RESEARCH AND TECHNOLOGY IN THE UNDERSERVED POPULATIONS OF THE BORDER: *A DESCRIPTION OF TECHNOLOGICAL NEEDS OF BORDER COMMUNITIES AND METHODS TO ADDRESS THOSE NEEDS**

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SUMMARY***

Healthy People 2000 identifies twenty seven areas of concern for Hispanics, including diabetes, obesity, growth retardation, tobacco use, teen pregnancy, homicide among males, dental caries, infant mortality, prenatal care, cancer surveillance and tuberculosis. These areas are fertile ground for research into the effectiveness of prevention and intervention programs for Hispanics.

Personal health technology has dramatically changed how patients are able to take care of their own health. Automated and miniaturized glucose monitoring instruments enable diabetics to monitor their blood sugar and improve diabetic control, but this technology is largely unavailable to patients in the border region. Personal technology is often unavailable due to high costs, lack of insurance and lack of patient and/or provider awareness. Computers as personal tools for access to technology in our society are also notably lacking in the border region.

Even though now considered as basic elements of modern diagnosis, conventional health technologies are also relatively unavailable in border communities. Examples include electrocardiography, radiography, laboratory assessment, mammography and other instruments for cancer surveillance. As a result, routine screening and diagnosis for this population is less than adequate.

The state of Texas has advanced technology capability that makes it possible to provide long-distance continuing medical education, however, these services do not generally reach providers in rural or poor border communities. Computerized tomography and magnetic resonance imaging have dramatically altered how medicine is practiced outside advanced referral centers. The same is true for telecommunications consultation. Such high tech services could be employed in specialized centers in border communities.

Transportation continues to be a barrier to care in underserved regions where public transportation is unavailable and facilities are distant. Development of networks of computers, interactive television and other communications devices could go a long way to alleviate transportation needs.

Several culturally-related barriers limit the use of technological advances with Hispanics. Language and inappropriate translation often contribute to dissatisfaction and noncompliance. Cultural biases also influence acceptance of treatment recommendations. Finally, reliance on folk medicine affects management of health problems in some populations.

Medical researchers need to seek ways to better apply advanced technologies with the border population. One way is to spend more time applying these practices in problem-solving settings in outlying clinics. Similarly, existing satellite and television communication networks should collaborate to reach out to border communities, applying the lessons learned from links with other rural communities. Local schools in Hispanic communities hold great potential as hubs for education and research. Promotores, or community heath workers, can serve as an important link between urban and rural medical communities as well.

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INTRODUCTION AND BACKGROUND

The four U.S. states that lie at the border between the United States and Mexico face major challenges in providing to their rapidly growing Hispanic populations a quality of health care that is comparable to the rest of our society and that permits effective integration of this population into the greater community. Examination of some of the issues within the state of Texas may serve as a model for the more global issues faced by all.

Consensus on definition of the border is the first challenge. Some federal funding initiatives define the border region as an area up to 300 miles inland from the border and even classify Florida as a border state. Texas designates 32 counties as the state's border region. Fourteen are contiguous and 18 are proximal to the border and affected by population, culture and economy. The border region counties abut four Mexican states. This region contains over 1.67 million people or nearly 10% of the total state population of 17 million. The population of the region has grown during the last census period at an estimated rate of 23.9%, greatly exceeding the growth rate of the state as a whole (19.4%). This population is young, largely rural, poor and medically underserved. For example, according to 1990 census figures, the physician: population ratio is 101.1:100,000 compared with that of the state (181.3:100,000) and of the nation (233.0:100,000). There is a corresponding underrepresentation of other health care professionals in the region. The shortage of health providers is evidenced by increased health problems in wide-ranging categories including diabetes, hypertension, childhood development, tobacco and alcohol abuse, and obesity.

At the same time, the State of Texas enjoys a remarkably strong medical education and research complex. Its one private and seven public medical schools serve as the focus of major health care centers in almost all of the largest population centers of the state. These medical centers provide state-of-the-art services and conduct research that is recognized nationally and internationally.

