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TEXAS JOURNAL OF RURAL HEALTH

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1999

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MISSION STATEMENT

The purpose of this journal is to provide a forum for sharing ideas related to rural health. Authors are encouraged to submit relevant and current research studies as well as legislative and/or health care policy papers. Descriptions of innovative strategies in primary health care settings are especially welcome. Manuscripts will be evaluated for pertinence to the issues on a statewide basis. Response to our articles is also encouraged and will be printed under the section "Letters to the Editor."

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TEXAS JOURNAL OF RURAL HEALTH

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Step Two: Blind or Masked Review Process
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After the manuscript is reviewed, it is forwarded to the managing editor who discusses the reviewer's recommendations and comments with the editor and members of the editorial board. If a manuscript is rejected during the initial review, every effort is made to encourage the author to proceed with the manuscript to make the article publishable. Reviewers' remarks are included with the return of the manuscript.

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Step Seven: Getting Ready for Publication
The managing editor performs the job of editing, proofing for grammar, syntax, spelling, and word usage and then puts the manuscript into page layout form.

Step Eight: Authors Final Approval
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CALL FOR PAPERS

TEXAS JOURNAL OF RURAL HEALTH

The Journal is now accepting manuscripts for publication on various topics relating to rural health care issues. The Journal is especially interested in articles on the following topics: migrant farmworker health, primary and emergency care in a rural setting, and Medicaid and Managed health care issues.

The Journal is also interested in articles that document the daily activities of health care professionals who serve patients in a rural community. It is recommended to include photographs that add to the content of the article and accurately depict the conditions or situations that these health care professionals encounter on a daily basis.

Papers should be submitted to the Managing Editor as outlined in the "Instructions for Authors."

CENTER FOR RURAL HEALTH INITIATIVES

The Journal is pleased to announce that Robert J. "Sam" Tessen, M.S. is the new Interim Executive Director of the Center for Rural Health Initiatives.

The Center for Rural Health Initiatives is the designated state office of rural health for the state of Texas. The Center serves as the primary resource in coordinating, planning, and advocating for continued access to rural health services in Texas.

The Center sponsors several programs such as the Outstanding Rural Scholar Program that brings health care professionals together with students who are committed to practicing primary health care in a rural community. For more information on this program and the other programs the Center offers, contact the Center for Rural Health Initiatives at (512) 479-8891 in Austin, Texas.

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LETTERS TO THE EDITOR

We are introducing a new section to the journal in order to encourage our readers to communicate their thoughts on the articles that we publish. In doing so, it is our desire to clarify questions or respond to challenges that can enlighten our readership. When we publish articles, we hope to disseminate knowledge that helps to benefit those living in rural communities. It is always rewarding to see that an article has encouraged debate, communication between medical professionals, and interest in topics of concern regarding important health issues.

Letter—September 3, 1998

Glycemic Effects of Various Species of Nopal in Type 2 Diabetes Mellitus

To the Editor.—With the entire basis and statistical foundation of the study resting on determinations of glucose in blood specimens, I find it interesting that serum specimens were chosen for analysis instead of plasma collected in glycolytic inhibition collection tubes. The authors state, "All the samples obtained on a given study day were processed together and sent for analysis at LabCorp in Dallas, Texas." Studies have shown that blood glucose values on specimens collected in clot/serum tubes decrease approximately 7% per hour after collection if not processed. If the samples were "processed together" on a given study day, in-vitro glycolysis could falsely lower test results.

Secondly, I am at a loss to understand why study specimens were transported to LabCorb in Dallas when there are multiple CAP accredited laboratories located in El Paso.

Jim Bob White, B.S., M.T.
Laboratory Manager,
Chillicothe Hospital
Chillicothe, Texas

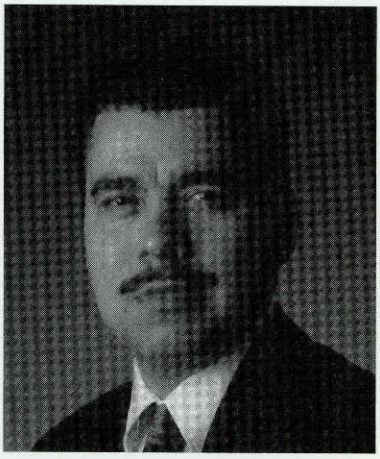
In Reply.—Mr. White brings up an important concern, namely that serum samples might give erroneously low glucose values if not processed in a timely fashion. We used serum instead of plasma because we also followed cholesterol changes (unpublished data), which required the collection of serum. We avoided the potential pitfall Mr. White alludes to by processing all specimens within 30 to 40 minutes of the collection of the specimen. Here, I think samples were processed as soon as clotted (within 30 to 40 minutes of specimen collection), refrigerated promptly, and sent together for analysis.

That our results did not suffer the pitfall mentioned is corroborated by the fact that our glucometer checks showed the same changes that the serum values did with nopal ingestion. Of course, the absolute values were slightly less on the glucometer, which is expected.

As to his question about sending specimens to LabCorp: our clinic has a contract with that lab, so it was logistically best to send it there. Since it is also an accredited lab, I don't see any problem with using that lab instead of any other. Specimens had been processed and remained refrigerated until analysis.

Keith Rayburn, M.D.
Assistant Medical Director
Centro de Salud Familiar La Fe, Inc.
El Paso, Texas

Editor's Comments



Leonel Vela, M.D., M.P.H.

In my previous editorial I alluded to rural health's breadth and complexity. One dimension contributing to this complexity is the diversity of population groups living or working in rural settings. One such population group is seasonal and migrant farmworkers, which in Texas alone is estimated at half a million—the majority of which work or live in rural communities throughout the country. Nationwide the farmworker population is estimated to number three to five million. The Texas Journal of Rural Health (TJRH) has recently put out a call for papers that specifically focuses on migrant farmworkers from a rural health perspective. I would like to introduce some aspects regarding this topic and we at the TJRH look forward to your submissions. Highlighting this important population affords us a perspective on the myriad of problems that must be addressed when considering a comprehensive agenda for rural health.

Given their dependence on interstate mobility for employment, migrant farmworkers face a unique set of challenges. For example, children enrolled in the Medicaid program in their "home" state cannot generally transfer their eligibility once they relocate to another state with their farmworker parents. Some states have taken an interest, and in fact implemented, state to state reciprocity for Medicaid. However, there is currently no uniformity among states on Medicaid program policies or implementation to deal with the unique situation facing migrant farmworkers. We do know that when children lose this important conduit for accessing health care, medical problems are exacerbated due to the lack of prevention and early intervention.

The migrant farmworker population is primarily Hispanic with 38% of the population consisting of women and children. As a group they are disproportionately affected by infectious diseases, such a tuberculosis and gastrointestinal diseases, and by chronic diseases such as diabetes, hypertension, and heart disease.

I had some recent meetings with migrant families that have come primarily from the Texas border to work in West Texas. My focus has been on providing disease prevention classes in Spanish and to learn from them the major health care issues they are confronting. Their problems and concerns mirror those that I have heard from migrant families in other parts of the country. They speak of barriers that include lack of transportation, lack of outreach services, and providers that neither speak their language nor understand their culture. They also express concern over how recent federal laws regarding immigration and government assistance programs will impact their families.

The spectrum of problems faced by these families parallel those that are generally attributed to rural communities—disproportionately higher rates of occupational injuries, inadequate access to managed care programs,

and the lack of a national constituency able to leverage a significant social/political agenda on their behalf. However, one cannot discount the significant improvements that have continued to occur in many fronts because of the work and advocacy that many of you have nurtured over the years. Healthier, future generations of migrant farmworkers and rural inhabitants will be a fitting legacy to your unselfish endeavors.

It is clear that migrant and seasonal farmworkers face unique circumstances that impact their health and well-being. They are a population group that provide a national benefit and contribute to the rich diversity in rural America. What they share with all inhabitants of rural communities is the desire for a better life and future for themselves and their children.

Crisis in the Country: Addressing the Challenges of Rural Trauma Care

Notes from the Field

Leslie Furlow, R.N., M.P.H.
President of AchieveMentors, Inc.
Tolar, Texas

Rural trauma cases aren't any less traumatic simply because no neurosurgery residency program is available. Car crashes, industrial and recreational accidents and even "gun and knife club" incidents can and do happen in rural areas. As cost containment practices infiltrate small community hospitals, their ability to deal with these situations has been seriously impacted.

Dealing with trauma, especially in facilities where the surgery program is limited or nonexistent, is challenging at best and fatal at worst. The "Golden Hour" from accident to operating room is not possible in these hospitals. Networks with tertiary facilities and good triage procedures by EMS and ER personnel can improve patient survival rates, but some rural facilities are more than two hours by air from the tertiary back-up facility.

This situation means that keeping staff members informed of trauma protocols as well as keeping their skills current to handle trauma cases is difficult. Rural facilities frequently have limited educational funds as well as a limited number of trauma patients to provide opportunities to maintain skills. This lack of exposure to trauma cases is true for all emergency personnel including the Nursing, EMS and Medical staffs.

Creative solutions have been developed by rural practitioners and the consultants they work with to deal with these challenging issues. Understanding the limited resources and special needs of rural areas has led to the following potential solutions:

Bring a speaker into the hospital rather than sending staff members out to seminars.

Educational dollars can produce a greater benefit-to-cost ratio by bringing in a speaker. Sending staff members to seminars is good for the people who get to go, but may not benefit the rest of the staff. Even though most facilities now require employees to report on the information they received at seminars, only one copy of the handouts is usually available and notes taken by one person seldom have value to another. The ability of some staff members to come back to the facility and share the information in a meaningful way is not consistent among all staff members.

Select a topic that is needed for the type of trauma seen in the area and contract with a

knowledgeable, respected speaker who is either nationally known or from a regional tertiary center. The cost of the program and the speaker's expenses will probably be only slightly more than the cost of sending an employee to a seminar.

This option enables all emergency providers to have access to the same information. It also helps to build teams and to define roles and expectations for actual trauma cases. Videotape the presentation and keep clean copies of the handouts so that staff members who are unable to attend the live presentation can review it on tape. In this way, new staff members can be oriented using the same information.

Subscribe to select journals.

The Journal of Emergency Medicine, *The Journal of Emergency Nursing* and *The Journal of Emergency Medical Services* are nationally known publications that offer a variety of articles relating to trauma subjects including up-to-date protocols and changes in legislation and treatment.

Most of these journals also offer continuing education courses. These seminars can be used as in-house education for the entire EMS team. They also provide inexpensive continuing education credits for license renewal. A different employee can be assigned responsibility for facilitating the educational program each month.

Interesting articles can be reviewed as a group by creating a Journal Club. Employees can read assigned articles and write a short synopsis to present to the entire department. Staff members can then decide which articles they feel would be of interest to read in their entirety.

Create in-house protocols for different types of trauma (e.g., blunt, penetrating, etc.).

Using EMS, nursing and physician staff to develop these protocols will increase team effectiveness and build a better understanding of the roles, responsibilities, and expectations of each practitioner. The inclusion of ancillary departments such as a radiology department or laboratory, for example, will further enhance the process.

Practice, practice, practice!

To maintain competency, staff members must be exposed to appropriate situations. Set up regular exercises to practice skills and protocols. Competency checklists should be used and placed in the employees' educational files to prove competence if requested by regulatory agencies or in the event of a poor outcome.

Identify traditionally "slow" periods for patient activity and plan drills for those times. It is not totally unreasonable to have an impromptu drill when the department is slow. Staff members will instinctively perform what they have practiced repeatedly.

Develop resident experts.

Large hospitals have teams that provide care for select patient groups. This situation is not possible in the small community hospital, but an alternative means of achieving a similar outcome can be used.

Assign different staff members a particular problem or protocol. Have those individuals learn all they can about the subject. They will keep up with changes as they occur in the field and keep all other staff members abreast of these changes. Recognize these individuals for their accomplishments and use them as in-house consultants for any issue concerning their area of expertise.

Create alliances.

Team with other rural facilities to conduct trauma rounds whenever a major trauma situation has occurred. This practice will keep the staff's skills from becoming stagnant and will encourage sharing and participation.

Use debriefing sessions and grand rounds.

When an interesting case is seen in the field or department, conduct grand rounds. This method helps everyone to learn and grow. This practice should be guided in a non-judgmental fashion from an educational perspective.

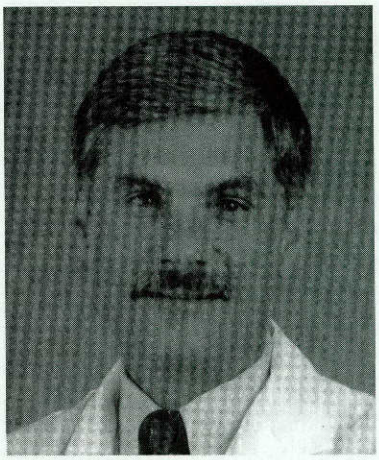
In the event of a poor outcome, hold a debriefing session with all involved staff members. Emergency staff members need to talk about what happened and how it has affected them. By giving staff members a safe environment to share, "burnout" can be decreased and productivity can be enhanced. Debriefing sessions also build team unity and loyalty. Debriefing should be conducted by trained counseling personnel such as psychologists, social workers, or clergy members.

The challenges and rewards of rural health care are magnified in emergency care. By spending a little money and some dedicated time, an excellent emergency system can be developed and maintained.

The National Health Services Corps: A New Perspective

Abstract

One of the medical challenges for the nation today is that we do not have enough competent health professionals with the right skills in the right place long enough to elicit a positive change in a community's health. To change this, we must blend the fragmented pieces of the medical system: the methods of funding, the division of curative and preventive health (i.e. develop community responsive medicine), and the placement of health professionals throughout our communities. With revision, the National Health Service Corps can be a valuable tool to help us fill the current void between medicine and public health.



David R. Smith, M.D.
President
Texas Tech University
Health Sciences Center
Lubbock, Texas

In Perspective

The challenge facing the National Health Service Corps, and the focus for this article is that our nation still does not have enough of the right kind of health professionals with the right skills in the right place long enough to make a sustained difference. After almost a century of effort, the United States does not have a cohesive health policy for the development and placement of competent and caring health professionals (Mullan, 1997b; Rosenblatt & Lishner, 1991). As health care has evolved in this country, its practice has splintered into separate approaches of curative and preventive medicine and an ever widening gulf of fragmented health profession's programs.

In order to focus on what is at issue, we must retreat from our current myopic view of disconnected programs and embrace the philosophy that the convergence of purpose for these existing disparate health profession's programs should be improved health care access and health care outcomes. The number, mix, talent, and distribution of these health professionals is part of the solution. The only appropriate endpoint for a coherent policy of health professional development and placement is the improved health status of the population. To reach that endpoint will require a new set of skills applied in a focused manner to populations at risk. Health professional policy and programs are merely a means to that end.

The efforts of the 103rd Congress and President Clinton's administration to address health care reform were not the precipitating events in the most recent effort to address the future of health care, nor was this effort the penultimate response to a changing landscape. Health care reform has been a part of

medicine and health care since Aesculapius (the father of medicine) strolled the coast of Greece and later watched as his daughter Hygeia was ushered into this world as the goddess of health.

This continuum of change that we call reform is but one of the constants of the health care landscape. A review of policy and legislation focused on health professions demonstrates a similar trend toward this change as this nation has refined its policy from Carnegie and Flexner, from GEMNAC and COGME, and from Carnegie and COGME revisited (Mullan, 1997b; Rosenblatt & Lishner, 1991; Immerman, 1977).

Over time, the issue at hand has not changed; it remains important to improve the health status of individuals and communities. With that goal in mind, we must reassess how we can redesign existing programs that have served us well in the past, such as the National Health Service Corps (NHSC), to deliver competent and caring health professionals for the next millennium.

HISTORY OF THE NHSC — BORN IN POVERTY

The roots of the NHSC and its companion programs for community–based health care were nurtured during the War on Poverty. Initial efforts to address the disproportionate health care needs of rural and inner cities included the Community and Migrant Health Center Program, Head Start, and the Emergency Health Personnel Act of 1970 (Immerman, 1977; Pollner & Parrish, 1974; Wasserman, 1974; Martin, 1975).

But history has been cruel to programs spawned out of the concern and desire to make a difference (Pollner & Parrish, 1974; Wasserman, 1974; Avery; 1971). For in order to effect change in the policy arena, one must represent a constituency with standing. The poor are often without standing and their issues are without staying power. This pattern of uneven support became evident in the 1980s as the NHSC, the Community and Migrant Health Center Program, and the Bureau of Health Professions struggled to remain at "level" funding.

When appropriation levels during the 1980s are controlled for inflation, the NHSC and the Bureau of Health Professions realized a dramatic cut in funding while the Community and Migrant Health Centers scrambled to keep pace with inflation. This occurred at a time when overall health care expenditures for the nation increased by approximately 120 percent. The 1990s have witnessed a similar ebb and flow of support as the NHSC approaches reauthorization (Immerman, 1977; Smith & Anderson, 1990; Rosenblatt & Moscovice, 1980).

