
The Diffusion of Medical Information Technology in Central and Eastern Europe and the New Independent States

**An Assessment of the AIHA Learning Resource Center
Project**

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Executive Summary

Accompanying the United States International Health Alliance (AIHA) Learning Resource Center Project Coordinator, two independent researchers conducted interviews with medical professionals at eighteen medical institutions in two Central and Eastern European (CEE) countries and five New Independent States (NIS). The purpose of these interviews was to assess the use of the new medical information technologies in the Learning Resource Centers (LRCs) of each institution and to consider the sustainability of the LRC in each institution.

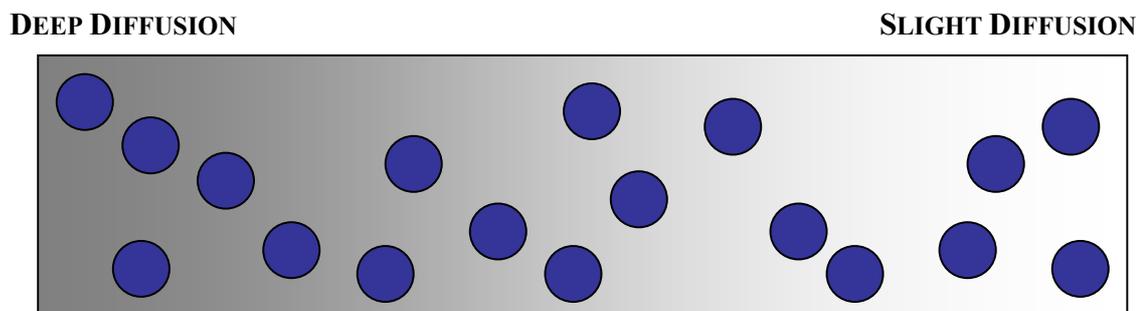
By using the theory of the diffusion of innovations, elaborated by Everett Rogers in *The Diffusion of Innovations* (1995), the researchers reached a number of important conclusions regarding the LRC project:

- As an innovation, the medical information technologies that constitute the LRC project consist not only of a new object, but also a new set of practices and a new way of thinking about the practice of medicine. In other words, the LRC project is both a concrete and abstract innovation.
- The depth to which this innovation has been diffused throughout the eighteen sites varies widely, although every institution was making excellent efforts to use the technology to the greatest extent possible given their particular contextual constraints.
- The depth of the diffusion was linked to ten identifiable factors:
 1. material infrastructure,
 2. partnership with United States medical institution,
 3. Role of the information coordinator,
 4. Communication channels among constituencies,
 5. Meeting the LRC project objectives,
 6. Identification with the LRC project objectives,
 7. Integration of the LRC as a concrete innovation,
 8. Going beyond the LRC project objectives,
 9. Additional funding sources,
 10. Integration of the LRC as an abstract innovation.
- The extent to which these ten factors exist at an institution indicates the depth to which the LRC project has established itself as a substantial, integral, and

sustainable entity in the institution. This depth varies, and this variation constitutes a continuum of diffusion (see figure below).

- This continuum is characterized by a clustering of institutions around the deep end of the continuum, where many of the ten factors are developed, across a middle range, and then again around the slightly diffused end of the continuum, where many of the factors are not yet developed.
- Most importantly, this continuum of diffusion also correlates with self-sustainability: those institutions at the deep end of the continuum have a much greater chance of sustainability at this point than do those that constitute the mid-range or those that cluster at the slight end of the continuum.

Figure: Continuum of LRC Diffusion Depth



As the figure above indicates, approximately one quarter of the LRCs appear at the deep end of the continuum, another quarter cluster at the slight end of the continuum, and the remaining half stretch across the middle range.

Introduction

From July 17 to August 2, 1998, two independent evaluators from the University of Minnesota, Doreen Starke-Meyerring and Julie K. Daniels, accompanied AIHA Learning Resource Center Director, Mark Storey, on eighteen site visits to medical institutions in two Central and Eastern European (CEE) countries and five New Independent States (NIS). We understood that the purpose of these site visits was to determine the status of the Learning Resource Center (LRC) Project in each site: how the LRCs were being used and how the information technology was being diffused throughout the medical institutions. Also, because we are communications researchers, we had the additional goal of assessing the communications practices and strategies used by the information coordinators as they communicated information about the LRC (its uses and possibilities) throughout their medical institutions and as they communicated with audiences outside their medical institutions.

According to the LRC project description, the LRC project exists to "create a link to the growing network of medical information available throughout the Internet. This link will provide new opportunities for continuing medical education for physicians, nurses, and other staff. Partnership institutions will be able to develop a virtual medical library at relatively modest cost" (1). In other words, this description points to three specific LRC objectives:

1. To provide access to current medical information in electronic form;
2. To train medical professionals to use information technology for professional purposes;
3. To find, organize, and maintain a collection of relevant medical information for the medical institution.

This report assesses the extent to which these objectives have been achieved (and sometimes surpassed); it describes factors that contribute to the achievement of these objectives (factors that also indicate an LRC's sustainability) as well as strategies that encourage and obstacles that impede the achievement of these objectives.

Method

We conducted open-ended, tape-recorded interviews, approximately 40 to 70 minutes in length, with three constituencies in each medical institution: information coordinators, staff members, and administrators. Sometimes we spoke with a mixed group (for example, staff members and information coordinators or administrators and staff members), and sometimes we talked with a single-constituent group (for example, the information coordinator alone or the staff members alone). In one case, we talked with an information coordinator and her staff members while an information coordinator from another medical institution was present in order to translate. These variations occurred because of the unique constraints at each institution: for example, at some sites, the administrator wanted to control the site visit to a great extent; at other sites, few staff members were available because of vacations; at other sites, the information coordinators had prepared rather formal presentations that left less time for interviews.

For almost every interview, we used interpreters who translated our questions from English to Russian. Because one member of our team could also speak Russian, she served occasionally as a translator when a site-specific translator was not available, was tired, or was not quite sure of the questions we were asking.

Although we prepared ten questions about the LRC project in advance (see appendix), we did not adhere rigidly to these questions because each situation was unique, and we followed the interests, to some extent, of each constituency (information coordinators, staff, administrators). The open-endedness of the interviews, along with our limited familiarity with the LRC project and the medical institutions themselves, allowed us to gain and then provide the AIHA with a fresh perspective on the project. Because we needed both background and specific LRC information, our open-ended interviews yielded more qualitative than quantitative data. Because our assessment focuses on qualitative data, it is intended to complement the AIHA evaluation of the LRC project.

Framework for Analysis

In order to interpret the results of our interviews, we use diffusion theory, most notably that of Everett Rogers as described in his book *The Diffusion of Innovations* (1995). A well-recognized diffusion theory, Rogers's model has been used by the United States Extension Service and other governmental agencies. What follows is a brief discussion of the two concepts "innovation" and "diffusion" as they relate to the LRC project.

Innovation

According to Rogers, an innovation is "an idea, practice, or object that is perceived as new by an individual or another unit of adoption [such as a medical institution]. An innovation presents an individual or an organization with a new alternative or alternatives, with new means of solving problems" (xvii).

In the LRC project, the innovation consists of all three components—object, practice, and idea. The **objects** are the computer and its accompanying information technology, such as a printer, a modem, software, databases, and discussion lists. The **practice** is the whole series of activities that this information technology allows, from email exchanges, on-line searches, and diagnostic consultations to on-line publishing of medical information, patient databases, and local area networks. The **idea** consists of a complex set of assumptions about the value of technology as it contributes to the practice of medicine, assumptions that are shared to varying degree by the CEE and NIS medical institutions.

Diffusion

According to Rogers, diffusion is "the process by which an innovation is communicated through certain channels over time among the members of a social system. It is a special type of communication, in that the messages are concerned with new ideas" (5). Diffusion in this sense is a kind of social change, the process by which an alteration occurs in the structure and function of a social system (6).

In the LRC project, information coordinators are the people who specialize in this particular type of communication. Their job is to facilitate the diffusion by communicating with their colleagues, both in ways suggested by the AIHA and in ways that they themselves find effective. They are in charge of creating and encouraging the process by which their medical institution will change enough to enable the innovation to take hold.

Characteristics of the Innovation

According to Rogers, the degree to which an innovation diffuses is largely dependent on its characteristics as they are perceived by potential adopters. These characteristics include the following:

- 1) the relative advantage of an innovation, including economic advantage, social prestige, convenience, and satisfaction;
- 2) its compatibility with existing values, past experiences, and needs of potential adopters; and
- 3) its complexity, trialability (the extent to which new adopters can practice with and test the innovation), and observability (the extent to which the innovation's effects are easily observed by the adopters) (Rogers 15-16).

Relative Advantage

The LRC project was almost universally perceived by those we interviewed as offering high advantage to the medical profession. For example, depending on the economic, social, and institutional context of the LRC, respondents identified various economic values of the innovation: well informed medical personnel are more likely to attract a larger number of patients and thus more funding; institutions can charge users a fee for conducting searches of medical databases; institutions can find information about granting agencies in order to secure additional funding. In addition, convenience was an advantage that a number of respondents mentioned, especially those who conduct research. Information from all over the world is available—fast. Researchers and students saved time by finding medical information on-line when preparing classroom lectures, conference presentations, journal articles, and dissertations. One medical

researcher estimated that she would have taken one-and-a-half years less time to do her dissertation research if she had had on-line resources.