A major challenge for the state is achieving a better balance in the distribution of its outstanding health care capabilities for the improvement of health care of the citizens of the border region with the long term goal that this health care comes to parity with the rest of the nation. The means to achieve this goal are not altogether clear, but it is apparent that there must be a greater investment in research and technology within the region to realize improved health outcomes.

Each of the other border states (California, Arizona and New Mexico) face similar problems that are framed within the geopolitical context of local communities. For instance, in California urban populations face health care problems in a more concentrated environment than do the rural populations of the other border states. Each state has varying resources with which to meet the problems of access, education, technology transfer, cultural differences and disease patterns that are common to them all. Thus, some research approaches may have particular currency in one or another location. One hopes that application will be more general.

CATEGORIES OF RESEARCH AND TECHNOLOGY

Basic Research

The widely quoted federal study "Healthy People: 2000" has set an agenda for specific health measures that will substantially improve the health of the American population. Although measurable outcomes seem clear, the means by which these objectives will be met is less certain. In particular, there have been identified 27 areas of concern for the Hispanic population. These include: diabetes mellitus, obesity, growth retardation, tobacco abuse, teen age pregnancy, homicide among the male population, dental caries, infant mortality, prenatal care, cancer surveillance, and tuberculosis.

Clearly, these and the other identified problem areas are fertile ground for active investigation of preventive and intervention programs and their effectiveness. There also exist opportunities for investigation of some of the basic biochemical and genetic mechanisms underlying the high prevalence of diabetes mellitus and other metabolic disorders within the Hispanic population. Much of our understanding of the unique aspects of diabetes in the Hispanic population has come from epidemiologic, metabolic, genetic and clinical investigations within the health sciences centers of the border states. Extension of these studies should be fostered as well as the application of this new information.

Personal Technology

Personal health instrumentation is a remarkable advance that has dramatically changed how patients are able to take greater responsibility for their own health care.

Automated and miniaturized blood glucose instruments have enabled patients to monitor their blood sugar reliably so that modifications of insulin, diet and exercise can be made on a short-term basis to improve the control of diabetes. In some patients, careful control results in fewer complications and an improved quality of life. Yet this technology is largely unavailable to patients in the region, especially in the *colonias*. These *colonias* are unincorporated communities of recent emigrants and low-income individuals, and they are recognized by the U.S. federal government as underserved areas. They are often without potable water, sewage disposal and other public utilities. Health care services are characteristically unavailable.

There are several reasons for the unavailability of this example of personal technology: (1) many patients do not have

Medicare, Medicaid or commercial insurance to cover costs, and they cannot afford them on their own; (2) the cost of supplies is often prohibitive; (3) many patients have not received adequate instruction in the use of these instruments; (4) many patients are unaware of the relationship of adequate control to improved outcome; and (5) health care providers have often not made monitoring an integral part of care for these patients. Although it remains to be demonstrated, it is a reasonable hypothesis to suggest that control of diabetes mellitus and its complications could be improved in the at-risk population through the advancement of this technology.

Hypertension is a common problem in Hispanic populations along the border. Good control is associated with a reduced risk of stroke and other complications. Home monitoring, using readily available automated devices, has been a useful adjunct to effective management in some populations. This resource is largely unavailable to poor Hispanic patients in the border region for similar reasons to those cited above for glucose monitoring. Good control of hypertension is also a problem in this population. Significant strides could be made if this technology could be made more readily available to the population at risk.

Computers have become a very personal tool for access to technology within our society. This is reflected in the spectacular growth of the Internet and the increase in ownership of personal computers. In some populations, the computer is used increasingly as a tool for health care promotion and disease prevention. This development is notably lacking in many border populations. Poor school districts have been demonstrated to lag behind more affluent school districts in hardware acquisition and in educational experiences. The differences are even more striking in the general population. Computer ownership is limited in communities where home and automobile ownership lags behind the national norms. Application of computer technology is also limited in this population for a number of other reasons: language barriers, access, training, resistance to new technology, and appropriate and useful applications.