MEDICINE VERSUS HEALTH

The debate over health care reform in the 103rd session of the United States Congress did not resolve the myriad issues facing our health care system. Members of the United States Congress and various constituency groups focused largely on the financing of sickness care and the concerns of major stakeholders such as hospitals, physicians, insurers, and small and large businesses. Little time was spent discussing the merits of the proposed methods for transforming the current sickness-oriented model into one that seeks to prevent disease and improve the overall health of the population.

History has witnessed a health care system evolve that is focused on a reactive and curative approach to patient care. Many insurers still do not provide first dollar coverage for such cost-effective and health-

effective interventions such as immunizations, mammograms, and pap smears. There is little logic in the present system as payers continue to deliver the message that they would rather provide full coverage for a mastectomy and charge a copay for a mammogram. Others will pay for the management of a child hospitalized in an intensive care unit with measles pneumonia, but deny payment for the vaccine that could have prevented the disease.

Preventive health remains largely in the purview of public health, a poorly financed system with limited advocacy and even less political capital. Public health suffers from the same lineage as the NHSC and other community-based programs established during the 1960s and 1970s. Widely perceived to only encompass "poverty health," the public health system touches the lives of all 265 million Americans on a daily basis. It is this system — with its focus on preventive health and population-based services such as food safety, water purity, vector control, and immunizations — that has been the greatest single contributor to our gains in longevity during this past century. One cannot escape the reach of public health from the moment one turns on a water faucet, eats fresh meat or shellfish, and finally lays down at night on an inspected pillow or mattress.

There exists an opportunity for sustainable reform, which blends the accomplishments of curative medicine with the broad-based focus of public health. To accomplish this goal, a new cadre of health professionals will be needed who can understand the determinants of health and feel compassion for the individual sitting in front of them while never losing sight of the needs of the community as a whole. This new discipline is community responsive medicine (Smith & Anderson, 1990; Weaver, 1993; Smith, Anderson, & Boumbulian, 1991). The NHSC is positioned to redefine health care for the future by asserting its leadership role in health profession's policy with the goal to develop a new generation of practitioners for the 21st century. This generation of practitioners will be needed as this country faces a growing number of uninsured people.

BEYOND POVERTY

What was once the domain of the poor and disenfranchised has become the concern of middle America. The problem of health care access has developed a broader constituency with the closure of many rural hospitals; the migration of health professionals to lucrative suburban settings; and the burgeoning number of uninsured. Children now represent 12 million of the estimated 42 million Americans without health insurance. More than 80% of these children reside in a home where the head of the household works and has employer-based insurance coverage for themselves.

The recent resurgence of many public health problems has refocused public attention on the basic determinants of good health. There is increasing concern over the re-emergence of diseases such as tuberculosis, hantavirus, dengue fever, and penicillin resistant streptococcus.

States such as Texas still confront the "Biblical" diseases such as plague, TB, leprosy, and rabies. Environmental health issues have returned to the headlines with stories about lead, mercury, pesticide, and polychlorobiphenyls (PCBs) poisoning. During this same time span, food safety has returned to "prime time" status with reports of E. coli in ground meat, Vibrio cholera in shellfish, and botulism in cheese products.

As a part of this changing landscape in health care, this nation and our communities are evolving. The term "minority" must be

replaced with a new and more appropriate nomenclature – the "emerging majority."

Many individuals served in the past by programs born out of the War on Poverty are now assuming leadership roles throughout the work force. Demographic trends dictate that these changes will accelerate as this nation catapults into the 21st century. Health professions must mirror these changes and provide leaders who can reflect these same cultural values.

These trends underscore the need to address not only the number and distribution of health professions, but also the knowledge base and skill sets required to respond to communities in need. It is no longer advisable nor acceptable to fracture the curriculum of health professions – splitting medicine and its curative and diagnostic technologies from prevention and the population-based approach of public health. The sciences of epidemiology and biostatistics should become part of the core curriculum for the health professionals of the future.

A void of sustainable talent positioned to anticipate the health challenges of today and tomorrow has resulted from this previous splitting of medicine and public health. The NHSC has the potential to respond to this challenge (Smith & Anderson, 1990; Weaver, 1993; Smith et al., 1991; Sumaya, 1995; Mullan, 1997a).

An opportunity exists to transform this program, which has focused on volume and distribution, to one that can challenge the role of health care professionals for the next millennium. A new curriculum and a new role for practitioners must be devised. The NHSC must provide and nurture the practice of this new age medicine within its mission of service (Immerman, 1977; Pollner & Parrish, 1974; Wasserman, 1974; Martin, 1975; Avery, 1971; Weaver, 1993; Sumaya, 1995; Harmon, 1992; Swanson, 1995; Carlson, 1990; Strosberg, Mullan, & Winsberg, 1982).

The result could be the evolution of health care leadership that transcends the current philosophy of trying to fill a vacancy (Rosenblatt, Saunders, Shreffler, Pirani, Larson, & Hart, 1996; Cullan, Hart, Whitcomb, & Rosenblatt, 1997). Such a transformation will require a fundamental restructuring of existing health profession's policy. In addition, new partnerships will need to be forged with public hospitals, departments of public health, and academic health science centers (Smith & Anderson, 1990; Smith et al., 1991; Mullan, 1997a; Harmon, 1992).

POTPOURRI OF HEALTH PROFESSION'S POLICY – FROM FLEXNER TO COGME

The debate can no longer be limited to the numbers of health professionals and sites of practice. What must evolve from a variety of parallel efforts is a cohesive strategy to nurture a team of professionals who respond to the health care challenges of today, yet are positioned to anticipate those of tomorrow. To be successful in this effort, we must reverse this century's trend and merge the interests of curative and preventive medicine.

The Carnegie Foundation supported a landmark report by Abraham Flexner in 1910 that accentuated the separate pathways of preventive and curative medicine. This seminal effort of Abraham Flexner was, in part, the impetus for developing a health care system based on a medical model, or curative approach to care.

Appropriately, it firmly anchored medicine and the training of physicians to academia. The report underscored the weaknesses of the then-existing apprenticeship model of training physicians and recommended that the education of future physicians be grounded in the academic disciplines of anatomy, biochemistry, and physiology.

An unintended consequence of this report was to shunt public health with its related disciplines of prevention, epidemiology, and biostatistics to the world of public policy and politics. The result was that the population-based focus on health care to include the impact of the environment on human health was fragmented from the care of the individual.

What followed the Flexner report was a series of studies, commissions, statutes, and programs designed to establish a health professions' policy for the United States. These efforts included the Committee on the Costs of Medical Care (1933), the President's Commission on the Health Needs of the Nation (1953), the Bane Committee (1959), the Carnegie Commission in 1970, the Graduate Medical Education National Advisory Committee in 1980 (GMENAC), and in 1988 the Council on Graduate Medical Education (COGME). The reports varied in tone and recommendations as the nation's health professional needs evolved from a shortage and maldistribution of all physicians to a shortage of some primary care physicians and an unresolved problem of maldistribution (Rosenblatt & Lishner, 1991).

These efforts and parallel policy debates culminated in a series of convoluted statutes. A series of federal bills, based in part on the findings of the Carnegie Commission of 1970, were passed to create the NHSC. These included the Emergency Health Personnel Act of 1970 and the Health Professional Education and Assistance Act of 1976.

The legislative leadership designed to resolve these shifts in thinking and direction reside in several committees in Congress, thus, fragmenting jurisdiction and programmatic responses. As a result, during the period of the 1970s and 1980s, the NHSC program and field staff was administered separately from the scholarship program.

Despite this ongoing pattern, no coherent health professional strategy has surfaced. Congressional responsibility and jurisdiction remain divided and responsibility for financing and implementing programmatic initiatives remains dispersed throughout the federal government. This further complicates the inexact science of health professional prognostication.

Responsibility for the funding and placement of health professionals resides in several federal agencies including the United States Department of Health and Human Services (DHHS) and the United States Department of Agriculture (USDA). The DHHS programmatic can be found in several agencies including the Health Care Financing Administration (HCFA) through Medicaid and Medicare, the Health Resources and Services Administration (HRSA) through the Bureau of Primary Care and the Bureau of Health Professions and more limited and focused initiatives within the National Institutes of Health and the Centers for Disease Control and Prevention (CDC).

Medicare, Title XVIII, is the major financier of graduate medical education. It is estimated that through direct payments for medical education and indirect payments, which acknowledge the higher costs of teaching hospitals, that Medicare contributes more than $5 billion dollars annually to graduate medical education.

Medicaid, Title XIX, a combined state and federal financing program for the poor and uninsured, also provides teaching hospitals with an enhanced payment because of their higher costs. In addition, Title VII and Title VIII are administered within the HRSA in a distinct administrative structure, the Bureau of Health Professions. These two programs support physician and nurse training programs throughout the country.

As a result of this fragmentation, the incubators of the health professions, academic medical centers, are largely discon-

nected from the national and state health professional programs designed to respond to the service needs of the nation. More significantly, health profession's policy is not consistently coordinated across programmatic or legislative venues. As the largest single financier of graduate medical education, HCFA has initiated policy changes designed to reduce the number of residents nationally.

This effort could have the unintended effect to adversely impact the provision of indigent care and should be coordinated with programs such as the NHSC. Many of the programs targeted for reductions rely heavily on International Medical Graduates (IMGs) to provide indigent care in large urban safety-net hospitals. The intent of the new policy is to convert these large in-patient centers into more community-based programs that focus on prevention. The goal is appropriate; however, the prerequisite skills and geographic orientation of physicians and other practitioners completing their education may not respond to the obvious health needs of large inner-city public hospitals and their surrounding communities.

Nationwide, the escalating numbers of uninsured may force policy makers to rethink our health professions' strategy of the past and expand our vision to focus not solely on numbers, distribution, and specialty, but require an expanded skill set, which includes preventive medicine, environmental sciences, epidemiology, and biostatistics.

The debate about reform of this nation's health professional policies must supersede numbers and location. With the collective resources previously cited, a greater focus must be directed to provide the knowledge base required to be successful to reduce illness in a community (Nguyen, O'Sullivan, & Fournier, 1991).

This will require changes in curriculum and new partnerships between academia, programs such as the NHSC and communities (Weaver, 1990). This evolution of thinking can position the NHSC in a leadership role to refine the work of Flexner, blending the art and science of medicine with the broader community focus of public health. That new discipline is community responsive medicine.

COMMUNITY RESPONSIVE MEDICINE

Community Responsive Medicine (CRM) represents the academic discipline of Community Oriented Primary Care (COPC). COPC is a health-oriented strategy that blends primary care with public health services.

Primary care, the structural foundation of COPC, is defined as the array of health services provided by a practitioner to a patient that are accessible and acceptable, comprehensive in scope, coordinated and continuous over time, and for which the practitioner is accountable for quality.

The distinguishing characteristics of COPC emerge from its community focus. COPC defines the geographic and demographic characteristics of a target population and applies health resources focused to respond to identified needs. Critical to the concept is the community's active participation in problem identification and prioritization.

The effectiveness of the program is measured in terms of its impact on the health status of the target population. In public health terms, COPC is a denominator-driven health care system concerned with the patient and the surrounding population. Effectiveness is determined through a formal epidemiologic evaluation of the population at risk. Ultimately, the question is posed, "Is the community healthier as a direct result of our care and public health interventions?"

THE RESPONSE: LEARN FROM THE PAST – DO NOT REPEAT IT

Responsive approaches to health professions' policy will require flexibility. The needs of individual communities vary. Successful strategies may require that we adopt a "grow your own" philosophy to avoid the revolving door phenomenon. Previous policy often did not recruit or match practitioners to the community in need, resulting in rapid turnover of scholarship and loan repayment recipients. (Rosenblatt et al., 1996; Cullan et al., 1997; Pathman, Konrad, & Ricketts, 1994; Pathman & Konrad, 1996)

The history of the requisite number and distribution of health professionals required to meet the needs of this nation has meandered through most of this century. Policy recommendations often hold us to a point in time, structured to meet the needs of yesterday while dedicating tomorrow's resources today. Solutions for this next millennium are not just about numbers of health professionals, but must include a methodology to develop a new set of clinical and epidemiologic capabilities in the practitioners of the future.

For if there has been one failure of our past and present health professions' policy it is that we have more often than not thrown volume at the problem and not reviewed or sought to modify the kind of care provided. Greater emphasis must be placed on preventive health, disease surveillance, environmental precursors of illness, and medical leadership, which can effect change at a community level.

POLITICAL PRAGMATISM

Health professions' policy, to include the NHSC, has the potential to expand its constituency beyond poverty. With the continued escalation in the number of uninsured and the fear that the safety net cannot (or perhaps should not) survive managed care and competitive markets, access to appropriate care is no longer the problem of the disenfranchised poor.

The chance of an average American becoming uninsured in any given year is now one in seven. The erosion of this nation's safety net, which includes many large public hospitals and medical centers, is of concern because with its demise goes the potential loss of a significant percentage of this nation's trauma and tertiary perinatal systems.

Throughout the health care arena, health professionals are being pushed into new and expanding leadership roles, often without the prerequisite skills in management, business, or public health. This void created by our Flexnerian-based medical education system is no longer acceptable and cannot meet the needs of this century or the next millennium. A void exists and an opportunity is created for evolutionary thinking at the national level.

ADMINISTRATIVE AND ORGANIZATIONAL REDESIGN

Simplicity should prevail in the policy and programmatic arena of the health professions. Successful policy can no longer depend on individual programs, but on a continuum of interventions, which can position the appropriate clinical skills in the right community. Efforts must begin to nurture potential applicants to the NHSC before they leave their hometown. A continuum of contact must evolve as that individual moves through college and ultimately into health professions training.

Scholarships should be established for some during their undergraduate years, the

number to be determined by need or opportunity not predetermined by the appropriation process. Service opportunities should be planned for summer months and elective periods within community health centers, departments of public health, and public hospitals. Loan repayment should remain an option for those in graduate medical education, but not restricted due to geographic variation in indebtedness.

The NHSC and the Bureau of Health Professions should be combined with the intent of supporting this continuum of contact with the Bureau of Health Professions investing in the incubators of future practitioners and the NHSC focusing on the individual and the community to be served. The NHSC scholarship and loan repayment programs should be consolidated.

A national trust fund should be created from dollars appropriated to HCFA to build a new paradigm within academia that can focus on the evolution of graduate medical education (GME) towards a more community-responsive curriculum. This trust fund would support GME in general and have a single line-item within its bill pattern dedicated to the post-graduate training of a new cadre of community responsive physicians.

PRESCRIPTION FOR LONGEVITY – PARTNERSHIPS

With the erosion of the public safety-net, the partners for collaboration become clear. Public hospitals, community and migrant health centers, Indian health and public health must develop a closer bond at the community level and become the narrowed focus of service for the NHSC (Mullan, 1997a). The NHSC will never have the capacity to resolve all of the issues related to the numbers and distribution of health professionals.

The NHSC can solve the problems of one community at a time and place an elite group of health professionals who bring a wider set of skills to the problems of inner city and rural America. By doing so the NHSC can set a standard of service and leadership, similar to the accomplishments of the Epidemiologic Intelligence Service (EIS) in the Centers for Disease Control and Prevention.

To be successful the NHSC must focus its response. Expanded partnerships with Community and Migrant Health Centers, public hospitals, departments of public health, and academic medicine must be forged. The NHSC should facilitate the development of a true system for the uninsured and bring these critical players to the table.

Sites for developing and enhancing the skills of new professionals must be developed in partnership with academia. Selected academic sites should become regional centers of training for this new elite cadre of health professionals. Centers of excellence in community responsive medicine should be established through the use of public and private funds and endowment.

An endowment for excellence could be established with the assistance of foundations, legislation, and the private sector. This endowment would recognize academic excellence by identifying and mentoring the new generation of health professionals through the establishment of scholarships, endowed professorships and chairs, fellowships in community responsive medicine, and research in population-based health.

Practice sites must encompass all aspects of the health care safety net and embrace an interdisciplinary approach to care. Through the endowment of excellence, clinical experiences during undergraduate and graduate medical education, nursing education, physician assistants, dentists and other oral health professionals would be supported. This experience would embrace the goal to establish a continuum of contact.

VALUE, ADDED SERVICE, AND PROFESSIONAL DEVELOPMENT

The NHSC for the next millennium must continue to enhance the skills and credentials of future scholars. Specific advanced training should be offered at a minimum in preventive health, public health, and health policy and practice management. Ideally, all graduates of the Corps should be conferred a certificate or fellowship in community responsive medicine upon completion of a core set of curriculum.

This effort will require collaboration with academic health sciences centers, schools of public health, and departments of public health. The employment of telemedicine and teleconsultation could enable rural areas to be part of an integrated safety-net system. Thus, isolationism is reduced and the standard of care is maintained. Recent developments in telemedicine could allow the scholars to achieve added academic prowess through this technology. Such a commitment would foster a process of enrichment—enrichment of the community's health and enrichment of the practitioner's professional armamentarium.