Social prestige, too, was seen as an advantage of the innovation. For example, one respondent said that knowing how to use information technology helped his institution demonstrate a level of medical knowledge similar to that of its United States partnership hospitals, making them equals rather than subordinates. Another physician pointed out that because the Soviet system had been a closed one, he did not know how the level of Soviet medical practices compared with medical practices in other parts of the world; through the Internet, he was able to learn about the practices in other countries and see similar standards and practices, affirming that Soviet practices were at a high level. In addition, using current medical information increased physicians' credibility when they presented their findings at international conferences. In a striking example at one medical college, a student club conducted studies and developed a nursing practice method with the help of on-line resources that they will write up and publish on-line. The students presented their work at a conference where they "surprised" and impressed the faculty and students at the college with the high quality of their research. The entire institution was proud of these students' work, which they felt contributed to the prestige of the entire college.

Most respondents clearly perceived the innovation as an advantage, as something that was "teaching them how to fish" rather than simply "giving them a fish." In fact, many staff pointed out the crucial importance of information technology when compared with medical equipment: although gauze for bandages and sharp needles for IVs were necessary, they were one-time aids. Information technology would continue to aid the institution into the future.

Compatibility

The compatibility of the LRC project innovation with the values, past experiences, and needs of the medical institutions depended largely on the cultural and economic conditions of that particular institution. For some institutions, especially those in countries that are more aligned with Western

values, the LRC project naturally enhanced their push to improve their medical practices; the information technology and accompanying training provided additional opportunities for these institutions to meet their own institutionally-determined needs.

For other institutions, however, pressing economic needs compete with the need for medical information; this competition seems to foster stronger re-invention processes, such as using the LRC project equipment only in the accounting department as a way of making the information technology compatible with the needs of the institution. In addition, in some regions, computers and network technology are less widely spread than in other regions, possibly indicating a difference in cultural values. It seems that computers reflect and support specifically United States cultural ideologies, particularly the valorization of speed, efficiency, individual virtuosity, and reliance on technical intervention in problem solving. Such values may be more compatible with or may have been more absorbed by some cultures than by others. As one administrator explained, the mind and the hands of a physician will always be more important than the computer; to him, the idea of using computer technology as a substitute for human mental processes did not seem to be compatible with his belief system.

Complexity, Trialability, Observability

In terms of complexity, trialability, and observability, the LRC project seems to be relatively difficult to diffuse. Given the variety of uses, functions, skills, and types of knowledge required to master the innovation, the majority of the respondents perceived the technology to be complex. This perception again also depended upon the extent to which such technology was already generally spread in the culture. In regions where the technology was not as widely spread, information coordinators found it helpful to reduce the perception that the information technology was complicated. For instance, one information coordinator tried to dispel her colleagues' image of the computer as "monstrous" by demonstrating the "friendly" side of the innovation: it could be used to send email messages to friends and to find non-professional information such as news about movie stars. Another information coordinator presented herself as a model

of a learner who started from ground zero, knowing nothing about the computer but being able to learn; if she could do it, so could others.

In addition, the AIHA itself has made great effort to reduce the perceived complexity of the innovation by organizing a number of extensive training workshops for information coordinators; respondents always pointed out the crucial importance of these workshops for the successful work with the LRC project.

Given such perceptions of the innovation's complexity, the two characteristics of trialability and observability become important. Unfortunately, with limitations in the number of computers and the time for Internet access, trialability—experimenting with the new information system—was not an option for many medical professionals. This obstacle may indeed be one of the most significant in the diffusion of the new information system, especially because, as Rogers points out, trialability is considered particularly important by early adopters of an innovation, much more important to them than to later adopters (16).

In addition, contrary to first impressions, the observability factor is rather complex for the LRC project. By observability, Rogers means the extent to which the results of the innovation are visible to others (16). Because the innovation is an information system, it consists not only of an immediately observable object (a computer), but that object also opens the door to practices and ideas that are not immediately observable; the innovation's impacts and advantages are mediated by other processes and human behaviors. For example, the results of a new treatment method discovered by means of the information system will be observable only after time has passed and the patient improves. To offset this delay in observability, the AIHA has expertly—and wisely—communicated these long-term advantages by publishing brochures and journal articles in Russian and in English, describing innovative uses of the technology that have saved and improved many human lives.

Considering these characteristics of the LRC project, it becomes clear that it is a highly complex and difficult innovation to diffuse, especially in regions where the technology itself is not as widely spread or does not coincide with cultural values

and belief systems. Consequently, the diffusion of the innovation varies from institution to institution. In the following analysis, we identify ten factors of the LRC project that can be used to assess the degree to which the innovation, as an object, a practice, and an idea, has been diffused in the institution.

Assessing the Diffusion of the Innovation

According to Rogers's theory, when an innovation is adopted by 20% of the members of a group, the rate of adoption starts to increase dramatically. A snowball effect takes place, and the innovation begins to diffuse rapidly. However, for at least three reasons, this simple quantitative assessment of the diffusion (20% of users) is not adequate for gauging the LRC project's rate of diffusion. First, the LRC project is complex, with the innovation consisting of an object, a set of practices, and an idea. An idea is more difficult to diffuse than an object because it is less observable, more value-laden, and it requires a change in institutional culture.

Second, the innovation is being diffused into an institution rather than simply to individuals, a process that Rogers indicates is "much more complex" (371). When an innovation is diffused through an organization, the process involves both collective and authorial decisions in a specific institutional context, a context that exists in addition to the social, cultural, and economic context. Institutions usually have predetermined goals, rules and regulations, informal patterns, practices, and relationships; thus, to a certain extent, members of the organization have prescribed roles (375-76). These roles may or may not be big enough to include the adoption of an innovation.

Third, a quantitative measure focuses on how widely the innovation has been diffused rather than how deeply it has been diffused. We use the term "widely" to refer to the number of constituencies or individuals who actually use the technology and the frequency with which they use it. On the other hand, the term "deeply" indicates the extent to which the innovation as an object, practice, and idea has become a substantial, integral, and sustainable entity in the institution. Although it is important to understand how many constituencies use the LRC and how frequently they use it, these quantitative measures do not fully indicate sustainability. Unless the innovation

has been integrated into the institutional culture, it can easily be given up or taken away without significant resistance on the part of the constituencies.

The term “deep diffusion” focuses on the complex interplay of at least ten identifiable factors, which are described below. Of these ten factors, no one factor is a direct indicator of sustainability, nor can any one configuration of the factors predict successful sustainability. The interplay of these factors can and does differ widely because each of the factors can be present to a greater or lesser degree in any of the institutions. Our data indicates that the possible combinations of factors are many. A dynamic interaction of the ten factors contributes to the achievement of a critical mass of users, which will lead to the sustainability of the LRC project.

Ten Diffusion Factors

Almost all of the people at every site concur with the primary LRC project objective, as stated in the AIHA brochure: to obtain up-to-date international medical information in order to improve the medical practices in each institution. However, to organize the discussion of the individual LRCs and to show trends that we observed, we will use the *long-term* goal of the LRC project—to create a *sustainable* link to electronic information sources—as the guiding principle. The extent to which an LRC will achieve sustainability seems highly correlated with the depth to which the LRC project goals have become diffused throughout the medical institution. The depth of diffusion is indicated by the following tangible and intangible factors:

- 1. Material infrastructure:** electricity, phone lines, space, security, financial support, etc.;
- 2. Partnership with United States medical institution:** length of partnership, number of institutions linked with the United States partner, frequency and nature of partnership correspondence, etc.;
- 3. Role of the information coordinator:** understanding the role to be that of a functionary, someone who responds to information and training requests, or that of a visionary, someone who imagines and develops innovative ways of incorporating information technology into the institution;

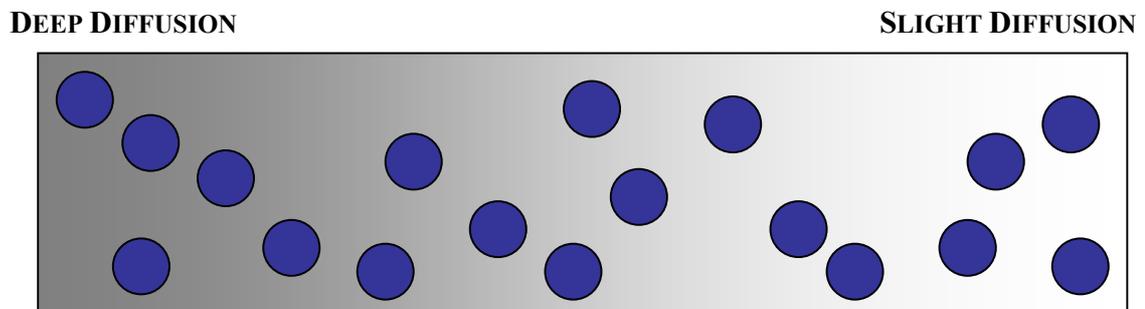
- 4. Communication channels among constituencies:** between information coordinators and staff, information coordinators and administration, administration and staff;
- 5. Meeting the LRC project objectives:** 1) access to information, 2) training, 3) maintaining a library;
- 6. Identification with the LRC project objectives:** the extent to which individual information coordinators, administrators, and/or staff members identify with, accept, and believe in the LRC project goals, as created by the AIHA;
- 7. Integration of the LRC as a concrete innovation:** the extent to which the object and practices of the LRC have been integrated into the normal routines of the institution;
- 8. Going beyond the LRC project objectives:** ambitious projects that individual information coordinators, staff members, and/or administrators have created in order to meet their own particular institutional needs;
- 9. Additional funding sources:** finding and securing financial support from agencies other than the AIHA;
- 10. Integration of LRC as an abstract innovation:** the extent to which the institutional culture and individual mind-set have changed to include the ideas and values rooted in the technology.

