

Use is not always what the user says it is in practically any domain, including health care delivery, as the authors' research revealed.

HOW A COMMUNITY HEALTH INFORMATION NETWORK IS REALLY USED

FAY COBB PAYTON AND
PATRICIA FLATLEY BRENNAN

COMMUNITY HEALTH INFORMATION NETWORKS (CHINs) ARE DEFINED BY THE ERNST AND Young Health Care Practice as "interorganizational systems using information technologies and telecommunications to store, transmit, and transform clinical and financial information. This information can be shared among cooperative as well as competitive participants, such as payors, hospitals, alternative delivery systems, clinics, physicians, and home health agencies" [8].

Our 1997 study of CHIN implementations compared diverse network models to categorize these systems based on their purpose, participants, funding source, and services provided [9], identifying four distinct CHIN models: home health delivery, voluntary, enterprise, and telephone-based networks. We looked at a phone-accessible Internet-based computer network called ComputerLink for medical caregivers in Cleveland that was developed for those caring for Alzheimer's disease patients [3] and that has since expanded to include other medical care specialties (see the sidebar "Our Study of Alzheimer's Caregivers"). Inspired by Roger's diffusion of innovation theory (outcomes of an innovation are characteristic of the users and the attributes of the innovation), ComputerLink links caregivers, patients, an academic institution (Case Western Reserve University), and public health agencies in order to reduce patients' and caregivers' social isola-

tion and the social stigma associated with certain medical conditions. ComputerLink and other similar systems are characterized by a cooperative effort from their participants and by their support of various CHIN functions. ComputerLink participants include the Alzheimer's Disease Association in Cleveland under the auspices of the National Institute of Aging, which is part of the Department of Health and Human Services (www.nih.gov/niha).

ComputerLink provides four classes of services: decision support, email, encyclopedia, and bulletin board. Email permits users to communicate anonymously with a nurse-moderator and other Alzheimer's caregivers; the nurse-moderator serves as technical liaison by providing systems and health support to ComputerLink users while maintaining all encyclopedia functions involving Alzheimer's and caregiving information. The decision-support service guides users through a myriad of scenarios permitting self-determined choices based on personal values.

The bulletin board enables users to communicate through an electronic support-group public forum, including participants in the CHIN study.

Meanwhile, other CHINs, including the Wisconsin Health Information Network (WHIN, www.whin.net) in Milwaukee, have emerged to track, access, and distribute voluntarily provided patient and medical information. Owned and operated by Ameritech, the Baby Bell local telephone company serving the Midwest, and Aurora Health Systems, a group of health care providers in Milwaukee, WHIN is technically compatible with various other networks to address its various participants, including hospitals, clinics, laboratories, insurers, pharmacies, and physician offices [3]. WHIN offers such services as eligibility verification, electronic claim submission, benefits

review, and prescription-refill authorization. These services focus on the health transactions needed by health-care professionals to tend to their patients. It also delivers access to application, human, financial, and time resources to support the CHIN initiative. WHIN operates independently of its member organizations as a for-profit organization that, in part, derives revenue from electronically processing health care transactions.

Another class of CHINs takes an enterprisewide approach that can be termed "integrated delivery systems." Enterprise models require that organizations possess or acquire the information technology and infrastructure needed to integrate and share data among their constituent systems. These CHINs generally seek to improve the health of the populations

Our Study of Alzheimer's Caregivers

In our study, we collected data from a passive monitoring system of 47 Alzheimer's caregivers involved in an experimental group using ComputerLink. The average age of the group's members was 60 (standard deviation = 14.4); 33% of the sample of surveyed caregivers were male; 28% were African-American; 86% had completed high school; and 12% reported no prior experience with computers. We analyzed the data to determine how caregivers actually used the system, including email, decision support, and the bulletin board. During an

bulletin board and read messages 2,095 times, representing the most popular CHIN service, or 53% of all accesses. This percentage is attributed largely to the social interaction among users as they formed electronic support groups and communities to cope with the challenges of caregiving. The question-and-answer utility represented 24% of the total frequency of use, clearly pointing to the critical role of the nurse-moderator in service delivery. The question-and-answer utility permitted caregivers to pose direct, confidential questions to a health care professional without the possible social stigma associated with caring for people with Alzheimer's, traveling from one's home, or having to physically leave their patients.

Despite the often perceived need by Alzheimer's caregivers for decision evaluation, the decision-making module was the second least accessed ComputerLink function (only 218 times, or 5% of the total frequency). These figures may be a function of the caregivers' emphasis on seeking to communicate with those in similar circumstances or socializing to overcome personal isolation, rather than for making decisions concerning delivery of care. Therefore, the minimal use of the decision functions supports the notion that caregivers need electronic social channels to reduce the burden often associated with caring for Alzheimer's patients.