BENCHMARKING SUCCESS

Those who pay for health care and those who regulate health care delivery are promoting health outcome research and outcome standards. Accreditation organizations such as the Joint Commission on Accreditation of Health Organizations (JCAHO) and the National Committee on Quality Assurance (NCQA) through the Health Plan Employer Data and Information Set (HEDIS) are instituting quality assessment programs that embrace outcome evaluation.

Many hospitals and managed care organizations are promoting quality improvement philosophies that go beyond the concepts of quality assurance. To meet these evolving demands, future health professional graduates will require a broader array of skills such as developing and maintaining health status indicators.

MARKETING – TAKING THIS MESSAGE PRIME TIME

Compassionate caring of the individual and community remains the vision of the National Health Service Corps. The constituency has grown and so with it the opportunity to make a difference and leave a legacy. To accomplish this goal in the 21st century the efforts of this vision must become apparent to a wider audience. This can only be accomplished through education and awareness.

The modality for this communication effort must be "prime time," not in an attempt to bring glory to the program or its scholars, but to highlight the issues they found in the communities they served and the successes achieved. The issue and the solution will remain obscure to the average American until it becomes personal. For 42 million uninsured Americans, the issue of health care access is now personal.

CHALLENGE

The challenge confronting this nation's efforts to reform our health care system has not changed, but the response must. The NHSC can bring partial focus to a very complex set of problems that have defined the need for reform.

On a personal level, the experience gained through service in the NHSC will leave an indelible mark on any scholar. The opportunity for personal growth garnered by experi-

ence-based learning can result in the transformation of the health practitioner surpassing what traditional academics could ever provide (Hotz & Miller, 1997). Exposure to poverty, poor public health infrastructure, environmental hazards and the "Biblical" diseases will help to broaden the skills and sensitivity of insightful scholars. The degree conferred by such experience can best be characterized as an honorary doctorate in community responsive medicine.

These elements combine to define an opportunity for policy makers to leave their mark on the landscape of health care reform. Through new and expanded partnerships with other members of the health care safety net and by expanding the talents of future practitioners, progress can be achieved. The ultimate challenge confronting all of us who profess to be leaders is to assert our vision. It is time to develop and to implement a cohesive health profession's strategy for this nation. The NHSC has demonstrated that it is a good place to begin that journey.

REFERENCES

Avery, C. H. (1971). Educational implications of a national health service corps. *Journal of the American Medical Association,* 218, 1194-1197.

Carlson, R. H. (1990) Models for increasing access: Rejuvenating community/ migrant health centers and the national health service corps. *Journal of Health Care for the Poor and Under-served,* 1, 116-125.

Cullen, T. J., Hart, L. G., Whitcomb, M.E., & Rosenblatt, R. A. (1997). The national health service corps: Rural physician service and retention. *Journal of the American Board of Family Practice,* 10, 272-279.

Harmon, R. G. (1992). The national health service corps: Bridging the gap in health care. *Academic Medicine,* 758-759.

Hotz, J., & Miller, O. V. (1997). *Where Remedies Lie: A Sequel to Doc Hollywood.* Leesburg, GA: Caduceus Press.

Immerman, B. (1977) National health services corps: Purposes and activities. *New York State Journal of Medicine*, April, 788-789.

Martin, E. D. (1975). National health service corps. *Connecticut Medicine,* 39,189-190.

Mullan, F. (1997a). The national health service corps and inner-city hospitals. *New England Journal of Medicine,* 336, 1601-1604.

Mullan, F. (1997b). The national health services corps. *The Lancet*, May 19, 1071-1073.

Nguyen, H. N., O'Sullivan, M. J., & Fournier, A. M. (1991). The impact of national health service corps physicians in the lowering perinatal mortality rate in Dade County, Florida. *Obstetrics and Gynecology,* 78, 385-390.

Pathman, D. E., & Konrad, T. R. (1996). Minority physicians serving in national health service corps sites. *Medical Care,* 34, 439-454.

Pathman, D. E., Konrad, T. R., & Ricketts III, T. C. (1994). The national health service corps experience for rural physicians in the late 1980s. *Journal of American Medical Association,* 272, 1341-1348.

Pollner, P., & Parrish, J. J. (1974) National health service corps and primary care training: A mutually beneficial plan affecting physician maldistribution. *The Journal of the American Medicine Association* , 228, 1405-1407.

Rosenblatt, R. A., Saunders, G., Shreffler, J., Pirani, M. J., Larson, E. H., & Hart, L. G. (1996). Beyond retention: National health service corps participation and

subsequent practice locations of a cohort of rural family physicians. *Journal of the American Board of Family Practice,* 9, 23-30.

Rosenblatt, R. A., & Lishner, D. M. (1991). Surplus or shortage? Unraveling the physician supply conundrum. *Western Journal of Medicine,* 154-50.

Rosenblatt, R. A., & Moscovice, I. (1980). The national health service corps: Raid growth and uncertain future. *Millbank Memorial Fund Quarterly/Health and Society,* 58, 283-309.

Smith, D. R., Anderson, R. J., & Boumbulian, P. J. (1991). Community responsive medicine: Defining an academic discipline. *American Journal of the Medical Sciences,* 302-318.

Smith, D. R., & Anderson, R. J. (1990). Community-responsive medicine: A call for a new academic discipline. *Journal of Health Care for the Poor and Underserved,* 1, 219-228.

Strosberg, M. A., Mullan, F., & Winsberg, G. R. (1982). Service-conditioned medical student aid programs: The experience of the states. *Journal of Medical Education,* 57, 586-592.

Sumaya, C. V. (1995). The national health service corps in the 1990s. *Journal of the American Medical Association,* 273, 1087.

Swanson, A. G. (1975). Mandatory requirement vs. voluntary opportunity for service in the national health service corps. *Journal of Medical Education,* 50, 406-408.

Wasserman, M. P. (1974). New directions for the national health service corps. *Journal of the American Medical Association,* 228, 1422-1423.

Weaver, D. L. (1993). Commentary from the national health service corps: Service-education linkages and serving the under-served. *Family Medicine,* 25, 304-305.

Weaver, D. L. (1990). The national health service corps: A partner in rural medical education. *Academic Medicine,* 65, S43-S44.

Rural Health Clinics in Oklahoma: An Exploratory Study

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Abstract

In response to a lack of access to health care for the rural medically under-served, Public Law 95-210 created the Rural Health Clinic (RHC) program. These clinics were designed to provide primary care services to rural patients. This article presents detailed features of these clinics as they enter into managed care systems and focuses on Rural Health Clinics operating in Oklahoma.

Introduction

Access to health care has been a vexing problem in rural areas. In addition to geographical barriers, rural populations typically require more medical care services then their urban counterparts since they are older, poorer, and less likely to sustain full-time employment that offers medical benefits (Christianson & Mascovice, 1993; Blazer, Landerman, Fillenbaum, & Horner, 1995). To alleviate the access issues in rural areas, the Federal government enacted Public Law 95-210, which created the RHC program. This program is intended to increase access to health care for rural medically under-served areas and expand the use of mid-level practitioners (nurse practitioners, physician assistants, and certified nurse midwives) in rural communities. RHCs receive cost-base reimbursement from Medicare and Medicaid. The Health Care Financing Administration

(HCFA) is responsible for the certification and oversight of the RHCs.

For the purpose of Medicare and Medicaid reimbursement, RHC services are defined as: (1) physician services that include required physician supervision of nurse practitioners, physician assistants, and nurse midwives; (2) services and supplies furnished as an 'incident to' a physician's professional services; (3) services of physician assistants, nurse practitioners, nurse midwives, and specialized nurse practitioners; (4) services and supplies furnished as an 'incident to' services provided by nurse practitioners, physician assistants, nurse midwives, clinical psychologists, and clinical social workers; (5) visiting nurse services on a part-time or intermittent basis to home bound patients (limited to areas in which there is a shortage of home health agencies); and (6) services of clinical psychologists (Omnibus Budget Reconciliation Act, 1987) and clinical social workers (Omnibus Budget Reconciliation Act, 1989).

A certified rural health clinic must be located in a rural area as defined by the United States Bureau of Census. They must also be located in a medically under-served area (MUA) and/or in a health professional shortage area (HPSA) as designated by the Federal Office of Shortage Designation or part of the state special designation. The RHC may be either provider-based (i.e., an integral part of a hospital) or an independent unit housed in a permanent structure or mobile clinic. It may be either publicly or privately owned and operated. It is required that the facility must be under the general direction of a physician who is present at the clinic at least once every two weeks and available by phone at other times for supervisory requirements. The RHC must comply with all applicable federal, state, and local requirements.

Reimbursements for Medicare and Medicaid services provided at the RHC are dependent upon whether they are provider-based or independent. Provider-based clinics receive reimbursements through an established cost-reimbursement methodology for covered services. Reimbursements made to independent RHCs are made as interim payments for covered services, based on an all-inclusive rate per visit computed by Medicare, with an end of the year adjustment to reflect actual costs.

Several aspects to the establishment of an RHC appear to be beneficial. These include payments based on the actual reasonable costs of providing services to Medicare and Medicaid beneficiaries and reimbursements for services of mid-level providers. Also, guidelines for the operation of the clinic are established through the certification requirements and a formalized practice system is developed from required policies and procedures that lead to an improved financial accounting and documentation process.

The first Oklahoma RHC established was in Billings, Oklahoma in 1977. It was not until 1989 that an additional five RHCs were established in Oklahoma; all of these were associated with the Cherokee Nation. Now Oklahoma has no less than 95 RHCs.

Despite their importance in providing health care services in rural areas, very little literature exists that describes the operation of RHCs. However, other types of rural care facilities such as rural health care networks have been described especially in the context of the proposed Clinton health care reform program (Christianson & Moscovice, 1993; Rohrer, 1995).

Even though it seems unlikely that any federally-based health care plan like the one President Clinton had proposed will be enacted, the networks of rural health clinics are still a crucial concern. This is particularly the case if access to care for the rural population is to be maintained at lower costs.

Following the suit of the health care policies of other states, Oklahoma, is expanding its Medicaid managed care program (SoonerCare) to rural areas, which for all intents and purposes will affect the operations of the RHCs. The impact of managed care for the RHCs arises from changing to a capitated payment from a fee for service reimbursement. Some who have studied this issue warn that if a capitation payment plan is imposed on the RHCs too quickly, RHCs may suffer financially and be forced to close (Ortolon, 1995).

In light of these market changes, we assessed Oklahoma's RHCs under the fee for service arrangement in order to develop a baseline data set on their operations. We are particularly interested in observing what services are currently being offered; what types of patients are being seen; how often and for how long RHCs are open to serve their patients; and what is their financial status. As managed care for both Medicaid and private insurers expands into rural areas of Oklahoma, we will follow these RHCs in order to determine what changes, if any, arise due to managed care in order to evaluate the impact of managed care on rural health care. In this paper we present the findings of the baseline survey to provide an overview of the RHC system in Oklahoma.

DATA COLLECTION

Data for this study were collected via a questionnaire sent to all RHCs operating in Oklahoma in 1996. We opted for the questionnaire approach rather than relying on existing data because the licensure data for RHCs only provide a financial audit and we wanted baseline information on funding sources, access by hours of operation, personnel, services provided and ownership of the RHCs. Forty RHCs responded to the first mailing of the questionnaire and an additional sixteen RHCs responded to the second mailing of the questionnaire for a total data set of 56 or a 66% response rate.

DESCRIPTIVE RESULTS

In this section the descriptive results of the RHCs that responded to the survey are presented. Sources of funding to the RHCs in this survey are given in Table 1. Medicare and Medicaid comprised the two most prominent sources of funding, which is of concern particularly for the RHCs as Medicaid (if not Medicare) moves towards managed care. Uninsured patients and patients who did not pay comprised 10.26% of the patients. Twenty seven percent of the RHCs used a sliding scale for patients who could not afford the full fee for service price.

Regarding Medicaid patients, the RHCs surveyed reported that 16.46% of these patients exceeded the two visits per month limit for reimbursement. As the state's Medicaid program moves into managed care, it will be interesting to note if the number of

Table 1. Sources of Funding

Source	Average Percent of Funding
Medicare	36.56%
Medicaid	22.96
Private Insurance	18.45
Out-of-Pocket	11.59
Other	10.44

visits are altered under a capitated system. In other words, if capitation payments will be sufficient enough to cover the visits not currently reimbursed by Medicaid. Given the proposed changes to a Medicaid managed care system, 46% of the RHCs surveyed reported taking at least some steps towards becoming prepared for these changes through information gathering and/or consultations with representatives from the Department of Health Services.

In terms of revenues and costs, the RHCs surveyed reported that, on average, they earned $308,877.42 in gross revenues and, on average, they spent $405,259.81 in gross expenditures. This funding indicates an average deficit of $101,382.39 system wide. Again, it will be worthy to assess if such deficits continue under a capitated/managed care system.

In order to measure access to care we surveyed the RHCs on their hours of operation as well as the hours that medical personnel are available. These results are presented in Tables 2 and 3. Note that during the week, a vast majority of the RHCs are open for service, with relatively long office hours (eight to ten hours) during the Monday through Friday period. There is little on-call time during the week, but the on-call schedules are increased dramatically on the weekend so that their patients still have access to services.

From Table 2, it can be seen that RHCs typically employ auxiliary medical personnel to work more total hours than physicians. Incorporating mid-level practitioners has been advocated by Rohrer (1995) in his work of accountable health plans in rural areas. Specifically, he advocates for flexibility in personnel and that quality of care from mid-level practitioners is equal to the care provided by physicians when mid-level practitioners stay within the scope of their practice (Rohrer, 1995). Further, he estimated that approximately 80% of the care provided by primary care providers can be provided by mid-level practitioners (Rorher, 1995), which is evident here because all services performed by RHCs in Oklahoma are primary care services. In Table 4 the types of specific primary care services provided by the RHCs

Table 2. RHCs Hours of Operation

Day	RHC's Open	Number of Hours Open	Percent of RHCs
Monday	55	8-10 hrs	83.2%
Tuesday	55	8-10 hrs	81.3
Wednesday	53	8-10 hrs	84.3
Thursday	54	8-10 hrs	80.9
Friday	52	8-10 hrs	72.0
Saturday	17	8-10 hrs	45.5
Sunday	9	8-10 hrs	14.3

Table 3. Hours that Medical Personnel are Available

Personnel	Mean Number of FTE	Hours Worked/Week
Physician	1.01	14
Physician Assistant	0.94	33
Nurse Practitioner	0.34	22
Registered Nurse	0.47	17.5
Lic. Practice Nurse	1.16	37
Clerical	1.15	38
Office Manager	1.65	39

as well as the percent of patients who use these services are presented.

On average, the RHCs reported that they have 118.42 visits per week. The services provided reflect the emphasis on auxiliary medical personnel rather than on full-time physicians.

Table 4. General Types of Services Used by Patients in RHCs

Service	Percent of Patients
Primary Care	54.09%
Prenatal	1.58
Pediatric	20.43
Geriatric	25.62
Immunization	5.02
Education	11.86
Chronic Care	9.06
Other	1.00

In terms of the age distribution of patients, 39.71% of patients seen by the RHCs are age 65 and over and 39.64% of all the visits are for that age group. Thus, the provision of geriatric services is required (see Table 5). Over twenty-seven percent (27.26%) of patients are pediatric patients and 30.45% of all visits are pediatric cases. The remaining one third of the patients and 29.91% of the visits are for adults, indicating a relatively evenly distributed mix of patients categorized by age, which runs counter to the notion that rural patient populations tend to be older.

We also surveyed the RHCs on a range of the specific services that they provide and the results are presented in the list below.