In an ideal situation, LRCs with a strong material infrastructure, strong partnerships, strong administrative support, and high levels of all the other factors would indicate the deepest diffusion and therefore the highest likelihood of sustainability. However, few LRCs work in situations with such an ideal interplay of these diffusion factors. For example, some LRCs may have a weak material infrastructure but strong administrative support coupled with a high degree of identification with LRC project objectives. These institutions might tend more toward deep diffusion than would institutions with relatively reliable material infrastructure but lukewarm administrative support or little identification with LRC project objectives. Moreover, an institution with an information coordinator who has taken on or been given an autonomous, visionary role and with a strong United States partnership may tend toward deep diffusion, despite a relatively weak material infrastructure. These examples are intended to show that the factors, while discrete, interact with one another in ways that are specific to each institution.

Continuum of Diffusion

When assessed along these ten factors, the eighteen sites we visited fall along a continuum of diffusion rather than in distinct categories (see figure 1 below). Because of the complex and various social, economic, political, and institutional contexts within which the LRCs exist, it is not possible (and is unwise) to rank or categorize the LRCs. The continuum is intended to show trends and tendencies rather than quantifiable data.

Figure 1: Continuum of LRC Diffusion Depth



Specifically, approximately one quarter of the LRCs appear at the deep end of the continuum, another quarter cluster at the slight end of the continuum, and the remaining half stretch across the middle range. What follows is a detailed discussion of the sites as they are distributed across the continuum, with particular attention paid to the presence, absence, and interplay of the ten diffusion factors.

Deep Diffusion

In about a quarter of the sites we visited, the LRC project seemed to be deeply diffused. All of the factors that contribute to diffusions seemed to be strong characteristics of these LRCs, although not every factor appears to the same extent in each of the LRCs. Overall, the LRCs are characterized by strong indications for sustainability, including a combination of such factors as a relatively secure material infrastructure, an active partnership with a United States healthcare institution, and dynamic personal relationships of the information

coordinator in the institution. Typically, LRCs that fall on this end of the continuum also have achieved all three objectives of the LRC project and also tend to go beyond the goals of the LRC project. These LRCs have secured additional funding to develop their own approach to using the innovation and to adapt the innovation to their institutional context. Different constituencies in the institutions of these LRCs tend to identify strongly with LRC project goals, and the LRC seems to have become an inseparable part of their daily practice and even of the institutional culture.

Material infrastructure: The LRCs with deep levels of diffusion all had a relatively strong material infrastructure, especially compared to some of the other LRCs. Typically, electricity did not present a problem, the phone lines were of sufficient quality, phone service was available, and the hospitals or institutions were able to pay for phone service on a regular basis. The LRCs were accommodated in a safe, stable, and secure space; often the LRC or its bulletin board was placed in a central location.

Although salaries were low or average compared to national standards, staff members at this end of the continuum typically received a salary on a regular basis. Notably, respondents from LRCs at other points on the continuum mentioned that some staff took on additional work to compensate for low salaries. This time pressure possibly decreased the time they were able to spend with the new technology. However, none of the information coordinators at the deep end of the continuum or their colleagues had to take on a second or even third job in order to earn sufficient income. In the case of one of the LRCs at this end of the continuum, for example, special financial attention from the country's Department of Health and from other funding organizations played a particularly important role, rendering this LRC exceptional in terms of the financial support it received.

Partnerships with United States medical institutions: The success of the partnership with a United States institution and the success of the LRC seemed to be closely related. The information exchange between the partner institutions was two-way: all information coordinators whose institutions had a strong partnership with a United States medical institution stated that the

LRC has helped them communicate with their partners. Moreover, the United States hospitals provided the LRCs and their institutions with a human link, an interpersonal connection that helped to develop the kind of consciousness and mind-set needed for this LRC project.

The partnership also provided the information coordinators in CEE and NIS with familiar colleagues at a United States institution and consequently with an immediate human and interpersonal context in which to apply the new technology. At the same time, this context for applying the technology reflected the cultural context out of which the innovation originated. The CEE and NIS physicians had a United States partner to relate to when discussing medical cases using the new technology; they did not have to begin working with the technology in an impersonal context.

The LRCs that tend toward the deep end of the continuum had strong partnerships. Some information coordinators, for example, held regular electronic consultations with their partners in United States hospitals, or the institution of the LRC maintained active partnerships that included common training seminars and the development of shared resources and approaches to medical treatments. If several LRCs in one city had originally partnered with one United States institution, the LRC that showed the deepest level of diffusion also tended to be one that continued to maintain the most active partnership exchange with the United States institution. The other LRCs that appeared to be less deeply diffused in their institution tended to either maintain a less active exchange with the United States partner or to have lost the contact with the partner.

Role of the information coordinator: Both administrators and staff had high regard for the information coordinators and actively shared in the information coordinators' efforts of disseminating the new technology and the ideas and practices associated with it. Administrators and staff tended to view the information coordinators more as innovators or visionaries than as providers of information retrieval services or as simple functionaries. Staff members tended not to rely on the information coordinator for search services but rather conducted searches on their own or asked for help.

Communication channels among constituencies: The vast majority of the staff we interviewed stated that they had learned about the LRC and its services through informal communication channels ("word of mouth"). This finding was consistent with Rogers' observation that "diffusion is a very social process," in which "people depend mainly upon a subjective evaluation of an innovation ... from ... near peers" (18). By and large, all the information coordinators at the deep end of the continuum had effective interpersonal horizontal and vertical communication channels across borders of age, gender, and hierarchy. They usually communicated informally and formally with other staff as well as with the administration. The staff had usually learned about the LRC project through horizontal and informal communication channels—through "word of mouth."

Achievement of LRC objectives, additional projects, and funding: The LRCs at the deep end of the continuum had achieved all three objectives of the LRC project. They all had provided access to electronic medical information, had trained staff in using the technology, and had established virtual libraries. They had also gone beyond the LRC project and had endeavored to implement their own projects for the benefit of their institutions. Most notably, one LRC had turned the AIHA computer into a server for the hospital and had developed and published extensive medical and pharmaceutical databases in Russian for anyone to access through the Internet. In addition, the information coordinator of this LRC involved the larger community by creating Web pages for the city. The information coordinator had also developed his own unique approach to his work by recommending that each Department select its own information coordinator to work with the technology. This concept seemed to work very well in this institution since it not only disseminated the innovation but also provided for back-up, structure, and organization of access to limited resources for colleagues with limited time.

Likewise, another information coordinator had developed a special database for medical care in his institutional unit and published his research and that of

his colleagues on the LRC's web site. At the same time, he used this research presentation on the Web site to persuade visitors to the site of the benefit of evidence-based medicine—a relatively new medical concept and procedure that is a part of the LRC project. The information coordinator had sought and received additional funding from the AIHA for the database. In addition, funding from other organizations supported the information coordinator's participation in medical seminars in Western Europe. The effort to secure additional funding was not limited to isolated instances but seemed to be part of the information coordinator's regular work with the LRC; when we were visiting, he was looking for funding for a new project.

Another information coordinator had developed his own approach by conducting training seminars on Saturdays to accommodate the time constraints of his colleagues. He also introduced his LRC and its services to doctors at medical conferences in the region. This LRC also had a special system for providing access to the technology by providing a central key and a sign-out book. Apparently, the staff had learned how to use the LRC on their own. Funding for continued Internet access and hardware updates did not seem to be a problem.

One of the LRCs at the deep end of the continuum was able to go far beyond the AIHA project, establishing a learning center with a large number of computers funded by different organizations. This LRC also had its own fee schedule to achieve financial sustainability. However, this LRC must be viewed as an exception because of its special role in the country and its special funding situation.

Identification with LRC project objectives: All the information coordinators at the LRCs at the deep end of the continuum very strongly identified with the objectives of the LRC project and also enacted this identification. Indeed, the strong identification of the information coordinator with the LRC project objectives might even be one of the most crucial factors indicating sustainability at these sites. This identification was most apparent in their initiative to go beyond the LRC project goals and to use of the LRC as an indispensable research tool for their work. Although the limited data

collected from the site visits do not allow for any definite conclusions, these information coordinators appeared to understand the innovation as an idea and a practice rather than simply as an object. During the interviews, the information coordinators of these LRCs typically emphasized and fervently supported ideas, such as evidence-based medicine, "learning how to fish," or "philosophy of continuous improvement," while information coordinators at other points on the continuum tended to stress the hardware and the CD-ROMs. Most of the administrators in these LRCs likewise strongly identified with the LRC's goals and provided strong moral and financial support. On the one hand, administrators in these institutions supported the information coordinators by understanding the information coordinator role to be visionary rather than merely functionary. Administrators involved information coordinators in decision-making processes concerning goals and vision for the institution and the LRC. On the other hand, sustainability of the LRC after AIHA funding ended was not a question for these institutions.