We further analyzed the data for the 47 caregivers' actual vs. self-reported system use. To capture self-reported use, caregivers were surveyed 12 months after ComputerLink's implementation. Actual use was captured through a passive

Table 1. Total frequencies of use, by ComputerLink function.

ComputerLink function	Mean accesses
Send message	305
Read messages, bulletin board	2,095
Question and answer module	960
Decision-making utility	218
Electronic encyclopedia (self care)	174
Electronic encyclopedia (about Alzheimer's)	174

18-month period, the caregivers' average access time was 17.86 minutes (standard deviation = 16.98); 30% of them accessed the system more than 100 times, though one accessed it 868 times (see Table 1 for the caregivers' system interaction).

Table 1 shows that users accessed ComputerLink functions 3,926 times, based on total frequencies of use for each system function. They accessed the

they serve by enhancing health care services [3, 8], integrating often dispersed but related applications within an enterprise structure.

Moreover, by acquiring and maintaining intraorganizational systems, health care organizations can migrate and implement such interorganizational technologies as e-commerce, database, and intranet applications. They seek expertise from application vendors, academic institutions, and each of their member hospital and provider affiliates. But before they implement broader CHIN models like WHIN, hospital affiliates generally form multihospital systems or organizations that fund systems implementation [3, 8].

Telephone-based networks (funded by organizations like ComputerLink) have emerged as a type of CHIN offering a relatively inexpensive alternative to

those involving a full-function centralized computer network. Telephones provide community links through a low-cost, widely used alternative to care delivery. Used to address public health needs (such as case management for cocaine-abusing pregnant patients), telephone technology can help deliver medical, prevention, and patient self-care services through conference calling, patient education, support groups, voice mail, referral information, and announcement services [3, 8]. Being less motivated by financial gain, these CHINs are also easier to finance, implement, and operate, as they focus on a limited number of participants, including academic institutions, local government agencies, community volunteers, and individual patients.

Some distinctions among CHIN models are worth

monitoring system (reported in Table 2 as number of ComputerLink accesses). The table shows the survey items, Alzheimer's caregivers' self-reported responses, and mean frequencies of use.

The table also shows that Alzheimer's caregivers underestimated their system use during the survey's 12-month duration. Though the study addresses the subject of time in assessing use, the table supports the findings of the earlier studies [4, 10] in that infrequent users tend to inflate their own use. Moreover, unlike traditional organizational users, as reported in those studies, ComputerLink subjects did not consistently distort their use of the network. Rather, self-reported figures lagged actual use; most ComputerLink users underestimated actual results compared to perceived figures. Thus, professional and nonprofessional users can be contrasted, as tightly coupled organizational users are strongly influenced by their managements' mandates, policies, and procedures governing system use. Given that the system's financial support came from the National Institute of Aging, ComputerLink users were not overly influenced by the kind of organizational pressures often associated with other professional domains. They were under no pressure to inflate use and somehow correlate that use with system success.

These findings prompt questions about behavioral measures of systems use. The number of accesses and mean time by caregivers on ComputerLink suggests two possible results: use inflation

and use deflation. Users may inflate their actual use by their actual vs. perceived time on the system [4, 10]. The passive monitoring system continues to "record" time connected to the system, even though users are not interacting with the system. For example, caregivers can log onto the network, access several functions, and be interrupted by having to administer care to their patients.

Use might be deflated if we were to examine only the number of accesses or connection times. For example, after a caregiver has logged off the system, learning, recall, and information processing can still take place. The system has ex post influence on users as a result of their use of it. However, these measures go uncaptured by the passive monitoring system. **C**

Table 2. Self-reported use vs. actual use, as calculated by the network.

Self report	Number of users reporting use	Mean accesses
Used computer more than eight times in a year	10	19.4 (standard deviation = 14.1)
Used computer once a month	13	60.6 (sd = 55.6)
Used computer once a week	16	79.4 (sd = 66.3)
Used computer once a day	7	147.4 (sd = 80.9)
Used computer more than once a day	1	590.0 (sd < 0.1)

noting [9]. For example, ComputerLink is a relatively small-scale CHIN with specific service offerings (such as referral information, an electronic encyclopedia, email, a bulletin board, and decision support) for specific populations (such as Alzheimer's, AIDS, and HIV patients). Moreover, ComputerLink is funded by the National Institute of Aging and other organizations that issue financial grants, unlike other CHINs. ComputerLink is not subject to specific organizational objectives, such as reducing costs and gaining competitive advantage. In the future, larger-scale CHINs will serve more diverse user populations with more services and more participating organizations.

No matter which CHIN model they implement, health care providers and payors (including insurers) can expect significant benefits. Intensive reporting functions are increasingly in demand in light of the current challenges to the Medicare and Medicaid systems—massive cost reductions, industry mega-merg-

A 1985 study, still cited regularly, of 404 IS managers and professionals using computer-based modeling systems examined perceived and behavioral measures of use [10], including report accuracy, relevance, usefulness, and timeliness. Based on self-reports, the author determined that users tend to overestimate their own personal use; actual use lagged reported use. An implication of these findings is that perceived and behavioral measures are not always positively correlated.