The diagnostic services available and the percentage of RHCs that offer these services are as follows:

- Chemical examination of urine by stick or table: 96.4%
- Microscopic examinations of urine sediment: 60.7%
- Hemoglobin or hematocrit: 87.3%
- Blood sugar: 96.4%
- Gram stain: 42.9%
- Examination of stool specimens for occult blood: 94.6%
- Primary culturing for transmittal to certified lab: 85.7%
- Test for pinworm: 57.1%
- X-rays: 49.1%
- EKGs: 48.5%

For services that are required, but are outside the scope of the RHC's capability, we also assessed their ability to refer patients. Fifty-two RHCs surveyed reported that they have referrals for laboratory and x-ray services not available at their clinics. In terms of the referral for secondary or tertiary care, 93% of the RHCs responded that they had at

Table 5: Age of Patient by Percent of Total Patients and Visits

Age	Percent of Patients	Percent of Visits
0 to 5	12.65%	15.39%
6 to 19	14.61	15.06
20 to 39	13.33	13.38
40 to 64	19.70	16.53
65 to 74	29.04	27.76
74+	10.67	11.88

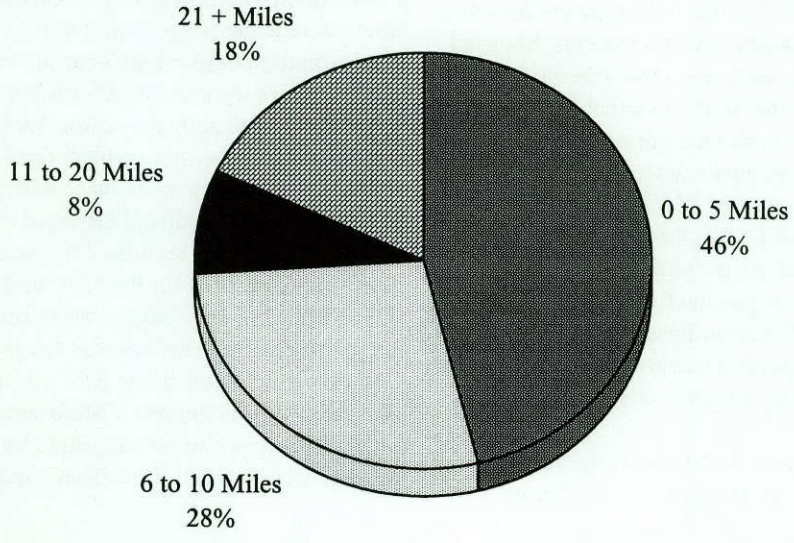
least one medical clinic or hospital identified for their patients. Seventy-three percent of the RHCs had two referral sites and 39% of the RHCs had three referral sites. These referral sites were spread across the state rather than being concentrated only in Oklahoma City or Tulsa, which indicates a state-wide network of hospitals and clinics that work in conjunction with the RHCs.

In addition to the types of services available and operating hours, access is also a function of the distance patients may travel in order to receive health care services. The results indicate that a majority of patients live within 10 miles of the closest RHC, which is less than the average 30 to 90 minute drive to health care services found elsewhere (Blazer et al., 1995). See Figure 1 for the distribution of travel distances.

In the law enacting the development of RHCs, it was designated that the RHCs could be either part of a network or independently owned. Thirty of the RHCs surveyed are owned by hospitals, 15 are owned by independent providers, 9 are owned by Native-American tribes, hospitals authorities, and a development corporation.

The above section of this article indicates results from a survey of the RHCs operating in Oklahoma. In the next section, results are presented from a more in-depth analysis of the financial and ownership status of RHCs.

Figure 1. Distances Traveled by Patients



ADDITIONAL ANALYSES

We assessed various characteristics of the RHCs on two dimensions: financial viability and ownership. We focused on these dimensions for two reasons. First, we wanted to ascertain if there were any statistically significant differences between RHCs that were financially viable (i.e., net revenues greater than zero) versus those that were not in order to determine possible causes for the RHCs financial status.

Second, we are interested in ownership (hospital-based versus privately owned) because under managed care, networks of rural health care providers will be necessary and we must surmise that those already attached to a hospital will be in a better position for managed care contracts vis-à-vis the RHCs that are free-standing.

The means for all the descriptive variables (given in the preceding section) were compared using the t-test statistic to determine if statistically significant differences existed. In Table 6 only the statistically significant values by financial viability are presented.

From these findings, it appears that the RHCs in financial distress typically see more Medicaid patients and young children as compared to RHCs that were financially viable and treated more Medicare patients that used more geriatric services. This latter finding may be attributed to the fact that Medicare's reimbursement rates are greater than Medicaid's reimbursements. Further, the financially distressed RHCs saw more patients who pay out of pocket than their financially solvent counterparts. Out-of-pocket patients typically do not pay the full amount charged for the visit, but regardless of how much they do or do not pay are categorized as out-of-pocket patients, which is analogous to "bad dept."

One question that arises from these findings is: If the RHCs which treat more

Table 6: Statistically Significant Differences by Financial Status (Mean Percentages Reported)

	Financially Distressed	Financially Solvent
Medicaid	25.22%	9.25%
Medicare	33.18	54.88
Out-of-Pocket	10.51	2.38
Age 0 to 5	11.67	3.50
Age 15 to 19	12.77	5.75
Geriatrics	22.02	36.25

Medicaid patients under a fee for service reimbursement plan are facing financial trouble, then will their financial woes be exacerbated under Medicaid managed care? Findings from a Texas study on this issue are mixed. On the one hand, there is the argument that RHCs already operate under a budget and use mid-level personnel; therefore, movement to a capitated plan would not be alien to them (Sternberg, 1995). On the other hand, there is the suggestion that if a capitation is imposed before RHCs recoup costs, they may have to close down (Ortolon, 1995). This may be especially precarious for RHCs that are already operating with deficits. Therefore, following up on these RHCs after the imposition of Medicaid managed care in Oklahoma is crucial, because if financial distress is intensified for the RHC under managed care, it may have to close and further hinder a patient's access to care.

Another question facing RHCs in Oklahoma is what may happen if Medicare moves toward managed care as suggested by the Republican Congress. Some RHCs may be

currently enjoying profitability under Medicare fee for service, but their financial status may well change under capitated payments.

Two interesting "non-results" are worthy of note. First, there was not a statistically significant difference on measure of distance on financial viability, which indicated that remote RHCs are not at a particular disadvantage to earn net revenues. Second, there was not a statistically significant difference between financial viability and the number of visits, which suggests that no dis-economics of scale exists among the RHCs.

In Table 7 we present the statistically significant findings by ownership (hospital-based versus free-standing). Interestingly, there was no statistically significant differences between RHCs that were privately owned versus hospital-based on financial status, which seems to indicate that hospitals may not be infusing additional resources into the RHCs and that financial viability is solely determined by the RHC itself.

Privately owned RHCs had more patient visits on average and had more pediatric services than their hospital owned counterparts. Conversely, hospital owned RHCs had statistically significant higher numbers of very old patient visits and provided more chronic services. These findings may be due in part to the location of the RHCs and that hospital-based RHCs tended to be located in areas with older and perhaps more lucrative patients. As far as the potential networking of the RHCs for Medicaid managed care is concerned, there does not appear to be any clear cut advantage for hospital-based RHCs vis-à-vis privately owned RHCs, but this may change given how the managed care contracts are devised.

Table 7. Statistically Significant Differences by Ownership (Mean Reported)

	Hospital	Free-Standing
Average Visit	80.92%	171.38%
Pediatric Services	21.15	10.00
Chronic Services	5.15	12.92
Visits By Those Age 75 +	6.42	12.53

CONCLUSION

In this article, a base line data set for RHCs in Oklahoma was developed. The value of these data include: (1) A greater understanding of RHC operations dealing with fee for service situations to ascertain how well they are meeting the challenges of providing health care services to the rural population of Oklahoma; and (2) A reference for assessing changes and consequences for RHCs under Medicaid managed care, which is the focus for subsequent research. Understanding how these entities operate as well as how they may adapt to change is critical in developing health policy for rural populations. Without this information, debate on the direction of health policy and managed care would be fruitless.

REFERENCES

Blazer, D., Landerman L., Fillenbaum, G., & Horner, R. (1995). Health services and access and use among older Americans in North Carolina: Urban versus rural residents. *American Journal of Public*

Health, 85(10), 1384-1390.
Christianson, J., & Moscovice, I. (1993). Health care reform and rural health networks. *Health Affairs*, 12(3), 58-75.
Oklahoma State Department of Health, Office of Rural Health (1996). *Oklahoma guide to federal designation of medically under-served areas and health professional shortage areas.* Oklahoma City, OK: Author.
Omnibus Budget Reconciliation Act of 1987, Pub. L. No. 100-203, § 2, 101 Stat. 1330 (1987).
Omnibus Budget Reconciliation Act of 1989, Pub. L. No. 101-239, § 2, 103 Stat. 2106 (1989).
Ortolon, K. (1995). Squeeze play. *Texas Medicine*, 91(3), 12-15.
Rohrer, J. (1995). Regulation of accountable health plans in rural areas. *Journal of Public Health Policy*, 16(2), 198-212.
Steinberg, R. (1995). Managed care goes county. *Texas Medicine*, 91(3), 20-23.

Assessment of an Educational Program to Reduce the Risk of Non-Insulin Dependent Diabetes Mellitus in School Children in Rural Southwest Texas

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Abstract

Mexican-Americans have a genetic predisposition for non-insulin dependent diabetes mellitus (NIDDM) with increased NIDDM prevalence, greater adiposity with a less favorable body fat distribution, earlier NIDDM onset, and greater severity of complications relative to non-Hispanic whites. Mexican-American children generally are shorter and heavier with more central body adiposity, which is a pattern that is well-established by adolescence and continues into adulthood. Behavioral intervention to reduce dietary fat intake and increase physical activity to prevent NIDDM in this at-risk population is needed.

Jump Into Action, a school-based diabetes education program, encourages students to eat low-fat foods and exercise regularly to reduce their risk for developing NIDDM. A study was conducted in Presidio County to assess the effectiveness of *Jump Into Action* in improving fifth-graders' knowledge, self-efficacy, and behaviors regarding NIDDM prevention. *Jump Into Action* was found effective in improving knowledge and self-efficacy regarding NIDDM prevention. While no significant program effect on dietary behavior was observed, interpretation of the students' dietary habits must include consideration that students' access to healthy foods may be limited.

INTRODUCTION

Diabetes mellitus comprises a heterogeneous group of chronic metabolic disorders characterized by increased blood glucose levels secondary to impaired insulin activity and/or insufficient insulin production. Insulin dependent diabetes mellitus (IDDM) is characterized by the loss of endogenous insulin production that is usually of an autoimmune origin. IDDM usually appears in childhood or adolescence and requires exogenous insulin replacement. Non-insulin dependent diabetes mellitus (NIDDM) is characterized by initial insulin resistance and hyperinsulinemia. NIDDM usually has its onset after age 40 and may be controlled with proper diet and exercise, sometimes in combination with oral hypoglycemics or exogenous insulin. NIDDM prevention should begin by developing healthy lifelong habits of children that decrease the likelihood of obesity and sedentary lifestyles as they grow through adolescence and become adults.

INCIDENCE AND PREVALENCE OF NIDDM

There were approximately 7.8 million diagnosed cases of diabetes in the United States in 1993 based on the National Health Interview Survey (NHIS) data (Harris, 1995). IDDM comprised about 7% of all diagnosed cases of diabetes mellitus. Most of the remaining 90% to 95% of the cases may be considered NIDDM. Based on the Second National Health and Nutrition Examination Survey (NHANES II), it is estimated that there are seven million undiagnosed cases of NIDDM in the United States (Harris, 1995). NHANES II included oral glucose tolerance testing (OGTT) in representative samples of people without diagnosed diabetes, which resulted in about one undiagnosed case of NIDDM for every diagnosed case. It is estimated that 625,000 new cases of diabetes are diagnosed annually in the United States (Harris, 1995). The prevalence of NIDDM is 6.6% of the United States population and rises to 17.7% among people 65 to 74 years old (Nelson, Everhart, Knowles, & Bennett, 1988). The prevalence of NIDDM is two to three times higher in Mexican-Americans than in non-Hispanic whites, as documented by the San Antonio Heart Study (Haffner, Hazuda, Braxton, Patterson, & Stern, 1991), the San Luis Valley Diabetes Study (Hamman, Marshall, Baxter, Kahn, Mayer, Orleans, Murphy, & Lezotte, 1989), the Starr County Study (Hanis, Ferrel, Barton, Aquilar, Garza-Ibarra, Tulloch, Garcia, & Schull, 1983), and the Hispanic Health and Nutrition Examination Survey (HHANES) (Flegal, Ezzati, Haynes, Juares, Knowler, Perez-Stable, & Stern, 1991).

In 1996, an estimated 890,000 Texans were identified as having diabetes and it is estimated that the same amount has undiagnosed diabetes. Almost 9% of both Hispanic and African-American Texans have been diagnosed with diabetes as compared to 5% of White Texans (Texas Diabetes Council, 1994). Between 1989 and 1994, almost 22,000 Texans over the age of 40 years died from diabetes (Texas Department of Health, 1996). In 1992, Texas spent over four billion dollars on the costs of diabetes and related problems including blindness, kidney disease, and amputations (Texas Diabetes Council, 1995; Warner, DeNiro, Pugh, Cornell, McCandless, & Marsh, 1995).

RISK FACTORS FOR NIDDM

NIDDM is a chronic progressive disorder, which may take years to develop, presumably starting with genetic susceptibility in most

cases. The simplest evidence supporting a genetic component of NIDDM is that this disorder is more frequent in certain ethnic groups and in certain families. The ethnic and familial clustering is likely to result from shared genes and shared behavioral and environmental risk factors (Hamman, 1992).

Studies of populations that derive from ethnic groups with different genetic risks of developing NIDDM provide indirect evidence for a genetic component of NIDDM. Hispanics in the southwestern United States share genes of Native Americans and of non-Hispanic Whites. The risk of NIDDM in this Hispanic population has been shown to be intermediate between the very high NIDDM prevalence in the Native American population and the relatively low NIDDM prevalence in the non-Hispanic White population (Gardner, Stern, Haffner, Gaskill, Hazuda, Relethford, & Eifler, 1984; Hanis, Hewitt-Emmett, Bertin, & Schull, 1991).

Presence of NIDDM in a family member is an established risk factor for NIDDM. Individuals with at least one diabetic parent have a much higher incidence of NIDDM than those of similar body habitus who do not have a diabetic parent (McCance, Pettitt, Hanson, Jacobsson, Bennett, & Knowler, 1991). Several studies of twins suggest that NIDDM is highly concordant among monozygous twins and less concordant among dizygous twins, indicating that genetic factors play a major role in the etiology of NIDDM. However, since the concordance in monozygous twins is much less than 100%, the studies also support a role for non-genetic factors in NIDDM development (Newman, Selby, King, Slemenda, Fabitz, & Friedman, 1987).

The dominating lifestyle risk factor that appears to facilitate the transition from a genetic predisposition for NIDDM to the onset of the disease is obesity. This is especially true with regard to central upper body or abdominal obesity. Central obesity has been shown to be the major predictor of NIDDM and is associated initially with insulin resistance and impaired glucose tolerance, and subsequently with the loss of insulin secretory capacity (Haffner, Stern, Hazuda, Rosenthal, Knapp, & Malina, 1986; Walker, 1995). The major nutritional risk factor for NIDDM is excess dietary fat intake, especially saturated fat. Fat consumption, adjusted for total energy intake, predicted the risk for NIDDM development in individuals with impaired glucose tolerance in the San Luis Valley Diabetes Study (Marshall, Hamman, & Baxter 1991; Marshall, Hoag, Shetterly, & Hamman, 1994). Also, non-diabetic individuals who developed diabetes in the San Antonio Heart Study consumed more saturated fat and cholesterol and less polyunsaturated fat than those who remained non-diabetic (Stern, 1991).

Physical inactivity has also been associated with the increased onset of NIDDM. Deconditioning and physical inactivity have been linked to insulin resistance (Eriksson and Lindgärde, 1996); whereas, regular physical training and exercise can increase insulin sensitivity (Eriksson and Lindgärde, 1991). It has been proven that behavioral interventions to modify these risk factors for NIDDM by restricting dietary fat, together with increased physical activity, decreases hyperglycemia significantly (Eriksson and Lindgärde, 1991). A six-year study of 47 to 49 year old males with an early stage of NIDDM or impaired glucose tolerance (IGT) who participated in a long-term intervention to improve diet and increase physical exercise found that the benefits to this group included weight loss and improved physical fitness, along with improved glucose tolerance, and reduced incidence of progression to NIDDM when compared to an IGT reference group. The intervention included dietary counseling and physical activity training, under the

guidance of a physiotherapist, for the first eighteen months of the study. Participants then continued the intervention protocol independently with periodic clinical follow-ups. The study demonstrated that it is possible to induce and maintain lifestyle changes in diet and exercise habits to prevent or postpone NIDDM onset in at-risk individuals (Eriksson and Lindgärde, 1991).

POPULATIONS AT INCREASED RISK

Mexican-Americans in south Texas have a three to five-fold increase in NIDDM prevalence, greater adiposity, and a less favorable distribution of body fat as compared to non-Hispanic Whites. The public health impact of NIDDM in Mexican-Americans is accentuated by their younger age of NIDDM onset and greater severity of NIDDM complications (retinopathy, proteinuria, end-stage renal disease, and microvascular complications). With the Mexican-American population rapidly growing and being demographically young, this population is particularly susceptible (Haffner et. al., 1991).

A study of low-income Mexican-American children, 10 to 14 years of age, in south Texas showed that they are shorter and heavier than United States reference data and have more upper and central body adiposity than non-Hispanic Whites (Guinn, 1993). This pattern is well-established by adolescence and continues into adulthood (Foreyt and Cousins, 1993). Considering the association between obesity and increased prevalence of NIDDM, along with a genetic predisposition for NIDDM in Mexican-Americans, childhood-onset obesity poses a significant health risk in this group. Because NIDDM is a major contributor to morbidity and mortality, behavioral intervention to prevent obesity in this at-risk population is indicated (Guinn, 1993). Prevention strategies would be expected to have the greatest impact in children who are overweight, relatively hyperglycemic, or from populations with a high NIDDM prevalence (McCance et. al., 1994).