Integration of LRC project as a concrete and abstract innovation: Most LRCs at the deep end of the continuum were fully integrated into the daily practice and culture of their institutions. Administrators were very involved in the partnership with the United States institution, strongly supported the LRCs, and had actively contributed to the integrating of the LRCs into the institutional culture. Integration strategies included appointing additional information coordinators in other departments of the institution, involving information coordinators in institutional decision-making processes, considering information research in the LRC as a regular part of doctors' work, making the work with a patient database part of the doctors' daily practice, including the work of the LRC in the discussions at morning meetings, and other strategies.

In disseminating the LRC project, administrators as well as information coordinators in these institutions focused on all its components—the object, the practice, and the idea. For them, mastering the hardware was not the main goal of the LRC project but rather a skill that was needed to integrate LRC practices and ideas into the procedures, goals, and life of the institution.

In fact, the information coordinators had worked out particular persuasion strategies or teaching approaches for disseminating the innovation. For example, one information coordinator had realized that senior colleagues tended to be more hesitant to learn how to use the new technology, especially when they learned together with younger colleagues. In response to this specific circumstance, the information coordinator structured learning groups around the age of the learners, teaching senior colleagues in groups separate from younger learners.

Overall, the staff in these institutions at the deep end of the continuum seemed to think that the LRC project benefits "everyone"—all the doctors, the entire institution, and the patients. In contrast, some of the staff in institutions with less deeply diffused LRCs tended to identify a particular unit of the institution that they thought benefited the most from the LRC project. This belief that the benefits extend beyond the hospital walls to the health of the general population indicates that the LRCs at the deep end of the continuum are having a deep effect on the institutional culture.

Mid-Range Diffusion

In over half of the sites we visited, the LRC project seems to have reached a middle-range of diffusion, meaning that some of the ten factors appear to some degree, with the interplay of the factors determining a site's location on the continuum. For example, an administrator at an institution might express identification with the LRC objectives, but that identification might be difficult to see in practice. Or perhaps an institution had had a strong partnership with a United States hospital, but that partnership had become limited to a single point of contact. Or perhaps an institution was seeking outside funding sources but was not yet successful in securing a substantial amount of funding. The interplay and weight of these factors was unique to each institution, and no specific configuration of factors can serve as a predictor of an institution's placement on the continuum.

Material infrastructure: Institutions in the mid-range, for the most part, have a relatively reliable, although sometimes limited, infrastructure, or they

have the means of overcoming infrastructure problems: electricity supplied by their own generator if necessary; relatively reliable phone lines (although one hospital in the mid-range had had its phone service cut off for over two months); a separate and secure (and sometimes quite spacious and pleasant) space for the computer, printer, software, various publications such as *Common Health*, and CD-ROMs; a more-or-less central space for displaying a bulletin board. Far from being perfectly equipped, these institutions knew that they could achieve a deeper level of diffusion if the infrastructure problems were eliminated, but they managed to run the LRC project effectively despite the problems.

Institutions at the mid-range of diffusion also have a degree of financial support for the information coordinator, even though that information coordinator was a volunteer. Sometimes that support took the form of paper, printing toner, and other supplies for the LRC. Other information coordinators were given financial support in the form of a stipend or released time. For example, at one hospital, additional funding was found and more was being sought to pay the information coordinator for his work. At another site, plans were being developed to release the information coordinator from his medical duties so that he could devote his time fully to his work as an information coordinator. Unfortunately, at other sites, the information coordinators were not paid for their LRC work—nor had they been paid for their regular hospital work because of financial difficulties at the state level.

Partnerships with United States medical institutions: Institutions in the mid-range of diffusion have, for the most part, positive, ongoing relationships with their partnership hospitals. In fact, the information technology supports the partnership by providing the NIS and CEE institutions a means of communicating regularly and efficiently with their partners. This communication primarily takes the form of email exchanges and diagnostic consultations (sometimes with images scanned and sent). For example, one medical college has put in place a comprehensive program for training nurse managers, a program that they learned from their United States partner; email helps them communicate about how the new program is working. Also, a physician at another hospital who is also a teacher at the medical university

regularly exchanges email with his colleagues in the United States and consults with them on difficult cases. This pattern is common, with many physicians and researchers reporting the two-way exchange of information that is now possible in a timely fashion, thanks to the information technology. As one respondent put it, the regular mail “is not so perfect,” and she remembered one letter that took five months to reach its destination. With email, she does not have to use or depend upon this unreliable system.

On the other hand, not every institution in this middle range has positive partnerships with their United States partners. In one case where the institution is one of three partnered with a single United States medical institution, the only portion of the partnership still in existence is a student exchange program. Even the equipment donations had ceased, which contrasts sharply with another institution in another country where “all its LRC equipment” was donated by its United States partner. In another site, a similar dissolution of the partnership had occurred. This site, too, is one of three institutions partnered with a single United States hospital, and the only connection left is the LRC.

Significantly, the information technology not only allowed communication with the partnership institution, but it also enhanced communication with colleagues in other republics. For example, a medical college department head in one country was able to consult with a colleague at a tuberculosis institution in a neighboring country. In another instance, the web site for a medical university in another country attracted students from outside that country. In a third instance, colleagues from three different countries were able to collaborate on a presentation for an AIHA conference in the United States

Role of the information coordinator: Institutions in the mid-range of the diffusion continuum were also characterized to a greater or lesser degree by information coordinators who had a significant place within the institution. For example, some of these institutions had administrators who knew about the project, supported its goals, and supported the work of the information coordinator. In one instance, the administrator supported the information

coordinator because she was his daughter. At another institution, the chief administrator himself learned to do his own searches because he believed it was important to model the behavior. At another site, the director, who had only been in her post a year, spoke forcefully about the usefulness of the LRC in three ways: as an information center for the Institute's personnel, as a way of consulting on difficult cases, and as an instructional tool.

On the other hand, at one institution that tends toward the slightly diffused end of the middle range, the administrator was severely skeptical about the project, characterizing computers as toys that took physicians away from their real work. The information coordinator overcame this obstacle, however, by extending himself to the staff, doing things such as translating materials for them and having the LRC open on weekends for their use. The staff members became allies in his struggle with the administrator.

Communication channels among constituencies: Diffusion happens most effectively when the innovation is communicated horizontally, between peers and near-peers. Therefore, personal relationships are important. Institutions in the mid-range of diffusion seemed to have information coordinators who are, for the most part, approachable and friendly, eager to reach out and teach their colleagues about the technology. They communicated well with their colleagues, both formally, such as at weekly staff meetings or through letters to department heads, and informally, such as sending a colleague a printout of an interesting article or providing one-on-one sessions where the information coordinator would walk a colleague through a complicated search. Repeatedly we heard that the staff learned about the LRC and about how to do searches from information coordinators through informal communication channels. “Word-of-mouth” and “through the grapevine” were phrases that staff used to describe how they heard about the LRC. Staff members often praised the information coordinators highly, saying that they were respected, worked diligently for the good of the institution, and were patient with the questions and frustrations of the staff.

Meeting the LRC project objectives: Most institutions in the middle range of diffusion have met, to some degree, two of the three LRC project

objectives. All institutions have met the first objective: to provide access to the medical resources available on-line. This access takes many forms. Most times the information coordinators in mid-range institutions receive requests and conduct searches for people. Sometimes the information coordinators assist their colleagues with their own searches, providing techniques for narrowing the search. Other times the information coordinator will find medical information that he or she feels will be useful to particular people or departments and then distribute this information to them. Also, all institutions at the middle range of the continuum of diffusion have met the third of the three objectives: to maintain some kind of library of resources. These resources include bookmarks of important websites, copies of journals provided by the AIHA or the United States partnership hospitals, and paper copies of electronic journal articles.

The second of the three objectives, to train medical professionals to use information technology for professional purposes, seems to be more difficult to achieve. Although all information coordinators have taught some of their colleagues *about* the medical information available on-line, fewer have been able to teach their colleagues how to find this information *for themselves*. With the exception of one institution that consists of only nine staff members, not one of the mid-range institutions had trained more than 10% of its staff members (physicians, researchers, students) to conduct their own searches. Most respondents cited the lack of computers or Internet time as a reason, as well as their own lack of time, both for getting trained and for practicing what they had learned. Importantly, most staff members we talked with agreed that they were eager to learn how to do this, but the limitations did not always allow them to do so.

Identification with the LRC project objectives: Institutions in the middle of the continuum vary in their identification with LRC project objectives. All expressed their agreement with the first objective, to provide access to current medical information, and all identified with the third objective, to collect and organize a medical information library. However, not all institutions act out this identification in the same way. Those institutions in the mid-range that tend toward the deep end of the continuum do enact their identification by, for

example, participating in conferences using medical information they have received electronically. Those institutions that tend toward the slightly diffused end of the mid-range are less likely to share the medical information they receive; they most often use it to change their own medical practice, such as trying a new surgical technique or administering a different drug.