Organizational users continue to perceive their system use at higher levels than recorded use. Still, use is not merely a binary construct, resting largely on users' experience, attitudes, and beliefs. Another study published in 1994 using interactive questionnaires sent to 219 professionals IS professionals also supported these notions [11], concluding that experience influenced use directly, and that five additional constructs—social factors, affect, job fit, long-term

IN THE CASE OF COMPUTERLINK, USERS SIMPLY WANT SOMEONE TO CONVERSE WITH AND SHARE IDEAS.

ers, the decline of fee-for-service medical care, and the shift away from the single-physician practice. Thus, health care organizations not only have to justify the services they provide but more and more how they use them.

Dimensions of IS Success

The taxonomy in [6] posits six major dimensions of CHIN system success, including use, which can be characterized by number of computer inquiries, computer functions utilized, and records processed, as well as connection time. The framework in [6] delineates how the computer field in general has adopted a myriad of implementation scenarios, resulting in diverse definitions of IS success. This diversity has prompted debate over various definitions of "use," including mandated and voluntary, guided and direct [5], actual and perceived, obtrusive and unobtrusive [12], and even who should be categorized as a system's user. Some authors have proposed that our notion of system use should be limited to the degree that use is voluntary [7].

consequences, and facilitating conditions—have moderating influences on system use.

A 1996 survey of 401 IBM managers and professionals observed that logged interactive use lagged self-reported use by 32% [4]; self-assessed time was 3.9 hours per day compared to a logged interactive time of 2.7 hours per day. Heavy users tended to underestimate their use; light users did the converse. Moreover, time, though a complex construct that does not fit easily into the usage context, should be included when IS researchers measure and assess system use.

Although these studies have contributed to our understanding of how systems are used, the relationship among the construct in question, as well as time and behavioral effects, warrant further investigation, especially in health care. That is, further investigation is needed if we expect to overcome economic, competitive, political, and interorganizational enabling factors (such as planning, needs assessment, and organizational readiness) during implementation. These considerations bring to bear improved model building and testing of systems use. For practitioners in

general and health care professionals in particular, these criteria provide a way to assess a system's value creation, economic benefits, and outcome measurements.

Who Are the Users?

Several authors have addressed the notion of use by examining the question of who actually uses a particular system [6]. At least one suggested the integration of use and time to eliminate or reduce biases in retrospective self-reporting [4]. Another studied direct use and so-called "chauffeured" use, or use through others [5].

Our study debunks the prescription that all users tend to overstate their use. In fact, practitioners and researchers should assess the class of user (such as professional vs. nonprofessional) when evaluating systems use. Our study has special implications for designers of systems in general and home health care CHINs in particular. Designers often develop systems based on their perceptions of what users want and need. In the case of ComputerLink, as shown in sidebar Table 1, users simply want someone to converse with and share ideas. Thus, they put little emphasis on ComputerLink's decision-support functionality, focusing more on email and bulletin-board services.

Though our results are based on a limited sample, they represent a model through which researchers and practitioners alike can examine the whole notion of use. But note that care is needed when interpreting such use, particularly in health care settings. Reports of a system's use can potentially lead to inflation of traditional health care services—many of which are non-billable and increase the cost of care. Use, in itself, is but one measure of value creation. CHINs and information delivery system sponsors have to develop economic models and mechanisms to overcome and reduce the political and competitive forces plaguing their implementations. Moreover, any assessment of use requires years of data to yield a more accurate evaluation.

A single anecdotal example of a system actually being used may fail to capture the social benefits of interorganizational systems as they are perceived by diverse user groups. Multiple characterizations of use can help us understand how a system is being used, particularly in a domain as complex as health care. The fields of computing and health care management have to explore these issues to ensure that health networks create value and improve the quality of patient care.

Limitations and Future Directions

Despite our findings and their implications, the research is limited. Our findings are based on a sam-

ple size of only 47 caregivers for Alzheimer's patients. Thus, the general applicability of our results should be weighed carefully, and the conditions under which they apply investigated further. Analyzing use in the remaining CHIN classes—voluntary, telephone, and enterprise—can add to our understanding of system utilization in general and in health care delivery networks in particular. Our findings suggest that a more user-centered design is advantageous, if we want our CHINs and other networks to provide functionality and services that are valuable to users. **□**

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FAY COBB PAYTON (Fay_payton@ncsu.edu) is an assistant professor of management information systems in the Department of Business Management in the College of Management at North Carolina State University in Raleigh, N.C.

PATRICIA FLATLEY BRENNAN (pbrennan@engr.wisc.edu) is the Moehlman Bascom Professor in the School of Nursing and College of Engineering at the University of Wisconsin-Madison in Madison, Wisc.

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