NIDDM SCHOOL HEALTH EDUCATION

The school is a convenient and cost-effective setting for reaching large numbers of children and is a potentially important site for the identification of children at-risk for NIDDM and for age-appropriate health education designed to help reduce that risk (Guinn, 1993; Foreyt and Cousins, 1993). It is important for children to acquire the knowledge and skills as well as develop attitudes, motivation, and behaviors that enable them to take charge of their eating and exercise habits to promote good health and prevent disease. Healthy People 2000 includes objectives to increase to at least 75% the proportion of the nation's schools that provide nutritional education from preschool through twelfth grade. Preferably this education will be part of a quality school health educational program. In addition, objectives have been set to increase to at least 50% the proportion of physical education class time that students spend being physically active (Department of Health and Human Services, 1991). Healthful eating habits are learned early in life and exercise habits established in childhood enhance the maintenance of physically active lifestyles throughout adolescence and adulthood (Guinn, 1993; Parcel, Simons-Morton, O'Hara, Baranowski, Kolbe, & Bee, 1987). Providing health and nutritional education during the developmental years will reach students when they are beginning to make their own decisions and eat more meals away from home (Department of Health and

Human Services, 1991). Obesity prevention is especially important during these years because juvenile obesity often begins or worsens during this period of accelerated growth (Guinn, 1993).

Social cognitive theory, as developed by Bandura (1986), has been useful in designing school health educational programs that emphasize the development of behavioral capabilities, positive outcome expectations, and perceived self-efficacy to develop and maintain healthy eating and exercise habits. Teaching methods include modeling through group activities, demonstrations, and videotapes; self-monitoring of behavior by keeping a journal record of eating and exercise; and social reinforcement of healthy eating and exercise (Foreyt and Cousins, 1993).

PURPOSE OF THE STUDY

Although studies have demonstrated that NIDDM onset can be prevented or postponed in at-risk individuals through education and behavioral intervention, there are no school-based health educational programs specifically designed for NIDDM awareness and prevention reported in the literature. In response to this deficit, *Jump Into Action* was developed at Baylor College of Medicine in 1995 as a school-based diabetes prevention program designed to encourage healthier lifestyle choices for NIDDM prevention and to enable students to take responsibility for their own health by enhancing their knowledge, motivation, and decision-making skills. The purpose of this study was to assess whether *Jump Into Action* improved students' knowledge, self-efficacy, and behaviors regarding NIDDM prevention as reflected in students' responses to pre-surveys, post-surveys, and follow-up surveys. The study involved students and teachers at two elementary schools in rural southwest Texas.

METHODS

Study Population

The research utilized a quasi-experimental design with control and intervention groups comprised of students enrolled in two elementary schools in southwest Texas. The intervention group was the 1996 fifth-grade class of Marfa Elementary School in the Marfa Independent School District, Marfa, Texas. Marfa is located in the northern portion of Presidio County and is sixty miles north of the Texas/Mexico border. According to the 1990 census, the total population of Presidio County was 6,637, with 2,424 people living in Marfa. The population distribution by ethnicity in Presidio County was 81.6% Hispanic, 18.4% non-Hispanic White, and 1% Black. There were 3,192 Presidio County residents living below poverty level with 63% of the students recognized by federal standards to be "at-risk." The intervention group's teacher participated in an in-service workshop in preparation for teaching *Jump Into Action* and received a *Jump Into Action* package that included the teacher's guide, student workbooks, and surveys to assess the students' knowledge, self-efficacy, and behaviors regarding NIDDM.

Fifth-grade students at Presidio Elementary School, Presidio Independent School District, Presidio, Texas, served as the control group for this study. Presidio is located 60 miles south of Marfa. Presidio students completed the *Jump Into Action* surveys without any other exposure to *Jump Into Action* or other NIDDM-related educational programs. The study was conducted over the three-month period of March to May 1996.

Educational Intervention

Jump Into Action includes a teacher's guide and student workbook that provide

information about NIDDM and obesity and encourage students to eat low-fat foods and exercise regularly to avoid obesity and reduce their risk for developing NIDDM. *Jump Into Action* takes an interdisciplinary approach to health education, integrating health education with reading, writing, math, science, and physical education and is designed to improve students' knowledge, self-efficacy, and behaviors regarding NIDDM prevention. The *Jump Into Action* student workbook provides information about the types, causes, risks, complications, incidence, facts and myths, and prevention of diabetes and involves the students in interactive and hands-on activities that reinforce and enrich knowledge, skills, and prevention concepts. The nutrition section includes information about the food pyramid and identifies high-fat and low-fat choices in each of the food groups. This section also provides information about nutrition labels and suggests activities to further develop students' ability to make low-fat food choices. The exercise section of the workbook emphasizes the importance of preventing obesity and NIDDM through regular exercise and recommends that students set personal fitness goals to pursue and encourages them to continue to maintain appropriate levels of daily activity for lifetime reduction of NIDDM risk.

Data Collection

The *Jump Into Action* survey was administered to the Marfa students as a pre-survey prior to beginning *Jump Into Action*; as a post-survey after completing *Jump Into Action*; and as a follow-up survey three weeks after completing *Jump Into Action*. Presidio students completed the surveys at approximately the same time intervals as the Marfa students. Students in both groups were asked to provide identifying information (initials and date of birth) and demographic information (gender, ethnicity, school, and teacher's name) and to respond to a forty-two item survey.

The *Jump Into Action* survey included 15 multiple-choice items to assess students' knowledge regarding NIDDM, food choices, and exercise. Twelve self-efficacy items measured students' perceived ability to make healthy food choices and participate in regular physical activity. Student behavior regarding food choices was assessed by asking the frequency of consumption of 15 food items on the previous day. Students' response choices were "No, I didn't eat any of this food yesterday," "Yes, I ate this food one time yesterday," or "Yes, I ate this food two or more times yesterday."

Each student's pre-, post-, and follow-up surveys were matched by the identifying information provided and assigned an identification number for purposes of entering the responses into data tables constructed using Paradox software. The entered data were converted to Dbase IV format and exported to the Statistical Package for Social Scientists for analysis.

Statistical Analyses

Correct knowledge responses were coded as 1 and incorrect knowledge responses were coded as 0. Knowledge scores were derived by calculating each student's percentage of correct responses relative to the total number of questions answered by the student. The self-efficacy responses on a 4-point Likert scale ranged from "I'm sure I can't" to "I am very sure I can" and were coded as 1, 2, 3, or 4, and higher values were assigned to more favorable responses. A self-efficacy score was determined for each student by calculating the mean value of the student's responses to these twelve items. The food choice behavior responses were coded as 1, 2, or 3, and higher values were assigned to more

favorable responses. A behavior score was determined for each student by calculating the mean value of each student's responses to these fifteen items.

The students' pre-survey knowledge, self-efficacy, and behavior scores were compared to their post-survey and follow-up survey scores using t-tests for paired samples to determine any significant differences within each of the two groups in the survey responses over time. The pre-, post-, and follow-up survey scores of the intervention group were compared to those of the control group using t-tests for independent samples to determine significant differences between the survey responses of the two groups. The critical value for significance was set at 0.01 based on a modified Bonferroni technique to compensate for possible multiple comparison bias (Glantz, 1981).

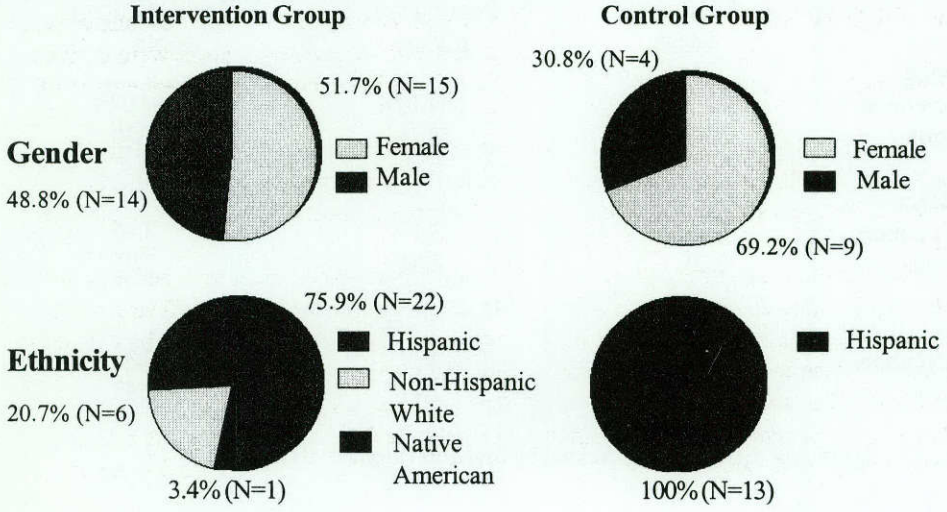
RESULTS

The intervention group was comprised of 29 Marfa Elementary School fifth-graders, including 14 males and 15 females, 22 Hispanics, six non-Hispanic Whites, and one Native American. All of the students in the intervention group completed pre-, post-, and follow-up surveys. The control group was initially comprised of 29 Presidio Elementary School fifth-graders, including 13 males and 16 females, 28 Hispanics and one Native American. However, due to teacher interference, only 13 Presidio students completed post- and follow-up surveys that were usable for study purposes (see Table 1).

Knowledge Regarding NIDDM

Analysis of the knowledge data for the control and intervention groups revealed pre-survey scores of 53.9% (SD 14.18%) and 59.77% (SD 12.01%) respectively ($p<.194$). As shown in Table 2, the post-survey scores of the intervention group greatly exceeded that of the control group ($p<.0005$). The magnitude of difference between the intervention and control groups was sustained at follow-up survey ($p<.0005$). The improvement in the intervention group's knowledge scores

Table 1. Demographic Characteristics of Intervention and Control Group Students



was statistically significant from pre-survey to post-survey (t-test for paired values p<.0005). This difference was sustained from pre-survey to follow-up survey (p<.0005). There was no statistically significant change in the control group's knowledge scores from pre-survey to post-survey and pre-survey to follow-up survey.

Perceived Ability to Make Healthy Choices

Analysis of the self-efficacy data for the intervention and control groups revealed pre-survey scores of 2.82 (SD 0.65) and 2.70 (SD 0.42), respectively (p<.534). As shown in Table 2, the post-survey scores of the intervention group exceeded that of the control group (p<.006). This difference was sustained at follow-up survey (p<.003). The improvement in the intervention group's self-efficacy scores was statistically significant from pre-survey to post-survey (t-test for paired values; p<.002). This difference was sustained from pre-survey to follow-up survey (p<.0005). There was no statistically significant change in the control group's self-efficacy scores (pre-survey to post-survey (p<.456) and pre-survey to follow-up survey (p<.028).

Behavior Regarding Food Choices

Analysis of the food choice behavior data for the intervention and control groups revealed pre-survey scores of 2.32 (SD 0.18) and 2.25 (SD 0.29), respectively; post-survey scores of 2.37 (SD 0.16) and 2.41 (SD 0.27), respectively; and follow-up scores of 2.35 (SD 0.19) and 2.47 (SD 0.29), respectively. There was no significant change in the intervention group's behavior scores from pre-survey to post-survey (t-test for paired values; p<.128) or from pre-survey to follow-up survey (p<.348). There was no significant change in the control group's behavior scores from pre-survey to post-survey (p<.053) or from pre-survey to follow-up survey (p<.021). The t-tests for independent samples comparing the behavior scores of the intervention group to the behavior scores of the control group

Table 2. *Jump Into Action* Survey Results of Intervention and Control Groups*

	Pre-Survey Mean	Post-Survey Mean	Follow-Up Survey Mean
Knowledge			
Intervention	53.79%	84.70%	82.07%
Control	59.77	58.25	59.30
Self-Efficacy			
Intervention	2.82	3.17	3.45
Control	2.70	2.61	2.91
Behavior			
Intervention	2.32	2.37	2.35
Control	2.25	2.41	2.47

*Statistically significant differences indicated by brackets (alpha = .01).

revealed no significant differences between the pre-survey ($p<.371$), post-survey ($p<.522$), or follow-up survey ($p<.112$) scores of the two groups (see Table 2).

DISCUSSION

The results of this study have specific limitations regarding their generalization: (1) the small size of the study groups limit statistical comparisons of results; (2) the participating teachers and students were volunteers and were not randomly assigned to intervention or control groups; (3) the participating elementary schools were located in low-income areas of rural southwest Texas and may not be representative of other rural or urban areas; (4) the same survey was administered to the students three times over a three-month time period that may have introduced a response bias; and (5) there were missing data on many surveys as student respondents failed to answer all questions as requested. The effect of these limitations on the study's outcomes is unknown, but must be considered when interpreting the results.

The data suggest that *Jump Into Action* was effective in improving the Marfa students' knowledge and self-efficacy regarding NIDDM prevention. The improvements were sustained for three weeks beyond the end of program participation. The gains in knowledge and self-efficacy are particularly important in this predominantly Hispanic population because of the higher rates of NIDDM among the adults of this ethnic group. It is important that these students be aware of their ethnic predisposition for NIDDM development and the correlation between NIDDM development and the high-fat consumption patterns and sedentary lifestyles in the Mexican-American community (McCance, 1994).

The *Jump Into Action* program was designed to enhance students' knowledge and perceived self-efficacy and to develop the behavioral skills necessary for students to select healthy meals and snacks. Despite this effort, no significant program effect on students' dietary behavior was observed. Interpretation of the students' self-reported dietary habits must include consideration that in order for students to adopt healthy dietary practices, they must have access to healthful food choices. Students' food consumption is dependent on food availability and their behaviors may be reflective of their school cafeteria menu and/or their parents' food selection and preparation habits. Barriers to students' adoption of healthy eating practices may also include the high cost of fresh produce and low-fat food products or lack of access to grocery stores with affordable and available low-fat products (Foreyt and Cousins, 1993).

The literature suggests that for increased health knowledge to result in improved health behaviors, environmental modifications also may be necessary (Parcel et. al., 1987). Integration of the classroom curriculum with interventions in physical education, school food service programs, and family involvement resulted in improved dietary behaviors as demonstrated in The Child and Adolescent Trial for Cardiovascular Health (CATCH) Program (Luepker, Perry, McKinlay, Nader, Parcel, Stone, Webber, Elder, Feldman, Johnson, Kelder, & Wu, 1996). Appropriate strategies regarding eating practices in this largely Hispanic population should include nutrition recommendations that are culturally sensitive and within the context of the Mexican-American diet (Guinn, 1993; Foreyt and Cousins, 1993).

CONCLUSION

Jump Into Action is an effective education program for promoting NIDDM awareness and prevention in this predominantly Hispanic population at high-risk for developing NIDDM. For healthier dietary behaviors to follow from students' health knowledge gains, healthy food choices must be available to them. Therefore, it may be necessary to involve the students' parents and/or the school food services staff in future dietary behavior interventions to improve students' access to a greater variety of healthy foods.

REFERENCES

Bandura, A. (1986). *Social Foundation of Thought and Action: A Social Cognitive Theory.* Englewood Cliffs, NJ: Prentice Hall.

Department of Health and Human Services. (1991). *Healthy People 2000: National Health Promotion and Disease Prevention Objectives.* (DHHS Publication No. PHS 91-50212) Washington, D.C.: U.S. Government Printing Office.

Eriksson, K. F., & Lindgärde, F. (1996). Poor physical fitness and impaired early insulin response, but late hyperinsulinemia, as predictors of NIDDM in middle-aged Swedish men. *Diabetolgia,* 39, 573-79.

Eriksson, K. F., & Lindgärde, F. (1991). Prevention of Type 2 (non-insulin-dependent) diabetes mellitus by diet and physical exercise: The 6-year Malmö feasibility study. *Diabetologia,* 34, 891-98.

Flegal, K. M., Ezzati, T. M., Haynes, S.G., Juares, R. Z., Knowler, W. C., Perez-Stable, E. J., & Stern, M. P. (1991). Prevalence of diabetes in Mexican-Americans, Cubans, and Puerto Ricans from the Hispanic health and nutrition examination survey. *Diabetes Care,* 14, 628-38.

Foreyt, J. P., & Cousins, J. H. (1993). Primary prevention of obesity in Mexican American children. *Annals of the New York Academy of Sciences,* 699,137-45.

Glantz, S. A. (1981). *Primer of Biostatistics.* (pp. 87-88) New York: McGraw-Hill.

Gardner, L. I., Stern, M. P., Haffner, S. M., Gaskill, S. P., Hazuda, H. P., Relethford, J. H., & Eifler, C. W. (1984). Prevalence of diabetes in Mexican-Americans: Relationship to percent of gene pool derived from Native American sources. *Diabetes,* 33, 86-92.