Identification with the second objective, training others to use the information technology, was the most variable. One institution, for example, simply said that training was not a priority because the LRC is for those who are interested, so they will learn without formal training. Another institution felt that the equipment should be used by those who knew it best—the information coordinators—and therefore others did not need to be trained to use it. Others could be trained *about* the technology, but not how to use the technology. On the other hand, many institutions in this range felt that training staff members was important. The information coordinator saw him- or herself as a trainer rather than a retriever, and administrators asserted that they themselves must be trained to use the technology if they were to provide a good model for their staff members.

Integration of the LRC as a concrete innovation: Most of the institutions in the mid-range have made attempts at integrating the LRCs into the daily practice of the institution. For example, one chief administrator pointed out that he was looking forward to the time when a critical mass of physicians began using the LRC because it would signal that it had become a normal activity of the hospital. At some of the medical colleges, it was considered normal and important to use the LRC for gathering current information for dissertations; in fact, a credible dissertation could not be written without using information received from electronic sources. Also, two Emergency Medical Service (EMS) centers routinely used PowerPoint for giving presentations to incoming trainees.

For many other institutions, however, the LRC is still a special place that few medical personnel visit even if they know about it. At one institution at the

slight end of the middle range, fifteen out of 200 physicians had been trained in the LRC. Another information coordinator reported an average of two information requests per week in his hospital of over three thousand staff members. Perhaps one reason why the LRC is not yet integrated into the daily practice of the majority of medical personnel in these institutions is that these institutions still focus on the innovation as an object and a practice, the more concrete aspects of the innovation. Their focus is on the hardware and on mastery of it rather than the integration of the new ideas to which the hardware can provide access.

Going beyond the LRC project objectives: Institutions in the middle range go beyond the project objectives much less often and less far than institutions at the deep end of the continuum. Instances include one site that uses the LRC to teach English so that staff can become better able to use the LRC productively as a research tool. Another site, an EMS center, has begun to use its LRC as a starting point for opening LRCs in regional EMS centers in the country. Also, more than one institution has published conference notices that they receive from on-line sources. The focus for institutions in the middle range seems to be on using the information technology in conjunction with the training they have received from the AIHA. They are mastering the technology as an object and a set of practices that can affect their own medical practices. None of the institutions in the mid-range have re-invented the innovation to fit their own distinct uses in ways that have not been anticipated by the AIHA, although some of them are moving toward this more abstract understanding of the innovation as they plan for a future without AIHA funding.

Additional funding sources: Although not as rigorous about searching for outside funding sources as those institutions where the innovation has become deeply diffused, institutions in the mid-range do make some attempts to secure other funding in order to enhance the work of the LRC. For example, United States partnership hospitals have donated printers, CD-ROMs, and computers to some of their partnership institutions. The Soros Foundation, too, is an important source of additional funding. It will enable one hospital to have ten more computers by fall. It also has awarded grants to a number of

other medical institutions, institutions both in the mid-range and at other points on the diffusion continuum. In addition, the information gleaned from medical electronic discussion lists and other on-line resources has helped administrators find new funding sources so that they are able to plan for the sustainability of the LRC.

Integration of the LRC as an abstract innovation: This factor is perhaps what most clearly distinguishes the institutions in the mid-range from those at the deep end of the continuum. No institution in the mid-range has assimilated the practices, values, and assumptions of the LRC into its institutional culture. These institutions are still using the innovation as an object and a practice; they have not yet fully integrated the idea of the innovation into their cultural mind-set. This is not to say that they have not used the innovation well; most have done an outstanding job at gaining and sharing the new knowledge that this technology makes available to them. But the LRC still functions as an add-on, an important but not yet essential feature in the day-to-day culture of the institution.

Slight Diffusion

LRCs at the slight end of the continuum, which show mostly beginning signs of sustainability, constitute about a quarter of those we visited. Various reasons exist for their appearance at this end of the continuum. Sometimes, these LRCs deal with unusual economic hardships and thus have a weak material infrastructure. They also tend to have weak partnerships or have even lost their partnership with a United States institution. The information coordinators tend to be put in functionary rather than visionary positions. Some information coordinators were new to the institution and consequently tended to have weaker interpersonal as well as horizontal and vertical communication channels in the institution. They often also had less power than other staff at the institution. They reported that they used persuasive strategies less frequently in their interaction with other staff and the administration because they did not see these strategies fitting in with their understanding of the role of the information coordinator. Most LRCs at this end of the continuum have achieved the first and third objectives (providing access to information and creating a "library") and to some extent, the second

objective—training staff how to use the technology. These LRCs usually do not pursue any projects that go beyond the AIHA specifications and consequently rarely endeavor to secure additional funding resources for the LRC. Different constituencies at the institution do not identify themselves as strongly with the goals of the LRC project as they might in other LRCs—sometimes because they consider other goals more important in their specific context. Consequently, these LRCs do not appear to be fully integrated into the daily practice, or even the institutional culture.

Material infrastructure: Most LRCs at the slight end of the continuum have a rather weak material infrastructure and often struggle with such problems as insufficient electricity, poor phone service, or limited Internet time. Some of the institutions did not receive any government funding and were dealing with irregular power supplies at the same time. Sometimes, the LRCs in these institutions were not provided with a secure space so those computers were stolen and sometimes could not be replaced. At some of these institutions, the staff members and information coordinators reported that they had not received salaries for an extended period of time and that they had had to depend on other income sources or family support. In slightly diffused institutions where the material infrastructure was somewhat stronger, the biggest problem seemed to be limited time on-line and the fear of overusing the time allotted. LRCs in the same city seemed to compete for resources, especially with regard to Internet access time. Even in the LRCs where the material infrastructure seemed to be somewhat stronger than others, additional factors such as weaker partnerships or a lower degree of LRC integration into the institutional practice and culture predominated.

Partnerships with United States medical institutions: An active partnership with a United States medical institution might be particularly important for LRCs at the slight end of the diffusion continuum because the partnership tended to provide a personal context for using the new technology. Considering the perception of the technology as "monstrous" and unfriendly in some of these institutions, this personal context could contribute considerably to the diffusion of the technology, and especially of the practices and ideas associated with it.

Close contact with a United States institution seemed to become less possible when more than one NIS institution was partnered with a single United States institution. The NIS institutions seemed to engage in a political and economic competition for this partnership and the resources that this partnership involved. The institution that emerged as successful from this competition also tended to be the one with the more deeply diffused LRC. The institutions who "lost" the competition, on the other hand, seemed to have less deeply diffused LRCs. Clearly, the factor of partnerships cannot be isolated from other factors, such as identification with the goals of the project or the material infrastructure; nevertheless, the partnership with a United States institution plays an important role in the diffusion of the LRC project.

Role of the information coordinator: Most of the information coordinators in the institutions at the slight end of the continuum seemed to be cast into positions with relatively little power. For the most part, information coordinators were asked to fulfill service requests and thus functioned more or less as reference librarians. They seemed to be viewed as providers of information services rather than as innovators who would inspire colleagues to actively participate in the diffusion of the LRC project. In short, they were assigned a functionary rather than a visionary role. This trend contrasts with more deeply diffused LRCs, where information coordinators tended to be granted a more visionary role. This trend contrasts with more deeply diffused LRCs, where information coordinators tended to be granted a more visionary role. Given such a visionary role, information coordinators were viewed as active participants in the LRC diffusion and integration process in the institution, along with their colleagues and their administration.

With this limited functionary role, information coordinators at the slight end of the diffusion continuum were not involved in any institutional decision making processes on any level. Generally, information coordinators in these institutions seemed to have little power; their position was not considered crucial for the future of the institution.

Communication channels among constituencies: Cast into functionary positions with little power, these information coordinators also seemed to have weaker interpersonal communication channels with administrators. With regard to information coordinator and staff interaction in LRCs at this end of the continuum, informal interpersonal communication channels seemed to play a less important role than in other institutions. Staff members in these institutions typically mentioned brochures and meeting announcements as their main source of information about the LRC's existence. In contrast, staff members at institutions that tended more toward the deep end of the diffusion continuum primarily mentioned informal interpersonal channels, such as "word of mouth" or "through the grapevine," as their source of information about the LRC. As Rogers notes, horizontal or interpersonal communication channels are "especially important in persuading an individual to adopt an innovation" (195).

Communication channels between administrators and information coordinators likewise appeared to be weaker in institutions at the slight end of the diffusion continuum than at institutions at the deep end of the diffusion continuum. In institutions with slightly diffused LRCs, communication between administrators and information coordinators tended to reflect the functionary role of the information coordinator and therefore to be less dynamic and intensive.

Achievement of LRC objectives, additional projects and funding: Most LRCs that tended toward slight diffusion had achieved the first and the third objectives (access to medical information and creation of a "library") to varying degrees. The second objective (training staff) was more difficult to achieve because of time constraints and limited access to technology, especially in regions where computer technology is generally not as widely spread as in other regions. Although the number of staff trained at these institutions was often comparable to that at other institutions, most staff at

these LRCs tended to ask the information coordinator to search for information; they rarely performed searches on their own because they were much less skilled in using the technology. Reasons for this tendency seemed to be limited Internet access time at these LRCs and the concern about possibly over using the allotted time, which was more pronounced at the institutions at the slight end of the continuum than at others.