Conventional Health Technology

Electrocardiography (ECG) is a technology that has been widely available for the diagnosis and management of heart disease for nearly a century. Even though this is viewed as a basic element of modern diagnosis, the technique is often not accessible available to patients in border populations. The equipment may not be available in the primary care facility where the individual seeks his care and/or appropriately-trained individuals may not be available to carry out the study or to interpret the results. A more advanced health care facility may be miles away and not practically available for the individual with acute problems.

Radiography is also a technology that has been available for many years. It is not reasonable to expect that techniques such as computed tomography or magnetic resonance should be available outside of sophisticated, centralized health care facilities. It is reasonable, however, to expect that more conventional radiographic methods should be available in such a manner as to obviate long commutes or lengthy delays in analysis of data for more straightforward radiological evaluations. Again, access to both equipment and interpretation often confound this process.

Laboratory assessment is an essential part of the evaluation of patients in a modern setting. In recent years, this sort of technology has become less readily available within a physician's office. This has resulted from regulatory changes made by the federal government to improve quality control and reduce expenditures. In large centers or in facilities nearby hospitals or reference laboratories, these capabilities are still readily available, but in small communities and in rural settings they may be difficult to obtain. It should be possible to deal with the problem using simple methods of improving access. However, identifying reliable courier service, recruiting stable laboratory and phlebotomy personnel, and assuring proper handling of specimens and laboratory results have all been problems that confound many efforts to obtain reliable support in poor, rural, underserved communities.

Modern transportation and communications technologies should be capable of dealing with such problems, but these methods have not been systematically applied to resolving the inadequacy.

Mammography is recognized as an important screening tool for cancer detection in middle aged and elderly women. Breast cancer is common in Border populations and is frequently not detected at an early and more manageable stage. It has been demonstrated in other populations that earlier detection results in the identification of smaller, more localized cancers that can be managed with less aggressive treatment resulting in less morbidity and improved survival. Such outcomes have not been as clearly demonstrated in populations within *colonias,* in some measure probably due to inadequate screening capabilities. Yet, such screening technology exists and is widely available in more affluent areas with better third-party coverage.

A systematic approach to screening and follow-up, using mobile mammography and modern epidemiological techniques, could be used to determine more accurately the prevalence of breast cancer within this population and to evaluate the results of early detection and appropriate intervention.

Cancer surveillance, in general, is not adequate in this population. Routine screening for cervical cancer in women, prostate cancer in men and colon cancer in both genders is deficient. One would anticipate that the corollary to that observation that detection and early intervention are also inadequate in this population. Early detection methods have

been applied successfully to other populations. Methods could be devised to transfer these interventions to the populations within border communities.

Advanced Technology

Interactive television as a long-distance tool for education and patient care has begun to develop with remarkable speed in many settings across the United States. In Georgia, a pilot study has been initiated to learn if patients with access in their home to computer links and interactive video are able to take advantage of health care resources in a reliable and rational way without leaving their home. In West Virginia, a state-wide network of interactive television sites is being developed to connect physicians in small towns with specialists in university medical centers. The goal is to bring sophisticated consultations and referral services to the most remote rural areas.

In some respects these capabilities are well developed in the State of Texas. Texas Tech University Health Sciences Center, Texas A&M University and the University of Texas System all have capabilities that make it possible for them to provide long-distance continuing education in medicine, nursing and other disciplines. In some instances they can also provide interactive consultation services to physicians in remote sites. However, these services are relatively limited and usually do not provide access to practitioners in rural or poor border communities. Moreover, clinical facilities in such communities are not networked in such a way as to promote the utilization of shared resources. It is ironic that the Texas prison system has greater networking capabilities for shared medical resources than do our citizens along the border.