Guinn, B. (1993). The overweight status of low income Mexican-American children 10 through 14 years of age. *Journal of Health Education,* 24, 132-34.

Haffner, S. M., Hazuda, H. P., Braxton, D. M., Patterson, J. K., & Stern, M. P. (1991). Increased incidence of type II diabetes mellitus in Mexican-Americans. *Diabetes Care,* 14, 102-8.

Haffner, S. M., Stern, M. P, Hazuda, H. P., Rosenthal, M., Knapp, J. A., & Malina, R. M. (1986). Role of obesity and fat distribution in non-insulin dependent diabetes mellitus in Mexican Americans and non-Hispanic Whites. *Diabetes Care,* 9, 153-61.

Hamman, R. F. (1992). Genetic and environmental determinants of non-insulin dependent diabetes mellitus (NIDDM). *Diabetes/Metabolism Reviews,* 8, 287-338.

Hamman, R. F., Marshall, J. A., Baxter, J., Kahn, L. B., Mayer, E. J., Orleans, M., Murphy, J. R., & Lezotte, D. C. (1989). Methods and prevalence of non-insulin-dependent diabetes mellitus in a biethnic Colorado population: The San Luis Valley diabetes study. *American*

Journal of Epidemiology, 129, 295-311.

Hanis, C. L., Hewitt-Emmett, D., Bertin, T. K., & Schull, W. J. (1991). Origins of U.S. Hispanics: Implications for diabetes. *Diabetes Care,* 14, 618-27.

Hanis, C. L., Ferrel, R. E., Barton, S. A., Aguilar, L., Garza-Ibarra, A., Tulloch, B. R., Garcia, C. A., & Schull, W. J. (1983). Diabetes among Mexican-Americans in Starr County, Texas. *American Journal of Epidemiology,* 118, 659-72.

Harris, M. I. (1995). Diabetes in America (2nd ed.). National Institutes of Health, National Institute of Diabetes and Digestive Kidney Diseases, 1995. NIH Publication No. 95-1468.

Luepker, R. V., Perry, C. L., McKinlay, S. M., Nader, P. R., Parcel, G. S., Stone, E. J., Webber, L. S., Elder, J. P., Feldman, H. A., Johnson, C. C., Kelder, S. H., & Wu, M. (1996). Outcomes of a field trial to improve children's dietary patterns and physical activity. *Journal of the American Medical Association,* 275, 768-76.

Marshall, J. A., Hoag, S., Shetterly, S., & Hamman, R. F. (1994). Dietary fat predicts conversion from impaired glucose tolerance to NIDDM: The San Luis Valley diabetes study. *Diabetes Care,* 17, 50-6.

Marshall, J. A., Hamman, R. F., Baxter, J. (1991). High-fat, low carbohydrate diet and the etiology of non-insulin-dependent diabetes mellitus. *Primary Care,* 15, 227-50.

McCance, D. R., Pettitt, D. J, Hanson, R. L., Jacobsson, L. T. H., Bennett, P. H., & Knowler, W. C. (1994). Glucose, insulin concentrations, and obesity in childhood and adolescence as predictors of NIDDM. *Diabetolgia,* 37, 617-623.

Nelson, R. J., Everhart, J. E., Knowles, W. C., & Bennett, P. H. (1988). Incidence, prevalence, and risk factors for non-insulin-dependent diabetes mellitus. *Primary Care,* 15, 227-50.

Newman, B., Selby, J. V., King, M. C., Slemenda, C., Fabitz, R., & Friedman, G. D. (1987). Concordance for type 2 (non-insulin-dependent) diabetes mellitus in male twins. *Diabetologia,* 30, 763-68.

Parcel, G. S., Simons-Morton, B. G., O'Hara, N. M., Baronowski, T., Kolbe, L. J., & Bee, D. E. (1987). School promotion of healthful diet and exercise behavior: An integration of organizational change and social learning theory intervention. *Journal of School Health,* 57, 150-6.

Stern, M. P. (1991). Primary prevention of type II diabetes mellitus. *Diabetes Care,* 14, 399-400.

Texas Department of Health (1996). Diabetes in Texas: 1989-1994 survey data. *Texas Risk Factor Report 2, 1.*

Texas Diabetes Council (1995). *Meeting the Challenge: A Plan to Control Diabetes in Texas.* Austin, Texas: Texas Department of Health.

Texas Diabetes Council (1994). Unpublished estimates using data from the Texas behavioral risk factor surveillance system, 1988-1993 applied to 1996 population data from Texas comptroller's office.

Warner, D. C., DeNiro, L. A., Pugh, J. A., Cornell, J. E., McCandless, R., & Marsh, G. M. (1995). Direct and indirect cost of diabetes in Texas, 1992. Unpublished paper, Texas Diabetes Council.

Walker, M. (1995). Obesity, insulin resistance, and its link to non-insulin-dependent diabetes mellitus. *Metabolism,* 9, 18-20.

Expanding Health Care Access to Rural West Texas through Education and Technology

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Abstract

There is a lack of access to health care in rural West Texas due to the shortage of health care specialists and the demographics of the region. The purpose of this article is to examine ways in which the Texas Tech University Health Sciences Center has expanded its Physical Therapy Program in order to address these problems and to describe the components of the satellite telemedicine network, HealthNet.

Introduction

Access to health care services continues to be a major issue for many parts of the country today. This is especially true for the regions of rural West Texas. Factors which amplify the situation in West Texas include the lack of health care specialists in the region, size, growth, density, and the demographics of the region (Smith, Black, & Monshiniskie, 1995). According to the Texas Department of Health in 1993, 196 of the 254 counties in Texas are defined as being rural (Pickard & Bond, 1995). There are 108 of these counties included in the 135,000 square mile area of West Texas, which is served by the Texas Tech University Health Sciences Center (TTUHSC). Of these 108 counties, 99 are rural and there are only eight major metropolitan population centers.

Approximately 20% of Texans live in rural

communities and 16% of the population is over the age of 64 years. People age 65 and older tend to have a higher demand for health services than do younger populations (Smith, Black, & Monshiniskie, 1995). The West Texas rural areas also have a higher percentage of patients on Medicare and Medicaid.

These sobering statistics help one to understand the problems that arise concerning health care in rural West Texas areas. Despite the large numbers of people requiring health care in these regions, there are only 24,000 rural health care providers. It has become the goal of the TTUHSC to address these problems.

TEXAS TECH UNIVERSITY HEALTH SCIENCES CENTER

Mission and Objectives

Texas Tech University Health Sciences Center has as its mission to provide the highest standard of excellence in higher education while pursuing continuous quality improvement; to stimulate the greatest degree of meaningful research; and to support faculty and staff in satisfying those whom they serve (Texas Tech University Health Sciences Center, 1997). More specifically, the school of Allied Health has as its mission, the education of well-prepared entry-level clinicians in the professions of physical therapy, occupational therapy, clinical laboratory science, communication disorders, and emergency medical services. Additionally, the physical therapy program has been expanded to include a three-year entry-level master's program and concurrently extended the program to two regional sites in Amarillo and Odessa. Four main objectives were established for the physical therapy program in order to guide the implementation of this program.

Program Objectives

1. Increase the number of physical therapy graduates.
2. Create a solution to the faculty shortage.
3. Provide an opportunity to share physical therapy clinicians with the expertise from the three sites.
4. Retain graduates from rural areas to practice in the under-served areas.

HEALTHNET SYSTEMS

HealthNet, a satellite telemedicine network, was created in 1987 by the TTUHSC to address the problem of the lack of health professionals and to improve health care and education in rural West Texas. This system is a national leader in telemedicine technology, which is the use of telecommunications for medical diagnosis, treatment, and education. It also leads the way in delivery of telemedicine programming via satellite and digitized signals (Jordan & Ramirez, 1995).

HealthNet is composed of three networks in order to reach the needs of patients, students, educators, and physicians. The first network is HealthNet's telemedicine consultation service. Telemedicine is performed over a two-way, interactive video system. This allows specialists at the Health Sciences Center to interact with physicians, nurse practitioners, physician assistants, and patients in rural West Texas communities. Through this system, patients in rural communities are able to receive quality, specialized care without the expense and burden of traveling to a metropolitan area. In conjunction with the Texas Department of Criminal Justice, telemedicine is used to provide health care to inmates in 13 sites including Abilene, Amarillo, Childress, Colorado City, Dalhart, El Paso, Lamesa, Fort Stockton, Pampa, Plainview, Snyder, and Wichita Falls as well as inmates at the

Montford Unit in Lubbock. The second network of HealthNet is the Rural Health Satellite Network (RHSN). This network allows thousands of physicians, nurses, and health care professionals to receive continuing education classes in order to maintain their licenses or further their formal training in 75 rural hospitals and clinics (McLarty, 1994). Studies have shown that the use of these continuing education programs produce a measurable increase in the quality of patient care in rural areas.

An additional aspect of this satellite-delivered continuing education service is EMSTAR, the Emergency Medical Services Training and Research network. This network broadcasts continuing education and management training to emergency medical professionals throughout the United States. The final Network of HealthNet is TechLink, an interactive system that connects the Health Sciences Center campuses in Lubbock, Odessa, El Paso, and Amarillo. This system allows administrators, instructors, and professionals to provide a quality education to students in rural areas through the use of compressed digital video, audio, and data technologies.

For several years now, HealthNet has provided health professional education including the disciplines of medicine, nursing, allied health, and pharmacy. As a result of this distance education approach, the quality and availability of health care is improving in rural communities.

DISTANCE EDUCATION

The HealthNet system is a form of distance education that has become increasingly popular in education today. To date, there is not a consensus on a single definition of distance education. It is important for the definition to encompass a general view that links educational institutions to learning resources and learners to the resources offered by the educational institutions (Dillon, 1996). Thus, for our purposes, we will define distance education as " the linking of learners and learning resources separated by time and/or distance" (Dillon, 1996).

Distance education is delivered by a wide range of technological options including voice, video, data, and print. These are options used to bridge the instructional gap (Gottschalk, 1996). The technological voice option consists of audio tools, which include the interactive technologies of the telephone, audioconferencing, and radio. Instructional video tools include slides, videotapes of pre-produced moving images, and real-time moving images combined with audioconferencing. The technological data option includes the instructional tools with computer applications such as computer-assisted instruction, computer mediated instruction, and electronic mail. The foundational element of distance education is print because it is the basis from which all other delivery systems evolved (Gottschalk, 1996).

Due to the rapid advances in technology, the numerous applications that have become available have caused both educators and learners to be overwhelmed at the different types of media and learning strategies that are offered (Cairncross, 1985). This is especially true for those involved in distance education. It is often unclear what it the most effective method for a particular learning program such as distance education. However, Cairncross states distance educational systems are beneficial to students because there is a wide range of media available that increases student access, offers greater control over their learning, and decreases costs (Cairncross, 1985). The telephone, which is one type of popular media, allows two-way interactions across distances between the students and the educators and provides

immediate feedback. Video-based instruction is also extremely effective because it can be linked with other media and is an important part of interactive technology due to its value in stimulating group discussions (Cairncross, 1985). Thus, studies have concluded that the ideal situation for a learning environment is to offer a wide range of media so the learner can utilize the approach which best suits his or her needs (Gottschalk, 1996; Cairncross, 1985).

The TechLink network is based on a combination of technologies including telecommunications and two-way video conferencing, which allows student/instructor interaction, and is considered the closest match to traditional classroom interaction. The teaching podium includes a preview/ broadcast monitor and a touch control panel. This control panel allows the professors an opportunity to provide multimedia presentation. They are also in control of technologies such as a flex document camera, slide projector, VCR, computer, light pen, and a " Zoom" camera. Additional communication between the students and/or instructors between different sites include FAX and electronic mail. The success of these technologies depends on equipment reliability, camera placement, and instructor/student behavior.

Since the popularity of distance education began, many have questioned the effectiveness of this type of instruction. Research comparing distance education to the traditional face-to-face method of instruction has found that studying at a distance can be as effective as the traditional face-to-face method as long as the method and technologies used are appropriate to the instructional task. Additionally, effective distance education programs must begin with careful planning and a focused understanding of the student's needs and course requirements (Gottschalk, 1996). The student's attitude toward being a remote student is very important here. Studies have found that initially some students often have a reluctance to actively participate in the distance classroom because they are unfamiliar with the new technology. However, it has been documented that familiarity with technology dissolves these anxieties over time (Reid, 1996). Studies have also demonstrated that students believe they learn as much, if not more, than those at the site where the course originates (Reid, 1996).

MASTERS IN PHYSICAL THERAPY

A study was conducted in July of 1997 to determine if there is a significant difference in learning outcomes between physical therapy students who took courses from the site where the course originated or from the receiving site via TechLink. A sample of 63 third-year physical therapy students was used. The sample consisted of 19 male and 44 female students. Sixteen of these students attended classes at the Amarillo campus, 34 attended classes at the Lubbock campus, and 13 attended classes at the Odessa campus. The students ranged in age from 24 to 53 years with a mean age of 28.5 years. Course requirements were identical for students at all sites. Students spent the same amount of time in class, completed the same assignments, and took the same examinations. All courses were taught in a lecture format over TechLink and originated from all three sites throughout the course of the program. Based on the results of the study, it was determined that there were no significant differences between the originating or receiving sites for the student based on grade point average in a particular class and the student's final grade point average.

POST GRADUATION

The same students at the Odessa and Amarillo campuses were further investigated following their graduation to determine where they were employed. It was determined that 54% of the Odessa students are currently employed in the Permian Basin region of West Texas including Odessa, Midland, Abilene, and Big Spring. Additionally, 81% of the Amarillo students are currently employed in the Panhandle and South Plains regions of West Texas including Amarillo, Borger, Pampa, Idalou, Lubbock, and Abilene.

Based upon the results of our search, it was determined that 69% of the Class of 1997 who attended class in Odessa and Amarillo practice physical therapy in the West Texas area. These results support the objective of the Physical Therapy Program to retain graduates from rural areas to practice in the under-served areas.

The expansion of the Physical Therapy Program in 1995 also helped to meet the remaining objectives of increasing the number of physical therapy graduates from 28 graduates in 1995 to 63 graduates in 1997; creating a solution to the faculty shortage by offering instructor positions at all three sites; and by providing an opportunity to share physical therapy clinicians with the appropriate expertise from the three sites.

With the success of the Physical Therapy Program at the TTUHSC, several inquiries from other higher education institutions have been received. As a result, on site visits have been made to view the expansion of the program via the assistance of the two-way interactive television systems by other physical therapy programs around the nation. These include the Kansas University Health Sciences Center and the University of Mississippi Medical Center as well as S.U.N.Y. Upstate Medical at Syracuse, Wichita State University, and the Florida Gulf Coast University. Based on our own analysis and on the interest demonstrated by other schools, it is quite apparent that this program and its growing technologies are and will continue to be a success for students in rural communities. Additionally, due to the growth and expansion of educational technologies in the field of allied health at the TTUHSC, great strides have been made in solving problems regarding the lack of health care specialists and poor access to health care in West Texas.

REFERENCES

Cairncross, R. (1985). Teaching and learning away from the medical center. *Medical Education,* 19, 310-317.

Dillon, C. (1996). Distance education research and continuing professional education: Reframing questions for the emerging information infrastructure. *Journal of Continuing Education in the Health Professions,* 16, 5-13.

Gottschalk, T. (1996). *Distance education: An overview.* [WWW document]. URL http://www.uidaho.edu./evo/dist 1.html.

Jordan, L., & Ramirez, S. (1995). HealthNet, Tex-Link, and the Texas telehealth/ education consortium. *Texas Journal of Rural Health,* 12, 58-61.

Pickard, M., & Bond, M. (1995). Nursing education via satellite in Northeast Texas. *Texas Journal of Rural Health,* 12, 29-35.

Smith, G., Black, C., & Monshiniskie, J. (1995). Emergency medical services education in rural Texas: Distance education solutions. *Texas Journal of Rural Health,* 12, 36-43.

Texas Tech University Health Sciences Center (1997). *TTUHSC Homepage.* [WWW document]. URL http:www.ttuhsc.edu/.

North Dakota's Interdisciplinary Fellowship Training Program for Medical and Allied Health Students

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Abstract

In 1994, the National Health Service Corps (NHSC) initiated a fellowship program for students pursuing a career in primary health care fields. The goal of the program is to increase the recruitment and retention of health care professionals in health professional shortage areas (HPSAs) and medically under-served areas (MUAs) by expanding the number of service-linked educational opportunities available in these communities.

In 1995, a total of 33 state programs were awarded funding for the project, including North Dakota. An evaluation of the North Dakota program indicated that although the experience did not increase or decrease students' commitment to future rural practice, participants felt their preceptorship experiences were worthwhile and most came away with a very favorable image of the program. Further, it was found that the program:

1. Clearly had an educational function with the students,
2. Increased the students' positive image of practitioners within their chosen professions, and
3. Increased the students' level of confidence regarding their abilities.