Few of the LRCs at the slight end of the continuum had begun to go beyond the objectives developed by the AIHA; only one institution had begun to search for additional funding opportunities. However, even if additional funding was secured for new technology, such as a computer network, there seemed to be no plans to integrate the new technology with the LRC project or even to expand the LRC project by means of the new technology.

Identification with LRC project objectives: For the most part, constituencies in these institutions seemed to show a lower level of identification with the goals of the LRC project. The information coordinators seemed to be cast into a functionary position. Consequently they understood their work with the LRC project as providing service to those colleagues who sought the service out after learning about the LRC, mostly through the bulletin board, brochures, or official meetings. Possibly as a result of their functionary position, information coordinators in these institutions also seemed to stress the hardware or object aspect of the innovation more than the ideas and practices associated with it. They focused more on the important goal of mastering the computer and its related hardware and software, such as programs and CD-ROMs. This focus on mastering the technology before moving on to ideas and practices is understandable and even natural, given the fact that sometimes the information coordinator was simply new to the LRC project and at times even to the institution.

Because the material infrastructure of these LRCs and usually their institutions was somewhat weaker than that of other LRCs, the administrations in institutions at the slight end of the continuum seemed to juggle other important needs that competed with the LRC for administrative attention and support. For example, LRCs were moved from one place to

another to accommodate other projects, or information coordinators were replaced several times. Administrators in these institutions also tended to be less informed about the LRC project and its activities. In some of the regions where computer technology was not as common, some administrators also seemed to identify less with the innovation.

Another reason for lesser identification with the LRC project in some regions may be cross-cultural differences, differences that did not prominent in other institutions with more deeply diffused LRCs. Depending on their culture, some information coordinators and administrators might understand their relationship with the AIHA differently than others. While some tended to view the relationship as that of a development or business project and were comfortable with its implied temporary nature, others seemed to understand the relationship as a partnership in the Russian sense of the word, which carries culturally specific implications. Although the term "partner" is linguistically almost the same in Russian and English, its cultural connotations are different. These connotations include an understanding that a partnership is a long-term relationship that is very much based on personal relationship and trust. This meaning of partnership might preclude an "evaluation" of one partner by the other. It might also exclude the idea of intended temporariness for the partnership; the words "temporary" and "partnership" might be seen as an oxymoron.

Thus, if some information coordinators or administrators view the LRC project as a "partnership" with the AIHA, they might feel less inclined to make it their own because the project should belong to the partnership and satisfy both partners rather than become the property of one of the partners. For example, the repeated response at some institutions of "as you wish" to AIHA proposals during the visit demonstrated considerable concern for ensuring that the AIHA be satisfied with the LRC project at their institution. Likewise, administrators' repeated requests that the AIHA point out the institution's "mistakes" in handling the LRC project seemed to indicate that they did not consider the LRC project *their own*. Viewing the relationship with the AIHA as a partnership in a culturally specific way, administrators or

information coordinators might fear that "taking" the project into their own hands is inappropriate.

One possible reason why the relationship with the AIHA might be understood as a partnership in culturally different terms is the lack of a schema for a development relationship. Development work was not a part of the experience of people in the former Eastern Bloc, and exposure to the West was and is somewhat more limited in some regions than in others. Therefore, people might apply existing cultural schema of partnership to development work and hesitate to make the project *their own*.

Integration of the LRC as a concrete and abstract innovation: The LRCs at the slight end of the continuum tend to be somewhat integrated into the daily of practice of some of the staff, mostly in the form of information requests. Staff members, administrators, and information coordinators typically focused on the concrete components of the innovation—the hardware, the software, and the practices associated with the hard- and software—rather than the abstract component, specifically the idea associated with the innovation. However, since constituencies in institutions at this end of the continuum showed mostly beginning signs of identification with the LRC project, the LRCs in these institutions were not integrated into the institutional culture. In some cases, economic conditions and institutional and regional culture may interact in such a way that cultural integration might be a more complex, long-term process.

The AIHA's Role in the Diffusion

The role of the AIHA in the diffusion of information technology is crucial. Information technology for medical purposes is a difficult innovation to diffuse for two primary reasons: First, it is highly complex and allows only for limited trialability and observability. Second, the innovation involves not only objects but also practices and ideas that originate from a specific cultural context. Considering these characteristics of the innovation, it is unlikely that this innovation would have been diffused without the thorough and persistent work of the AIHA.

The efforts of the AIHA in the form of the LRC project have made it possible for most of the institutions we visited to achieve the three major project objectives: to provide access to up-to-date medical information, to train medical professionals in the use of information technology, and to develop information resources for medical institutions. Through the LRC project, information technology appeared to be deeply diffused in about a quarter of the institutions we visited, with the LRCs in these institutions indicating high sustainability. More than half the institutions we visited appeared to be more or less sustainable, with some institutions tending more toward deeper diffusion and sustainability and others less. Again, considering the characteristics of the innovation, the relatively short time frame for the diffusion, and the sometimes difficult economic and technical conditions, the work of the AIHA was clearly indispensable for this diffusion process.

This remarkable success was achieved by a variety of AIHA diffusion strategies. From our observations, our conversations with AIHA representatives, our participation in the AIHA mailing list, and the materials we have received from the AIHA, the following strategies seemed to stand out as particularly successful: training workshops, publications, use of a mailing list and email, English language classes, well organized feedback processes, focus on sustainability, and encouragement of re-invention processes.

Training workshops

The AIHA organized a number of training workshops and conferences for CEE and NIS information coordinators as well as conferences for administrators. On the one hand, these workshops provided information coordinators with technical expertise in the use of information technology and in information management. Information coordinators also received training in business plan and grant writing to support their sustainability efforts. In this way, the training workshops helped reduce the complexity of the innovation and promote sustainability. On the other hand, the workshops contributed to the creation of a sense of community among the information coordinators and consequently encouraged the exchange of information about new technologies and successful information coordinator

strategies. During our visits, information coordinators repeatedly mentioned that these training workshops were very helpful.

Publications

Publications, such as *Common Health* and *Health Care Without Borders*, highlight issues of health care and medical information technology in CEE and NIS. In particular, *Health Care Without Borders* highlights the activities of LRCs in different countries, including ambitious projects, innovative uses of information technology, and successful partnership activities. These publications are particularly important because the institutions have passed early stages of the diffusion process, such as decision making and implementation and are all working through a confirmation stage (Rogers 162-183). According to Rogers, during this stage, change agents "have the additional responsibility of providing supporting messages [confirmation] to individuals who have ... adopted [the innovation]" (182).

The publications also fulfill another important function: to promote the horizontal exchange of ideas for using the innovation in addition to the vertical exchange between change agency and adopters. Rather than learning about the innovation only from the AIHA, information coordinators, their colleagues, and administrators learn about the technology also from peers—other adopters of the technology. In this way, the publications provide an additional source of ideas about how to use the innovation.

Mailing list and email

The use of a mailing list and email serves a similar function as the publications on a more informal level. Like the publications, the mailing list provides information coordinators with up-to-date information about medical information technology. For example, a series of *Tech Topics* analyzes an extensive amount of resources on a specific topic, such as evidence-based medicine, provides an overview of the topic tailored to the needs of information coordinators, and directs them to the most helpful and easily accessible resources on the topic.

Again, similar to the publications, the mailing list also fosters horizontal communication among the different LRCs in addition to vertical communication with the AIHA. However, since it is more informal than a publication, it also fosters a sense of an on-line community and immediate support for difficult medical problems. This sense of community also promotes the distribution of information about medical information technology.

English language classes

By providing English language instruction, the AIHA has enhanced communication with the LRCs and has helped to overcome language barriers and thus to reduce linguistic heterophily between change agents and adopters. At the same time, English language instruction has helped information coordinators to work more effectively, considering that much of the medical information on the Internet and in most medical databases on CD-ROMs is published in English. Although some information coordinators and staff we talked to reported that they learned English on their own, others mentioned that AIHA classes constituted their first opportunity to learn English.

Well organized feedback processes

The AIHA has developed multiple and effective ways of soliciting feedback from the information coordinators about the LRCs and also of providing feedback to them about the overall development of the project. For example, monthly reports from the information coordinators enhance the AIHA's ability to watch the diffusion process, thus allowing for support if needed. "LRC topics," written descriptions of a software program, an Internet resource, or a particular use of technology at an LRC, provide not only feedback to the AIHA about the activities of the LRCs but also allow the AIHA to feed back this information to information coordinators. This practice facilitates the horizontal exchange of information among information coordinators.

At the same time, the AIHA provides information coordinators with feedback about the overall development of the LRC project in all regions. "LRC project

News" is sent out to information coordinators on a regular basis, providing them with current information about new developments, activities, and funding.

Focus on sustainability

From the beginning, the LRC project's overarching goal was sustainability. As Rogers states, this goal is important: "...self-reliance should be the goal of change agencies, leading to termination of client dependence on the change agent."