Imaging technology is yet another method that is absolutely essential to the modern diagnosis and management of many illnesses. Computerized tomography and magnetic resonance imaging and ultrasonography have dramatically altered the way that medicine is practiced. In some circumstances they have made surgery unnecessary. Even with the availability of these techniques, the use of conventional radiography remains important in the diagnosis and management of many disorders. The high costs of technology, exacting standards of protection against radiation, magnetic fields and associated hazards, operational costs and availability of trained personnel all go to make these technologies less available outside of the referral center. It is not likely that CT and MR imaging will ever be available outside of such centers. However, it is reasonable to conceive of regionalized radiology sites in which consultation for routine radiograph studies and demonstration of specialized studies carried out in the referral center are available from radiologists working by remote television and computer links. These capabilities are already under intensive development and have found application in some sites across the country. Application in Border communities would provide a powerful tool to investigate effectiveness and to develop health care strategies that would utilize this new information.

Telecommunications consultation exists in some sites in Texas using two-way interactive television as noted above. The technology permits interpretation of radiographs and could address specialist consultations, if radiography equipment were in place at the initial site. Likewise, through telemetry, cardiac rhythms are monitored with wireless transmitters and receivers in modern medical centers. EKGs are transmitted from ambulances to hospital emergency departments while patients are enroute. The key again is instrumentation at the source and personnel trained to use that equipment.

Transportation

Transportation remains a major problem within underserved regions. It is difficult for patients to travel outside of the area for their care. Even in communities close to urban centers, family members can be site bound because the family vehicle is away during the day with the individual employed in a nearby urban setting. Public transportation is inadequate or nonexistent in the majority of rural areas.

It is often difficult for health care providers to get to the area to provide care. Transportation of supplies, medical specimens and reports is often inadequate. Emergency transport of seriously ill patients is often exceedingly expensive or even unavailable. Rural and frontier counties in Texas develop referral and transport patterns based on geopolitical territorial divisions dictating reimbursement patterns. Health districts are large and their tax revenues small. Political units including city and county governments are reluctant to provide these services for a number of reasons, and private transportation services often cannot generate enough revenues to maintain useful service.

Creative methods of providing transportation of goods, services and information should be examined. Certainly, well-developed networks of computers, interactive television and other communications devices would go a long way to deal with information transfer as well as some services. Use of alternative transportation modes and methods for paying for them should be explored.

CULTURAL ADAPTATION TO TECHNOLOGICAL ADVANCES

There are several culturally-related barriers to the introduction of technological advances to health care in Hispanic populations. These include language and tradition.

Numerous reports exist in the literature demonstrating that difficulties in communication often result in dissatisfaction, failure

to follow instructions and impaired quality of health care. Frequently, the problems in communication can be traced to failure to use appropriately trained translators and poor translation by untrained individuals, including relatives of the patient. Many health care agencies do not employ adequately trained translators or make them available on a limited basis. It is highly likely that the use of such individuals on a regular basis would result in improved compliance, better acceptance of advanced technologies and even improved health outcomes. Systematic studies addressing this hypothesis are limited and need amplification.

It has been reported that cultural biases reduce compliance with many technologies including cancer-screening in male Hispanic populations. In part, these biases may be deeply ingrained culturally, but they may also reflect an inadequate understanding of the nature of the procedure, risks associated with the process and the potential advantages of the procedure. In some surveys of relatively small populations, functional health literacy is deficient. It would be useful in developing strategies of intervention to know about the levels of functional health literacy in target populations and to use this information to design educational programs.

In some populations reliance on traditional folk medicine complicates effective medical management of health care problems. It has been common practice among the health care establishment to dismiss folk treatments out of hand and to ignore possible complicating factors contributed by these treatments. It has been decidedly uncommon for health care professionals to try to manage a clinical problem within the framework of such a competing treatment strategy. A greater understanding of these issues is essential in order to develop applications of technology that will be accepted and utilized by the population at risk.

MECHANISMS FOR INTRODUCING RESEARCH AND TECHNOLOGY

Use of practice in a minimal technology environment as a bridge to access

Medical researchers and health care providers who use advanced technologies are often cosseted in medical centers away from populations who may be the subjects of research and potential beneficiaries of modern technologies. This separation undoubtedly contributes to lack of communication and to problems of technology transfer. It would probably be of great use for health care providers within these categories to spend sufficient time in outlying clinics to identify novel problem-solving approaches to problems that are unique to or especially complicated in these settings. It is expected that similar problems and potential experiences could be found in the underserved inner-city environments of the border urban areas.