INTRODUCTION

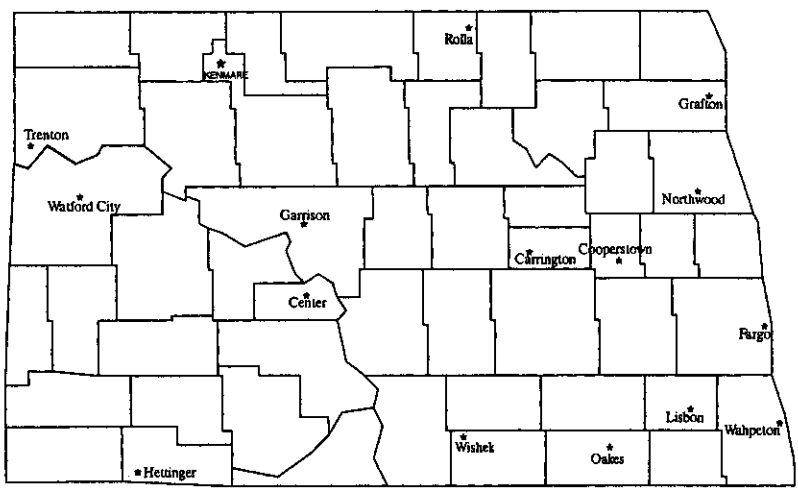
In 1994, the National Health Service Corps (NHSC) initiated a fellowship program for students pursuing primary health care fields. The goal of the program is to increase the recruitment and retention of health care professionals in health professional shortage areas (HPSAs) and medically under-served areas (MUAs) by expanding the number of service-linked educational opportunities available in these communities. Secondly, it sought to promote an interdisciplinary approach to primary care in rural and under-served areas. An interdisciplinary health care team exists when two or more health professionals meet regularly to set goals, communicate, and collaborate to provide patient care or address a community issue (Office of Educational Development, 1993; Padgett & Davis, 1994). The members of the interdisciplinary health care team may be professionals, para-professionals or non-professionals from any of the health professions.

To accomplish this goal, the NHSC envisioned that the fellowship program would (1) increase statewide alliances to form a network of organizations to meet the diverse primary care needs of the under-served; (2) promote structured learning experiences, beginning with opportunities for students and residents to train in interdisciplinary teams; and (3) nurture the formation of culturally competent, community responsive primary care providers.

There were to be approximately 30 awards to state agencies, ranging from $50,000 to $175,000 per year. A total of 36 programs were funded for the project in 1994 and 33 were funded in 1995.

The NHSC directed programs to use the fellowship funding to increase the number of service-linked educational opportunities available in under-served communities for primary care students and residents. The fellowship was to support the core components of networking, clinical experiences, community experiences, mentoring, faculty development, clinical experiences, and critical skills development.

North Dakota National Health Service Corps Fellowship Sites



THE NORTH DAKOTA EXPERIENCE

The North Dakota Fellowship was one of the 33 grantees carried over from 1994. North Dakota's overall goal was to promote opportunities for students to develop an appreciation for and an understanding of the interdisciplinary team approach to the delivery of primary health care services in rural and/or under-served areas of the state. Specifically, in the clinical experience of the fellowship period, the primary goals were the collaboration of team members and the development of an appreciation for an interdisciplinary team approach to providing primary care services. In order to accomplish these goals, the interdisciplinary approach sought to provide a practical application of theoretical knowledge. Students would learn how to utilize the skills of other health care providers during team patient care conferences. Students would also have the opportunity to work side-by-side with preceptors in the actual delivery of patient services. In doing so, they would be given the opportunity to foster these relationships with students of other health professions and hopefully refine their own clinical judgement and skills in assessments, diagnosis, and the management of conditions commonly seen in an ambulatory setting versus the acute care setting.

Selection criteria for the 1995 Fellowship program included displaying a commitment to an educational process that extends beyond classroom training, demonstrating a desire to practice in a rural/under-served area, and completion of one year in medical school, advanced nurse practice program, mental health program, or an accredited primary care residency program. Given that the program participants were to be first-year students, they were assumed to have minimal clinical training/experience. The resulting cohort consisted of 30 students: 18 medical students (60.0%); seven PA/NP students (23.3%); and five social work students (16.7%).

FELLOWSHIP ASSESSMENT

Fellowship students were required to fill out a pre-test and post-test questionnaire. The pre-test was administered in March and the post-test was handed out in September

Table 1. Reasons for Wanting to Practice in a Smaller Community Among Students Who Indicated Such a Preference (N=12)

Reason	Percent
The need for health care providers	83%
Grew up in a small community	75
Can see a greater variety of patients	75
Better place to raise a family	67
Spouse likes a small community	50
Can be more active with community affairs	42
Opportunity to work with established practice	42
Just like a small community	37
Can build a productive practice early	33
Spouse grew up in a smaller community	17
Other factors	17

1995. Exactly one-half (50.0%) of the thirty students were females and ages ranged from 23 to 47 years (mean=29, median=26, mode=23). Family medicine was the most commonly-mentioned future field of practice (58.3%) among the MD/PA/NP students, followed by internal medicine (16.7%), undecided (12.5%), and other (12.5%).

Students' commitment to rural practice

Students were surveyed about their pre-fellowship commitment to rural practice. At the time of the pre-test, twelve students (41.4%) said that they would like to practice in a community with fewer than 25,000 residents. These twelve students were then asked to indicate from a developed list the various reasons why they would prefer a smaller town (see Table 1). Issues that were most commonly mentioned dealt with substantial medical need in these areas (83% of students), their own familiarity with these regions (75%), variety within medical practice (75%), and safety of the environment for family (67%). Also frequently cited were the spouse's inclination toward a smaller town (50%), greater impact on community affairs (42%), and the opportunity to work in an established practice (42%).

Students' perceptions of the preceptor

Students were asked a series of questions regarding their preceptor and the extent of their interaction with him or her. Preceptors were full-time, practicing clinicians in their fields of expertise. "Preceptor sessions" are defined as any education-related encounter between the student and preceptor that occurred during the fellowship experience. More than two-thirds (69.2%) felt the frequency of preceptor sessions was about right, whereas (26.9%) said they were spaced too far apart, and 3.8% said they occurred too often. Students did indicate that they had some degree of input regarding their preceptor's practice and 70.4% said they were encouraged to provide suggestions and 63.0% said their preceptor heeded at least some of their ideas. However, students' perceptions as to the overall significance of their contributions to their preceptor's practice were mixed. To illustrate, more than one-half (56.0%) felt their assistance did not entail a substantial amount of care provision.

Findings indicated that students felt their preceptors were very helpful during the course of their experiences. Students were asked if there were ways in which their preceptor could have been more helpful. As most were generally satisfied with their preceptors, few students offered a response to this question. Of those that responded, the most common suggestion was to encourage more interaction/contact between student and preceptor (29.2%). As one student stated, "There is a need to meet more often in regard to how it's going and to make needed changes along the way." Also mentioned was the desire for the preceptors to increase their preparation in regards to taking on students (16.7%) and students wanted to take a more "hands on" approach (16.7%).

Students' perception of rural/under-served practice

Fellowship students were asked about their perspectives in terms of the positive and negative aspects of a rural practice. Participants felt that one of the strongest aspects of a rural practice is the high degree of patient familiarity and continuity of care (25.4% of the responses). As one student put it, "The community takes you in as one of their own—they become loyal friends as well as patients." Mentioned in similar frequency (25.4%) was the small town environment. "The rural lifestyle is nice," stated one student. The

third most frequently given response was the high level of autonomy (18.6%) afforded to practitioners in rural/under-served areas. One student noted his preceptor's "affinity for being flexible and creative." Another said, "You run the whole show; you are your own boss." Also mentioned by students were the positive feelings associated with filling a significant service need or void (11.9%). A student remarked, "Practicing in an under-served area may make a difference as to the total well-being of a community."

Some negative aspects of a rural practice were noted by the students. The most commonly mentioned response was the scarcity of resources such as technological equipment (16.4% of the responses). One participant noted that "the facilities and staff may not be as up-to-date as in a larger hospital." Another stated that one was "unable to perform some complicated procedures." Also frequently mentioned were poor access to social amenities (14.5%), lack of collegial support (14.5%), and long working hours (14.5%). One student noted his dislike for the "lack of social events and entertainment opportunities." Another felt a "sense of practicing without the support of much of the medical community." Students also mentioned the lack of privacy/confidentiality (12.7%) as a negative aspect of a rural practice. As one student asserted, "Some people are afraid to come in for help because the community knows they're receiving services." Others mentioned that there may be language barriers or cultural drawbacks as well as poor access to continuing medical education.

Students' perception of the fellowship program and experiences

Several questions on the fellowship post-test were designed to elicit information regarding students' perceptions on various facets of the program. For example, students were asked about the degree to which they felt they were prepared for the clinical experience. Results indicated that most felt they were ready for the practice site itself, as more than one-half (55.5%) said they were very prepared. The remaining 44.5% indicated being moderately prepared. No participants reported being poorly prepared for the experience. Students felt they were less prepared for the amount of faculty and administrative support they would receive as well as the nature of preceptor interaction.

When fellowship participants were questioned about their perception of the amount of time involved with the program, more than three-quarters (76.9%) said it was about the right length. Five students (19.2%) said the experience was too brief and one (3.8%) felt it was too long.

When students were asked to share ways in which the fellowship program might be improved, responses tended to reflect concerns about the preparation of the students (29.6% of the responses) and sites (18.5%). One student stated that "the sites we travel to need to be more informed as to the goal of the fellowship—they were as lost as I." Another suggested that, "In the orientation, it should be explained how important it is to be self-directed and creative in working in these rural areas."

Pre/Post experience comparisons

Students were asked about their strength of intention to practice in a rural/under-served area (see Table 2). Prior to the experience, (37.0%) of the students expressed a strong interest (codes 4 through 5) in someday practicing in such an area. After the event, more than one-half (55.5%) indicated a strong preference. Further, the mean ranking increased slightly from 2.82 to 3.44 in the pre/post experience time frame. It should be

Table 2. Strength of Intention to Practice in a Rural/Under-served Area

	Pre-Experience		Post-Experience	
Response	Percent	Mean	Percent	Mean
1 (weak)	14.8% (4)		3.7 (1)	
2	25.9 (7)		11.1 (3)	
3	22.2 (6)		29.6 (8)	
4	37.0 (10)		48.1 (13)	
5 (strong)	0.0 (0)		7.4 (2)	
		2.82		3.44

noted that the observed increases are not substantial enough to conclusively assert that the students' commitment to a rural practice was significantly stronger after the fellowship experience. Further, one could not state that the fellowship program itself substantially increased the likelihood of the students practicing in these areas. However, one could confidently state that the program did not lessen their commitment to practice in under-served areas.

The mean strength of their intention to practice in a rural area was broken down by student type. Results indicated that all three types experienced some kind of increase after the fellowship experience. NP/PA students expressed the most commitment to such a practice in both the pre- and post-tests. The NP/PA and social work students had the largest increases in the mean scores. Again, all noted increases were modest.

Table 3 displays the community size of the students' preferred practice sites. Because students were not asked about the degree of service needed by the community, these two items solely dealt with the students' commitment to practice in sparsely populated (likely rural) locations. Pre-test results indicated that 41.4% would like to practice in a community with a population less than 25,000. Following the experience, 37.0% indicated the same community preference. This percent decrease is negligible and provides impetus for the conclusion that no change in commitment to rural practice was found. When community size preference was broken down by student type (see Table 4), NP/PA students were found to have the strongest commitment

Table 3. Size of Community in which Respondent would Prefer to Set Up a Future Practice

	Pre-Experience	Post-Experience
Response	Percent	Percent
Less than 5,000	6.9% (2)	3.7% (1)
5,000 to 9,999	13.8 (4)	18.5 (5)
10,000 to 24,999	20.7 (6)	14.8 (4)
25,000 to 49,999	17.2 (5)	29.6 (8)
50,000 to 9,999	37.9 (11)	25.9 (7)
100,000+	3.4 (1)	7.4 (2)

toward practicing in an under-served region.

On both the pre- and post-test, students were given a 18-item scale that measured their level of agreement to statements that dealt with various professional issues. The scale was constructed to measure the effect of the fellowship experience on the students' knowledge of health professional tasks, responsibilities, and conduct. All of the statements were worded in a positive tone such as, "Individuals in my profession are well-trained." Agreement level was measured from 1 (strongly disagree) to 6 (strongly agree). Results indicated that of the 18 items, 17 had a positive change in the overall means. These findings provided support for concluding that students (1) learned more about their respective professions, and (2) came out of the fellowship experience with a more positive image of practitioners within their chosen professions.

Students were also asked about their perceived level of confidence regarding a variety of professional tasks and abilities. Confidence level was measured on a scale from zero (no confidence) to 100 (100% or full confidence). Items were designed to measure the effect of the fellowship experience on the students' beliefs in their own abilities to (1) practice in their chosen profession and (2) work effectively in an interdisciplinary arrangement. Results showed that of the 16 items, 14 had a positive change in mean confidence level from the pre- to post-experience period. A few exceptionally large increases were noted. Students were, on average, 10% to 13% more confident in their abilities after the fellowship experience to identify cultural differences that exist in rural-based patients (change = +12.7%), assist a patient in obtaining rural health care (change = +10.7%), and communicate health information to a rural patient that cannot speak English (change = +10.6%).

When figures were analyzed by student type, some interesting differences and congruencies were observed. Of all fellowship participants, medical students had the highest number of positive changes (13) among the 16 items. The items that had the largest improvements in mean scores among these students included the same three items that had the largest change scores among the fellowship class as a whole (listed above). In addition, medical students also had substantially large improvements in their confidence level regarding their ability to identify differences between rural and urban health care systems (change = +9.3%) and conduct effective problem-solving techniques using various resources of several types of health personnel (change = +9.3%). These students did rate their confidence level substantially lower on one item. One-half (50.0%) of the medical students reported a lower confidence level after the experience regarding the notion

Table 4. Students Who Preferred to Practice in a Community of Less than 25,000, by Student Type

Student Type	Pre-Experience	Post-Experience	Change
ALL (N=30)	41.4%	37.0%	-4.4%
Medical (N=18)	29.4	25.1	-4.3
NP/PA (N=7)	85.8	71.5	-14.3
Social work (N=5)	20.0	20.0	0.0

that participating in the fellowship program would improve their professional interaction skills (mean change = -6.7%).

The NP/PA students had improvements in confidence level on 10 of the 16 items. The items that had the largest positive changes among these students mirrored those that had the largest increases among all fellowship students as a whole. Similar to medical students, NP/PAs reported a substantial drop in confidence level regarding the experience's role in improving their professional interaction skills.

Social work students also had improvements in mean confidence level for 10 of the 16 items. These students had the largest confidence increases on one of the three that saw most improvement among all students as a whole: ability to identify cultural differences that exist from patients in rural communities (change = +14.0%). Social work students also reported large increases in their confidence level regarding their ability to contribute to a discussion with a team of health care professionals regarding: a patient care treatment plan (change = +14.0%) and a patient (change = +10.0%). Similar to all other program participants, social work students reported a decrease in confidence regarding the experience's role in improving their professional interaction skills (change = -11.0%).

On both the pre- and post-tests, participants were asked to assess the amount of contact they would have with a variety of other health care professionals in the course of their future practice. Items were rated on a 1-to-5 scale with 1 equaling no contact and 5 signifying daily contact. Examination of the net changes in means revealed that none of the items had noteworthy transformations. Professional types that students said they might see slightly more often than they had anticipated included NPs/PAs (+0.27) and respiratory therapists (+0.15). Those that students felt they might encounter slightly less than they had envisioned included pharmacists (-0.27), social workers (-0.18), physicians (-0.06), and physical therapists (-0.03). Although pre/post mean changes were slight, it did appear that the fellowship students did learn about the degree of contact they can expect in a rural interdisciplinary practice. This was clearly the primary aim of this particular item grouping.

These professional interaction figures were also analyzed by student type. Few large pre/post experience changes were noted among medical students regarding the amount of contact they will have with other professionals. They did indicate that they would have less contact with social workers than they had previously thought (change = -0.31). NP/PA students concluded they would have more contact with respiratory therapists (change = +0.33) than they previously believed and less with pharmacists (change = -0.71). Social work students stated they would have more contact than they had previously thought with NPS/PAs (change = +0.80) and respiratory therapists (change = +0.40).

CONCLUSION

Based on the response of students, it is clear the North Dakota fellowship program has been a positive influence in a variety of ways. Analysis of the data led to several conclusions which are listed below, along with a brief discussion of supporting evidence and recommendations. First, the fellowship experience was viewed as a positive, worthwhile endeavor by students. Very few negative encounters were reported. Communities where positive encounters occurred should be considered for further development as sites in ensuing years. Those

sites where students reported negative experiences need to be further scrutinized as to the reason why this occurred.