However, as Rogers also points out, many change agencies do not achieve this goal: "They usually promote the adoption of innovations, rather than seeking to teach clients the basic skill of how to evaluate innovations themselves" (357). In the case of the LRC project, the AIHA conducts comprehensive workshops that not only help information coordinators evaluate information technology and resources, but also teach them how to support their LRC financially, for example by means of grant or business plan writing.

Encouragement of re-invention processes

Re-invention, according to Rogers, is "the degree to which an innovation is changed or modified by a user in the process of its adoption" (17). Re-invention is more likely to happen when an innovation is complex, when users don't have full knowledge about the innovation, when the innovation is abstract and has many different applications, or when it can solve a wide range of users' problems (Rogers 178-180). Usually, re-invention does not receive much attention from change agencies and is often even discouraged for fear that re-invention will become so strong that funding purposes are undermined, which makes spending difficult to justify to funding agencies.

However, re-invention processes are important in the diffusion of an innovation because users need to be active decision-makers, adjusting the innovation to their cultural and economic context rather than passively implementing the innovation. The AIHA has openly encouraged re-invention in the form of medical projects that go beyond the objectives of the LRC project. At the same time, the AIHA has tried to balance such processes and to prevent them from moving to nonmedical

purposes by developing regular feedback processes and by providing users with full knowledge of the innovation.

As originator of the LRC project, the AIHA has done much to ensure its ongoing success.

Conclusion

The Learning Resource Center (LRC) project is a success. Adopters unanimously agree that the project has great advantages for the medical profession, for institutional units, entire institutions, and ultimately for patients. The project presents a viable solution to the problem of inadequate information (variously described by those we interviewed as "an information hunger" or "an information vacuum") in CEE and NIS medical institutions. The advantages extend throughout the medical institution and reach far into the future because the innovation allows for continued access to medical information rather than simple use or consumption of a static object.

The LRC project has made it possible to diffuse medical information technology deeply in about a quarter of the institutions we visited, with the LRCs in these institutions indicating high sustainability. More than half the institutions we visited appeared to be more or less sustainable with some institutions tending more toward deeper diffusion and sustainability and others less. Considering the relatively short time frame for the LRC project, the complexity of the innovation, and the at-times difficult conditions, this success is remarkable. With continued support, the majority of these LRCs can be expected to move along the continuum toward deeper diffusion and sustainability similar to those LRCs that are already deeply diffused. About a quarter of the LRCs we visited show only the beginning signs of diffusion. However, these institutions tend to be the ones who seem to have the greatest need for information technology and will need continued support and particular attention from the AIHA in order to move along the diffusion continuum.

The extent to which an LRC will achieve sustainability is related to the depth to which the LRC project goals have become diffused throughout the medical

institution. The depth of diffusion is indicated by the following tangible and intangible factors:

- Material infrastructure
- Partnership with United States medical institutions
- Role of the information coordinator
- Communication channels among constituencies
- Meeting the LRC project objectives
- Identification with the LRC project objectives
- Integration of the LRC as a concrete innovation
- Going beyond the LRC project objectives
- Additional funding sources
- Integration of the LRC as an abstract innovation

These factors indicate a deep rather than merely wide diffusion, which points to the extent to which the LRCs as an object, a practice, and an idea have been integrated as a substantial and sustainable entity in the institution rather than simply as a frequently used resource.

Strategies that work

A number of strategies employed by information coordinators, administrators, and the AIHA help to make an LRC sustainable. The following communication and practical strategies appear to be particularly effective in diffusing the innovation in the institutions:

Information Coordinator Strategies

- In order to help others overcome their fear of computers, an information coordinator used herself as a model learner, someone who did not know anything about computers before becoming an information coordinator.
- One information coordinator split up training classes by age so that the older colleagues, who were less comfortable with the technology, would not feel self-conscious when learning with their younger colleagues.

- One information coordinator taught others by beginning with the "friendly" side of the computer—contacting friends via email, looking up movie star websites—before moving on to the medical information resources.
- In order to assure that each department in his hospital would have access to the information technology, one information coordinator trained one person in each department to serve as a departmental information coordinator.
- The most common persuasive strategy used by information coordinators when confronted with a colleague who was resistant to information technology was to demonstrate the power and usefulness of the technology. These demonstrations include showing colleagues specific images, databases, or on-line journals that pertain to their work, proving to them that the information technology was both fast and vast.
- Information coordinators opened the LRCs and conducted training workshops during weekends and evenings to accommodate their colleagues' schedules.
- Many members of the institution used the LRC to maintain active links to their United States partnership hospital.
- Some information coordinators have sought out and secured outside funding in order to support not only the current LRC but also to buy additional hardware and software in order to extend the usefulness of the LRC.

Administrator Strategies

- Administrators involve information coordinators in institutional decision-making processes concerning the vision of the institution and how the LRC could be integrated in the institution to realize this vision.
- Administrators maintain effective and regular communication channels with information coordinators. They have up-to-date information on the most recent developments in the LRC.
- To inspire colleagues to use the LRC, some administrators act as models and have learned how to use the LRC for themselves.
- Many administrators provide financial and moral support for the LRC.
- Some administrators try to find funding to pay for information coordinators' volunteer work and/ or released the information coordinator from some of their other duties.

- One administrator fostered the use the LRC by encouraging departments to use the LRC for semiannual research report because those departments. The departments that used Internet based resources could base their findings and practices on recent international research.
- Administrators in institutions with deeply diffused LRCs assign the information coordinator a visionary rather than a functionary role in the institution and encourage information coordinators to make their own decisions and to develop their own ideas and suggestions for the LRC's role in the institution.
- To promote the diffusion process, some administrators select individuals with strong horizontal and vertical as well as formal and informal communication channels for the position of the information coordinator.

AIHA Strategies

- Publications reaffirm the adoption decision, provide new ideas for the innovative use of medical information technology, and foster the horizontal exchange of partnership and LRC project ideas.
- A mailing list and email build a sense of community and foster horizontal communication among information coordinators
- English language classes for information coordinators reduce language barriers and help information coordinators work more effectively in an English-language environment—the Internet.
- Well-organized feedback processes help identify a potential need for support and keep communication about the project flowing.
- Training workshops and conferences reduce the complexity of the innovation and build a sense of community among information coordinators.
- A strong focus on sustainability helps information coordinators learn how to support their LRC financially in difficult conditions.
- Encouragement of balanced re-invention allows adopters to adjust the innovation to the specific cultural, economic, and political context of the institution.

Obstacles

Some of the above-mentioned strategies were employed to overcome obstacles in the LRC project. These obstacles ranged from more tangible and external factors—for example, poor phone service or unreliable power supply—to intangible and usually more internal factors, such as communication channels or the power of information coordinators. At times, though, these factors are not clearly separable. For example, the characteristics of partnerships with United States institutions were determined by internal as well as external factors, such as institutional homophily with the partner institution and competition among institutions.

The following obstacles seemed to be predominant:

Difficult material and technical conditions

Almost all LRCs faced obstacles with the regard to the material and technical infrastructure in their countries and institutions. These obstacles ranged from a lack of funding, regular salaries, and secure space to unreliable phone lines and electricity. At times, these difficult conditions and economic needs competed with the needs of the LRCs to function effectively and thus impeded their work. Some institutions were able to overcome these difficult conditions by securing additional funding for the LRC project. Some conditions, such as poor Internet connections, are improving rapidly.

Weak or collapsed partnerships with United States institutions

Partnerships with United States medical institutions played an important role in the diffusion of the LRC project by providing a human and personal cross-cultural context and support for using the LRC, which—as an innovation project—is cross-cultural in the same way that the partnership is. When this context and support were missing, the diffusion of the LRC seemed to be more difficult, especially for those LRCs that demonstrated a slight level of diffusion.

Functionary and powerless positions of information coordinators

Although all information coordinators were committed to the LRC project, some were limited by the position they had within the institution. When their position was limited to providing information services, i.e., if they played a functionary role, they did not have sufficient power to diffuse the innovation and to help integrate it within the institutional practice, culture, and long-term goals.

Varying levels of administrative support

Because the LRCs exist in widely different economic, political, cultural, and institutional contexts, sometimes other institutional needs competed with the needs of the LRC for administrative attention and support. This tendency was often related to an understanding of the innovation as a concrete object rather than as a practice and an idea. Furthermore, administrative support also seemed to be related to the strength of the partnership with a United States medical institution. Strong partnerships presented an additional need and catalyst for administrative attention to the LRC. When partnerships had collapsed, this additional need or catalyst did not exist.

Limited communication channels

Information coordinators who were cast into a functionary position and had less administrative support than those at other institutions often also seemed themselves less integrated within the institution and therefore had weaker informal and formal as well as vertical and horizontal communication channels. These channels, however, are crucial to the diffusion of the LRC project since the diffusion process is essentially a communication process.

Culturally different perceptions of the relationship with the AIHA

Adopters might apply their own cultural schema of a cross-cultural institutional relationship to their relationship with the AIHA. If they perceive their relationship with the AIHA as a partnership built on long-term commitment and personal trust, which some of them seemed to do, they might not be inclined to "appropriate" the LRC project from the partnership.

