV high-risk population. The results of the four models are reported in this section.

Model 1: Traditional Medical Practice Model

In Model 1, physicians provided treatment without prevention to the 168 patients. The simulation predicted that, without any HIV prevention offered, 99.7 persons (6.5% of patients, partners, and partners' partners) would contract HIV over a 10-year period (Table 1). The symbols in Table 1 correspond to the usage in Figure 2. It was projected that 18.2% of patients, 35.7% of their partners, and 2.6% of partners' partners would be infected.¹

Model 2: Physician Management Model

The second practice model proposes that when the patient visited the physician, the physician offered an HIV prevention intervention. The results in Table 1 show that due to this HIV prevention, 6.2 persons were prevented from becoming HIV infected over the 10-year time frame. This decrease in patient risk behavior had the

¹ The low value for potential seroconversion of the partners' partners was because much less information was available on their sources of potential risk.

Table 1. HIV Transmission Risks

Model		Total number of individuals projected to seroconvert within the next 10 years	Percent infectivity for the patients and their network	Total number of individuals projected not to seroconvert	Percent of patients and their network projected not to seroconvert
Model I					
	Patient (N = 168)	31.8	18.9	0.0	0.0
	Partner (N = 99)	35.3	35.7	0.0	0.0
	Partners' partner (N = 1269)	32.6	2.6	0.0	0.0
	Total network (N = 1536)	99.7	6.5	0.0	0.0
Model II					
	Patient (N = 168)	29.0	17.3	2.8	1.6
	Partner (N = 99)	33.8	34.2	1.5	1.5
	Partners' partner (N = 1269)	30.7	2.4	2.0	0.2
	Total network (N = 1536)	93.5	6.1	6.2	0.4
Model III					
	Patient (N = 168)	28.5	17.0	3.3	1.9
	Partner (N = 99)	32.2	32.5	3.1	3.1
	Partners' partner (N = 1269)	29.7	2.3	2.9	0.2
	Total network (N = 1536)	90.4	5.7	9.3	0.6
Model IV					
	Patient (N = 168)	28.0	16.7	3.8	2.3
	Partner (N = 99)	30.4	30.8	4.9	4.9
	Partners' partner (N = 1269)	28.6	2.3	4.0	0.3
	Total network (N = 1536)	87.1	5.7	12.6	0.8

projected effect of preventing 2.8 patients, 1.5 partners, and 2.0 partners' partners from HIV infection and seroconversion.

Model 3: Integrated Provider/Patient Management Model

Model 3 simulates a healthcare provider-patient team where both the physician and the behavioral health providers offered treatment and prevention to the patient and enlisted the patient as an intervention agent on his or her own behalf. It is assumed that this practice model reduced the partners' behaviors as well as the patients' behaviors. This model resulted in 9.3 persons avoiding infection in the 10-year time frame because of the intervention. The patient's intervention with their partners resulted in the prevention of infection for 3.3 patients, 3.1 partners, and 2.9 partners' partners.

Model 4: Integrated Network Treatment Model

This model simulates a practice where healthcare providers treated the patient and his or her network as a system and provided the prevention intervention to both the patient and the patient's partners. Table 1 indicates that this model had the projected result of preventing 3.8 patients, 4.9 partners, and 4.0 partners' partners from contracting HIV and seroconverting within the 10-year time frame, for a net effect of preventing 12.6 seroconversions. The simulation shows that Model 4 offers the greatest potential in preventing disease, in particular HIV. These results could be extended to include other diseases associated with HIV, such as hepatitis (Amaral, 1998) and sexually transmitted diseases (Wrotten, Crockett, & Kertesz, 1999).

DISCUSSION

This study suggests that it may be time to revisit the traditional medical practice model and explore models that may be more effective in the current environment. The integrated network treatment model is one alternative that holds promise in an era of time constraints, uninsured patients, and rapidly spreading yet easily preventable diseases. On the surface, treating patients in a group rather than in a one-on-one setting may appear neglectful to those who are more familiar with the traditional treatment model; medical effectiveness, lack of privacy, and confidentiality are some of the issues which currently concern the established system and limit innovation and adaptation. However, upon close examination, treating patients in their social networks also offers significant advantages, especially in situations where both the patients and their networks have health needs that require specialized prevention interventions and behavioral health management.

Traditional medical care (Model 1) provides direct benefits to the health and well-being of the patient and provides indirect benefits to others in the patient's social network in the form of reduced caretaking costs. However, as Model 1

shows, when a physician does not engage in prevention efforts, neither the patient nor the community reap other kinds of long-lasting benefit, and they can even be harmed in the long run when the opportunity for preventive interventions is missed by the use of this model.

In Model 2, the inclusion of prevention efforts on the part of the physician affects not only the patient but also indirectly the patient's network as well, which is where the first positive change to the traditional medical model arises. A "high risk" patient and his or her social network may derive significant benefits from a physician's intervention for the sake of disease prevention and risk reduction, and this model begins to show the effects of physician-provided prevention efforts. It demonstrates how individuals beyond the immediate patient can derive benefit.

Model 3 includes the patient in the intervention process, allowing him or her to take ownership of the intervention itself, and the integration of a behavioral health practitioner to the program brings even greater benefits to the patient and network than Model 2. Since patient compliance is greater if the patient is an active part of the treatment plan rather than just a casual participant, working with the patient's network in the next adaptation not only ensures that he or she is taking a greater part in health management, but that the people around him or her are doing that for him or her and for themselves. These results are achieved in Model 4, which treats the entire patient/partner network as the focus of prevention; under this paradigm, the effects are stronger for all members of the network than in any of the other models.

The implication of the simulation, however, is limited by its assumptions. The success of our recommendations will depend on how the parameters of the simulation correspond to real world effects. We need to know what actual behavioral changes occur due to physician or medical team interventions. Much work needs to be done to develop specific intervention scripts that can be delivered within the context of medical care and these scripts need to be evaluated for effectiveness with different patients. Investigation is needed on the tradeoffs associated with integrated care. Does medical care suffer if the physicians are distracted by providing intervention messages? Or is medical care actually enhanced by a broader physician-patient relationship resulting in patient trust?

While some health management organizations have attempted to integrate the strategies of behavioral health providers with those of physicians, and others have attempted to treat patients with similar health needs in a group setting, the use of an integrated network treatment model in prevention techniques simply has not been explored thoroughly enough. The potential benefits of both styles of treatment, when combined into one integrated treatment model, are definitely worth examining in a real world setting. Rather than focusing on the families of patients, as healthcare providers do when aiding diabetic patients in a group setting, it is important to meet the needs of high-risk patients within their actual social contexts. This may necessitate working with partners who facilitate an

unhealthy lifestyle, who may contribute to an increased risk for the transmission of disease, and who may face the same risks themselves. Taking behavioral health management to a new level by considering the actual environments in which patients function and the social networks in which they interact is the next step in joint practice and group medical care.

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Direct reprint requests to:

Dr. Isaac D. Montoya
 3104 Edloe
 Suite 330
 Houston, TX 77027
 e-mail: imontoya@affiliatedsystems.com