Second, the fellowship experience clearly had an educational function with the students. They reported learning a great deal about the nature of a rural practice. Also, many stated they had learned much about what individuals in their chosen profession do on a day-to-day basis. Many students returned from their preceptorships with renewed vigor toward succeeding in their educational endeavors.

Third, the fellowship experience increased students' positive image of practitioners within their chosen professions. Generally, they had good impressions of their chosen fields before the fellowship experience. Post-test results indicated that their views on a variety of professional tasks and characteristics became more positive.

Fourth, the fellowship experience increased the students' level of confidence regarding some professional tasks and abilities. They were substantially more confident in their abilities to interact with rural/under-served populations and to successfully provide care to them.

Finally, the fellowship experience did not substantially increased students' degree of commitment toward rural/under-served practice. Yet, it clearly did not decrease students' level of intention to practice in such areas. It should be noted that this is a highly subjective measure of commitment to this type of practice. The real test will entail examining who and how many of these students actually end up practicing in such an area of the state or nation.

REFERENCES

Office of Educational Development. (1993). *Education for interdisciplinary rural health care: Program directors' resource manual.* Chapel Hill, NC: University of North Carolina.

Padgett, J. J., & Davis, B. (1994). Quality improvement: A project to improve interdisciplinary team care. In J. R. Snyder (Ed.), *Interdisciplinary health care teams: Proceedings of the sixteenth annual conference.* Bloomington, IN: Indiana University Medical Center.

Utilizing Capture-Recapture Techniques to Determine the Diabetes Prevalence in the Rio Grande Valley

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Abstract

The purpose of this study was to estimate the diabetes prevalence in the Rio Grande Valley (RGV) of South Texas and to compare the results to the reported prevalence from other data sources. The Texas-Mexico Border Diabetes Registry Project has compiled a database of persons with diagnosed diabetes and this database provided the raw data needed to determine prevalence rates in the RGV. Two independent data sources that supplied names to the Diabetes Registry were used to determine diabetes prevalence utilizing capture-recapture techniques. The capture-recapture method estimates population size and is based on an incomplete sampling. The technique has been used primarily in ecological applications as a statistical model to count wildlife. Prior to this study, reported diabetes rates for the RGV varied from 60,000 to 75,000 persons. The capture-recapture method employed in this study estimated that there was a 100% diabetes prevalence rate undercount.

Introduction

Prevalence rates of diabetes in Mexican-American populations have been derived from the 1982-84 Hispanic Health and Nutrition Examination Survey (HHANES) and The San Luis Valley Diabetes Study (Flegal, Ezzati, Harris, Juarez, Knowler, Perez-Stable, & Stern,

1991; Hamman, Marshall, Baxter, Kahn, Mayer, Orleans, Murthy, & Lezotte, 1989). These survey data have been applied to determine the diabetes prevalence rate in the Rio Grande Valley (RGV) of South Texas. However, health educators, researchers, and health providers from the RGV have contended that the diabetes rates were much higher. Since the development of the Texas-Mexico Border Diabetes Registry Project (Diabetes Registry), one of the goals of the project was to determine the diabetes prevalence rate in the RGV.

Animal population scientists share the same goals as human population scientists in wanting to determine population rates. However, animal scientists recognized that it was not possible to count every member of a species and developed techniques to estimate animal populations using incomplete sampling such as capture-recapture (Seber, 1982). Capture-recapture models are an indirect method of estimating population sizes and have been employed in recent epidemiological studies (LaPorte, McCarty, Bruno, Tajima, & Baba, 1993; Robles, Marrett, Clarke, & Risch, 1988; Schouten, Straatman, Kiemeney, Gimbrere, & Verbeek , 1994). This method has been successfully used in both animal and human populations to determine population size (Bruno, Bargero, Vuolo, Pisu, & Paagano, 1992; Wittes, Colton & Sidel, 1974). Capture-recapture utilizes a simple statistical method that solves for the unknown with a 95% confidence interval that determines prevalence when multiple incomplete data sources are employed (LaPorte et al, 1993).

Estimating human populations by using statistical models goes back to Graunt in 1662 and Laplace in 1783 when they calculated the populations of London and France respectively (Manly & McDonald, 1996). Laplace obtained a register of births (B) for the whole country, including a set of parishes and the number of parishioners (n) for which he knew the number of births (b) and calculated the population size (N) to births for the whole country. He concluded that population to birth should be approximately the same as the ratio for the parishes (N/B=n/b). He knew everything but N, so he estimated N by B*n/b. Graunt's and Laplace's model is an example of what is known today as capture-recapture.

The following example illustrates how capture-recapture techniques work. To determine the number of whitetail deer in the King Ranch of South Texas, you would go and trap deer on the ranch, count them (a), mark them, and then release the deer. On a different day, you would go to the ranch again and trap deer and then record the total number of deer (b) in the second trapping and the number of previously marked deer (c) that were recaptured. This activity will produce an estimate of the deer population (N) in the King Ranch by using a simple formula ($a \times b \div c = N$) that solves for the unknown.

Because of a dearth of explicit methods for determining if all diabetes cases have been counted, indirect methods for estimating the population with the disease have been adopted. Of interest to the Diabetes Registry was the goal to determine the number of persons with diabetes in the RGV and to decide if published diabetes rates were similar to those determined by capture-recapture techniques. The capture-recapture technique the Diabetes Registry used was a simple one. Two sources of names were drawn from the same population, the number of names from one source, which also occurred in another independent source, should roughly equal the proportion of the population represented by the whole.

METHODS

The Diabetes Registry took the first step toward determining the diabetes frequency in the RGV through a system of multiple

captures of names of persons with diabetes and then a grand capture with a recapture or duplicate variable. The capture-recapture technique enabled the Diabetes Registry to estimate the number of persons with diabetes needed for complete ascertainment by determining a prevalence rate for the RGV. Various sources (Figure 1) provided the names of persons with diabetes to the Diabetes Registry. The activity that contributed the most names (49%) for the Diabetes Registry of persons with diabetes was the School Enrollment and Education Program [SEEP] (Villas, 1997). Clinics that were evenly distributed throughout the RGV provided 26% of the registered diabetic population and 25% were from other independent sources. A recently completed randomized reliability pilot study of the Diabetes Registry database revealed some inexactness in the types of complications reported in the initial collection instrument; however, all persons surveyed acknowledged and reaffirmed that they had been diagnosed with diabetes (Felkner, Villas, & Lopez unpublished).

The capture-recapture procedure first registered and assigned a code designation to persons with diabetes (capture) and then entered them into the diabetes database. Next, another independent procedure registered and identified persons with diabetes and the proportion of cases in common was then used to estimate the number of persons with diabetes in the RGV. Data Source 1 included all network sources except the SEEP. Data Source 1 contributed 5219 registrants to the Diabetes Registry. The second independent source (Data Source 2), the SEEP, contributed 5191 registrants with recaptures or duplicates of 297 persons (Figure 2).

RESULTS

Traditional methods count the total number of cases identified, which culls out all duplicates. However, this may only produce a crude rate and does not take into account the completeness of ascertainment and the number of missing cases. Capture-recapture

Figure 1. Percentage Contribution from Sources Used to Obtain Names of Persons With Diabetes for the Diabetes Registry

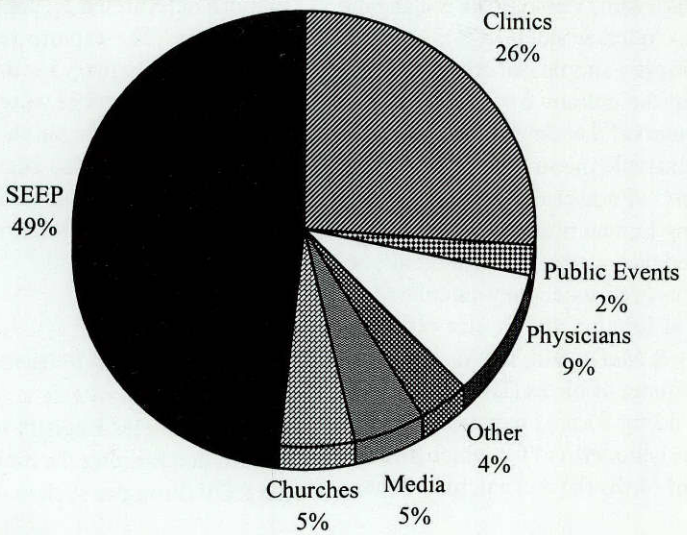
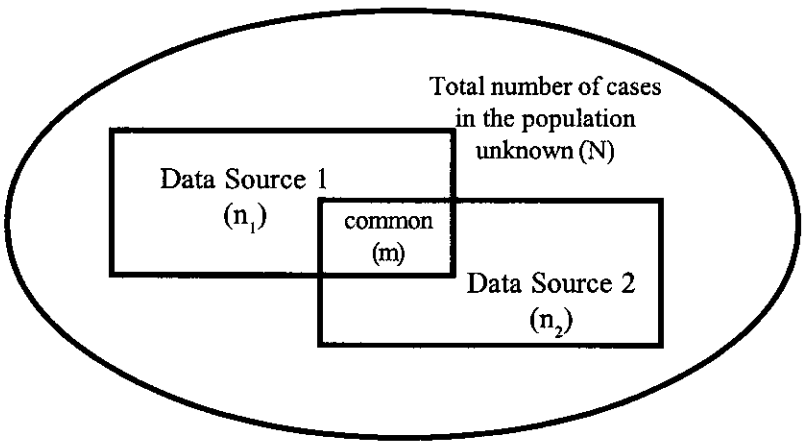


Figure 2. Capture-Recapture Model



takes advantage of all interactions between sources and uses duplication instead of eliminating them. In the case of the Diabetes Registry database, these duplicates represented "recaptured" people who have diabetes. Thus, the degree of undercount is estimated and the rates of the disease are corrected for undercount. Implementation of a monitoring system such as the capture-recapture model provides a much broader and more timely monitoring of diabetes with a 95% confidence interval ascertainment-corrected rate (LaPorte et al, 1993). Table 1 presents the capture-recapture formula used to calculate the total number of individuals with diagnosed diabetes, which totaled 90,946 with a standard deviation of ±4,959. The Texas Department of Health, Texas Diabetes Council (1997) reported that 50% of the total population with diabetes is undiagnosed (i.e., those who have diabetes and do not know it), suggesting that the undiagnosed population is equal to the calculated diagnosed group. Since capture-recapture techniques needed to only estimate diagnosed cases to determine the total, the estimated range of the diabetic population in the RGV is between 143,974 to 161,810.

Table 1. Capture-Recapture Formula with Standard Deviation

$$\text{Total Cases} \quad N = \left[\frac{(n_1+1)(n_2+1)}{(m+1)}\right] - 1$$

$$\text{Standard Deviation} \quad = \pm\sqrt{\frac{(n_1+1)(n_2+1)(n_1-m)(n_2-m)}{(m+1)^2(m+2)}}$$

n_1= Data Source 1
n_2= Data Source 2
m= Common Data
N= Number of Cases in the Total Population

The same independent data sources utilized to estimate the diabetes prevalence rate in the RGV were used to calculate the rate in the four counties that comprise the RGV. The independence of data sources and proportional opportunity of the diabetic population to be "captured" and "recaptured"

and assigned a county identifying code enabled the Diabetes Registry to estimate the county diabetes rates in Hidalgo (17%), Cameron (23%), Willacy (26%) and Starr (39%). The RGV had a combined prevalence rate of 20%.

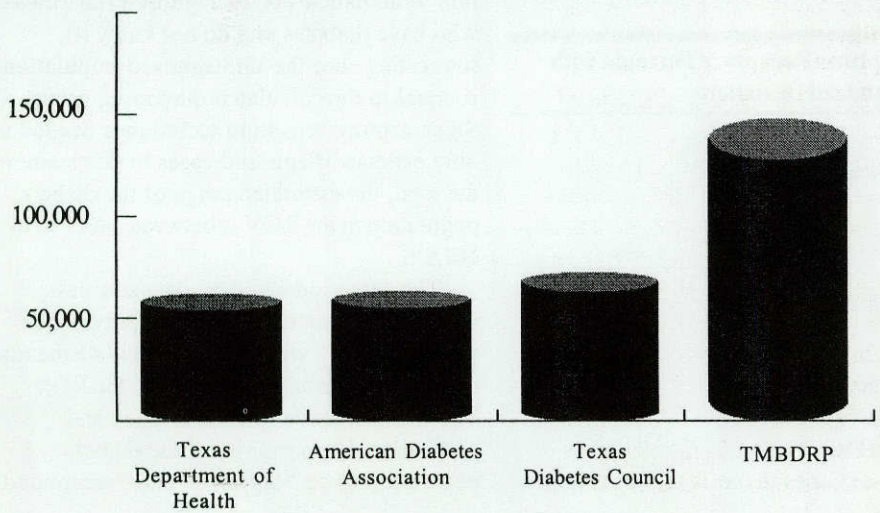
Figure 3 compares the RGV estimated diabetes population from four different sources. The Diabetes Registry estimate was derived from the capture-recapture formula.

DISCUSSION

The capture-recapture technique of estimating diabetes in populations makes surveillance of the disease in large populations possible. The fact that various local, state, and federal agencies, and other organizations count and document the number of persons with diabetes indicate this activity is worthwhile. Laporte (1993) and his colleagues have illustrated that capture-recapture estimates are more accurate than those derived from lists and surveys and have demonstrated that not everyone needs to be counted to determine population estimates. Capture-recapture techniques have been successfully utilized in estimating animal populations and in human disease monitoring systems. The Diabetes Registry has demonstrated that capture-recapture techniques can be employed to determine the diabetic population in the RGV, which can be used for the planning of future health initiatives.

The Diabetes Registry is confident that the capture-recapture technique employed to estimate diabetes prevalence in the RGV is an excellent model. It is recommended that a future project for the Diabetes Registry to assess the completeness of the reported results would be to obtain names from multiple independent sources and apply log linear modeling, which produces more accurate estimation by controlling for degrees of dependency among sources. The author believes that capture-recapture techniques and reliable reporting sources can produce a system that public health initiatives should endorse. Since diabetes is such a destructive

Figure 3. Rio Grande Valley Diabetes Population with Different Sources



disease if not managed properly, improved surveillance, education, and awareness should be undertaken to eliminate, reduce, and/or postpone the serious consequences of the disease. Therefore, having the correct prevalence rate will enable and assist efforts targeting the prevention and delaying of the disease.

REFERENCES

Bruno, G., Bargero, G., Vuolo, A., Pisu, E., & Paagano, G. (1992). A population-based prevalence survey of known diabetes mellitus in Northern Italy based upon multiple independent sources of ascertainment. *Diabetologia*, 35, 851-856.

Flegal, K. M., Ezzati, T. M., Harris, M. I., Haynes, S. G., Juarez, R. Z., Knowler, W. C., Perez-Stable, E. J., & Stern, M. P. (1991). Prevalence of diabetes in Mexican-Americans, Cuban, and Puerto Ricans from the Hispanic health and examination Survey, 1982-84. *Diabetes Care*, 14 (Supplement 3), 628-638.

Felkner, M., Villas, P., & Lopez, A. (unpublished). Results of the diabetes registry reliability pilot study.

Hamman, R. F., Marshall, J. A., Baxter, J., Kahn, L. B., Mayer, E. J., Orleans, M., Murthy, J. R., & Lezotte, D. C. (1989). Methods and prevalence of non-insulin-dependent diabetes mellitus in a bi-ethnic Colorado population: The San Luis Valley diabetes study. *American Journal of Epidemiology*, 129, 295-311.

LaPorte, R. E., McCarty, D., Bruno, G., Tajima, N. & Baba, S. (1993). Counting diabetes in the next millennium. *Diabetes Care*, 16 (2), 528-534.

Manly, B. J. & McDonald, L. L. (1996). Sampling wildlife populations. *Chance*, 9 (2), 9-19.

Robles, S. C., Marrett, L. D., Clarke, E. A. & Risch, H. A. (1988). An application of capture-recapture methods to the estimation of completeness of cancer registration. *Journal of Clinical Epidemiology*, 41 (5), 495-501.

Schouten, L. J., Straatman, H., Kiemeney, L. A., Gimbrere, C. H., & Verbeek, A. L. (1994). The capture-recapture method for estimation of cancer registry completeness: A useful tool? *International Journal of Epidemiology*, 23 (6), 1111-1116.

Seber, G. F. (1982). *The estimation of animal abundance and related parameters*. 2nd Edition, London: Charles Griffin.

Texas Department of Health, Texas Diabetes Council (1997). *Texas Diabetes Fact Sheet 1997*, Austin, Texas.

Villas, P. (1997). Utilizing fourth grade students to increase diabetes awareness: The school enrollment & education program (SEEP). *Texas Public Health Association Journal*, 40 (2), 6-8.

Wittes, J. T., Colton, T. & Sidel, V. W. (1974). Capture-recapture methods for assessing the completeness of case ascertainment when using multiple information sources. *Journal of Chronic Diseases*, 27, 25-36.

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