Language barriers

Closely connected to culture are language differences. These also presented obstacles for the diffusion of the technology, which exists mostly in the English language. Both the AIHA and the information coordinators made considerable effort to overcome language barriers, the AIHA by offering English classes for information coordinators, and the information coordinators by helping staff navigate through medical information in English and by translating large amounts of information. Despite all these strategies, however, language still remains a barrier for many medical professionals in accessing electronic medical information.

Many of these obstacles were overcome to varying degrees by means of practical and communication strategies employed by administrators, information coordinators, and the AIHA. Nevertheless, both the obstacles and the strategies used to overcome them point to some considerations for the future work with the LRC project.

Future Considerations**Continue the project**

Because the LRC project is and has been valuable, a first consideration should be to continue the project. Continuing workshops will teach information coordinators new methods of integrating the information technology into their institutions. Making each LRC's achievements observable to others should continue, too, especially among LRCs, as a way of deepening the diffusion in institutions where it is slight. The LRC project's contribution to each partnership institution is clear and undisputed: some level of observable improvement in medical practice has occurred in all but one institution, and almost every respondent from every constituency—from students to researchers, from physicians to administrators—answered "continuing the project" when asked for their suggestions. One

respondent in particular focused on the fact that continuing this LRC project, rather than starting up new projects, was of extreme importance.

All institutions could benefit from sustained support from the AIHA because that support has already helped more than 50% of the institutions achieve a mid-range of diffusion. They would be more likely to achieve a deep level of diffusion, and thus a stronger likelihood of sustainability, with support rather than without it, especially those institutions toward the slight end of the continuum. These institutions in particular can be encouraged to view the LRC project as an idea as well as an object and a set of practices. In addition, continued support should be tempered with awareness that not all institutions can meet the same set of expectations. One respondent in particular noted that different expectations, along with continued support, should exist because of the wide range of political, socioeconomic, and cultural contexts in which these eighteen sites exist.

Support those institutions where the diffusion is slight

However, unlimited support from the AIHA is not possible, nor is it desirable given the project's long-term goal of self-sustainability. This fact points to a second consideration: that the institutions with the least level of diffusion should be the ones that are supported the most. In Rogers's terms, these institutions are "heterophilous" with (different from or least like) the change agency, which in this case is the AIHA. Because of this heterophily, communication between these institutions and the change agency is more difficult than it is with "homophilous" or similar institutions. This difficulty is normal, an inherent characteristic of the diffusion process, but because of it, these institutions often receive less attention from the change agency. However, as Rogers notes, it is usually these heterophilous institutions that need the most attention (275).

In the case of the LRC project, this paradox has proven true: those institutions whose cultural norms and values are least similar to the AIHA's and its representatives reflect a slight level of diffusion rather than a deep level. In our estimation, the institutions at the slight end of the diffusion continuum will benefit most from continued support from the AIHA, even though this support may require extra effort and time. This support may seem excessive when

compared with the support given to those institutions at the deep end of the continuum; however, it is precisely because these institutions are struggling the most that they need the most attention.

Understand and foster partnerships

A third point is related to this idea of support as a continuation of a relationship: partnerships should be fostered in every way possible. Healthy partnerships seemed to strongly support the diffusion process because they provide ongoing, person-to-person contact with the same cultural context from which the innovation originated. The values and assumptions inherent in the LRC project arise out of a Western perspective; thus, the intercultural communication processes that are necessary for the project's success can be supported through personal relationships between people in CEE and NIS and their colleagues in the United States

In addition, healthy partnerships seem to flourish where there is little competition for partnership resources. In the cities where more than one institution was partnered with a single United States institution, it was difficult for each of the CEE and NIS institutions to maintain a productive relationship. Although this difficulty may have been due to circumstances beyond the control of the AIHA, such as personal conflicts, varying administrative commitment to the relationship, or differing cultural understanding of the concept of "partnership," every effort should be made to encourage productive partnerships.

Encourage visionaries, not functionaries

A fourth point that ties the previous considerations together has to do with vision: If the LRCs are going to survive, they need to be coordinated by people who have been given the authority to act as visionaries rather than cast into the role of institutional functionaries. This distinction between visionary and functionary is crucial for the self-sustainability of each LRC. By "visionary" we mean agents who have people skills as well as technical skills, who have a view toward the future as well as the past, and who imagine and develop innovative ways of incorporating information technology into their institutions; ideally, these people

have the power to implement their vision. By “functionary” we mean agents who have useful technical skills and who function well in their prescribed roles but have not been given the authority to go beyond this role.

Rogers talks about an innovation as an object, a practice, and an idea, three concepts that relate to the level of diffusion that we see in the LRCs. Institutions that focus on the object and practice nature of the innovation rarely move to the deep end of the diffusion continuum because the information coordinators at these institutions remain in the role of functionaries, whose job it is to help others understand the new object in their midst and the new practices that it can enable. Sometimes, these functionaries are not really even integrated into the medical practice of the institution. On the other hand, those institutions where the information coordinators are more integrated into the institution and have positions that give them the authority to work with the LRCs as an idea achieve a deeper level of diffusion because these information coordinators can use the new technology in a visionary way.

This powerful tendency to be a visionary can only be encouraged, not created, by what the AIHA can provide. Institutions that cast information coordinators into the role of a functionary, as someone who has technical skills, who carries out the requests of others, and who is given little authority for making decisions, will remain at the slight end of the continuum. Without deep diffusion, the innovation will not take hold, and the LRCs will not be self-sustaining.

This distinction between visionaries and functionaries also has implications for the horizontal exchange of information, an exchange that leads to deep diffusion and LRC sustainability. Horizontal communication (communication between peers) rather than vertical communication (communication between subordinates and superiors) leads to a deeper level of diffusion and therefore a greater chance that the innovation will be sustained. The role of a functionary is to communicate information to those who do not understand (subordinates) and then report on this process to those in authority (superiors). This role does not allow for broad-based, knowledge-generating communication between peers. The role of the visionary, on the other hand, centers on communication in its epistemological sense, as a way of making new knowledge. Visionaries create new knowledge, new ways of

using the technology, new understandings of the place an innovation has in their institution. All these characteristics increase the chance of the innovation's sustainability. When they are communicated among peers—between information coordinators who have been given the functionary role and their peers who have been given the room to be visionary—these characteristics can enable functionaries to try new strategies in the diffusion process.

Begin a next phase

Given this important distinction between functionaries and visionaries, three steps could be taken in the second phase of the LRC project. First, information coordinators should be given the opportunity and assistance to develop a vision of the LRC in their institution. This topic could be addressed in regional workshops and continued in on-line discussions. Because this conceptual task is so central to the sustainability of the LRCs, it becomes an important reason for continued support when making the argument for future funding.

Second, administrators at medical institutions must be made aware of their role in fostering an environment where a visionary can work. Their understanding of the information coordinator as more than a person who fulfills a functionary role becomes crucial because it supports the project goal of sustainability. The AIHA's role in this encouragement is unclear: the tendency to see an information coordinator as simply someone who handles requests rather than a person who constructs an infrastructure has much to do with the power dynamics at any institution, which the AIHA cannot control. It is our observation, however, that LRCs with information coordinators who are change agents in a visionary sense will survive, and LRCs with information coordinators who function as information retrievers will not survive. Therefore, every opportunity should be taken to help administrators 1) understand the distinction between visionary and functionary and 2) give information coordinators the room to make their own decisions. Administrative support correlates highly with deep diffusion and therefore with sustainability.

Third, every effort should be made to expand the use of the excellent communication channels that have already been established among the LRCs,

such as training workshops and the electronic discussion list. The discussion should expand to include more exchange about the diffusion process, about specific problems and solutions that the information coordinators have encountered, about the people skills in addition to the technical skills needed to persuade others of the value of this innovation, about problem solving as well as problem software. Opportunities should be given when information coordinators are together at workshops in the physical world; discussions should be prompted and encouraged on-line in the virtual world so that information coordinators can use these communication channels to teach each other ways of using their LRCs and of achieving sustainability.

Moving into a next phase of the project means moving from the very important stages of understanding the concrete aspects of the innovation (the computer and its accompanying accessories as objects, the information-gathering strategies as processes) to understanding the more abstract aspects of the innovation (the idea of information technology as a means by which to make new medical knowledge). This movement from concrete to abstract is natural and necessary for creating self-sustaining Learning Resource Centers.

Appendix

Questions for University of Minnesota Study of the United States International Health Alliance Learning Resource Center Project

1. How would you describe the LRC project?
2. What medical problems are most prominent in your area (region)? How has the LRC (not) helped solve them?
3. How has the LRC project changed your work and that of your colleagues?
4. Who is taking advantage of the LRC and why, do you think?
5. What kinds of strategies have you found successful in implementing the project? (in training your colleagues how to use the LRC?)
6. Whom do you think benefits from the LRC project? How?
7. What kinds of obstacles are you running into as you try to encourage others to use the technology?
8. How easy/difficult is it to repair malfunctioning technology (printer, computer, etc.)?
9. What differences in communication style and attitudes toward information have you experienced between United States AIHA representatives and healthcare employees in your country (including yourself)?
10. What would be the most important suggestion for improvement that you would be able to give?