Long-Distance Technology

Long-distance technologies have not been applied in a systematic or sustained fashion to the health-care delivery problems associated with poor Hispanic populations in Border communities. As described above, interactive television is being applied to many other populations including prisoner patients in Texas, rural communities in West Virginia, and home-bound patients in Georgia. The elements for the development of such a program along the Texas Border already exist.

Texas Tech has a mature network of satellite- and land-line-linked health care sites. The university provides ongoing education, technology transfer and patient care through this system. A remote site in Alpine, Texas has been in place for a number of years. Funding is available to develop a regional network with Alpine as the hub for communities throughout the Big Bend region of the Border, but technical problems have prevented full implementation of this program. The lessons learned should provide valuable information in developing other programs.

The University of Texas System and the Texas A and M University also have significant interactive television networking capabilities, but these resources have not been focused on health care technology transfer to the border region. Perhaps of greater potential is the resource that would be available if these networks were linked with one another as the means to provide education, patient care and even research information and protocols on a shared basis. These efforts would obviously require considerable planning, technology development and applications analysis, but their potential remains particularly attractive.

Similarly, computer networking has grown remarkably within the last few years and has provided important links in cooperative research efforts throughout the world. Unfortunately, this technology remains inaccessible in many border communities and certainly has not been used as a research tool within this setting.

Cooperative Efforts With Schools

Public schools within Hispanic communities represent one of the greatest resources. They serve as the center for educational efforts and are often the only governmental structure in unincorporated communities. The schools are often the most respected local organization. They have also begun to receive attention at local, state and federal levels for improved communications and computing capabilities within the framework of expanded programs in all schools. The schools also represent a potential reservoir of future scientists and health care professionals. With all of these strengths, the schools should be developed as a means to educate the population about the importance of research into the health care problems that particularly affect them (in general, they are very cynical about "research" and have a concern about

"being experimented upon"). The schools should be used as a base for studies of hereditary problems, childhood development and family issues. Obtaining the cooperation of the school boards would provide considerable force to the successful implementation of such studies.

Promotores

Promotores (also called community health workers, lay health advisers or health advocates) are individuals recruited from the community and who have a commitment to their community and to health care issues. *Promotores* have been used successfully to improve health status in rural and urban environments world wide. Because they are of the community, they provide an important link between the community and the provider institutions. Because of their training, they are able to explain the health care issues in lay terms and confer trust on the health care organization. They can also serve as a powerful means for research efforts. These are usually very intelligent and self-motivated individuals who may lack formal education; they are very quick to learn new concepts and anxious to apply them to life situations. They should be brought into the process, taught about research methods, included in population-based research efforts and developed as spokespersons for important research activities. Their insights will undoubtedly improve community cooperation in participation in clinical studies.

Networking of Resources

Although this issue has already been addressed above, it is important to reiterate that cooperative efforts will likely be more productive in providing important information for improvement of health care delivery. The cooperative cancer study groups (*e.g.* Southwest Oncology Group or SWOG and the Eastern Cooperative Oncology Group or ECOG) represent examples of successful inter-university groups that have substantially advanced our understanding of and the treatment for cancer. This approach may also be successful in the advancement of research efforts directed toward health care research in the Hispanic population. At the very least, regular symposia should be developed whereby researchers can share information in a regular and systematic way in order to advance one another's efforts.

COSTS AND FUNDING NEEDS

Presently it is not possible to estimate the costs of these proposed initiatives. A true evaluation of cost needs will depend upon a careful analysis of the most deserving programs. However, it seems clear that funding for these important health care concerns must be identified, either as new moneys or as shifts in health-care priorities. One consideration is that block grants to the individual states be provided to address specific and well-defined health care research questions.

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