

Report on Telemedicine Needs Assessment
For Barbados

A report prepared for
The Ministry of Health
Government of Barbados
by
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I. Introduction

This report is part of the Telecommunications and Network Reform Program for the Caribbean financed by the United States Agency for International Development and prepared by the Carana Corporation under contract RSQ1, Increased Employment and Diversification in Selected Non-Traditional Activities.

Objectives.

This report's objectives are (i) to assess Barbados' current health care needs, and (ii) to evaluate responses using telemedicine applications. The objectives include evaluation of related existing IT infrastructure and requirements to support telemedicine applications. Two outcomes should follow from this assessment: formation of a Steering Committee to guide telemedicine applications; and a Telemedicine Application Plan.

Telemedicine is the use of telecommunications and information technologies to provide clinical care, medical and health care professional education and public health information and services, with the objective of improving access to affordable quality health care.

Methodology

The methodology used in assessment of telemedicine needs in Barbados was defined by the Kansas Telemedicine Policy Group, a blue ribbon panel of experts sponsored by the Kansas Department of Health and Environment and the Kansas Hospital Association. The methodology for assessment and implementation of successful and cost-effective telemedicine applications -- developed in the early 1990s and endorsed by the US Department of Health and Human Services -- provides a structured approach to evaluating and implementing telemedicine applications that are community based. Information from the health community at large, including hospitals, clinics, providers and consumers, as well as government, business, educators and others is assessed; particular needs are identified and appropriate telemedicine applications recommended.

This report acknowledges policy guidance from the Office of Advanced Telemedicine, US Department of Health and Human Services, and program guidance from the Telemedicine Center, Brody School of Medicine, North Carolina University system (East Carolina University campus).

This report assesses health care needs and telemedicine solutions, based on interviews and meetings at the relevant organizations listed in Annex 1. Visits and meetings (with the exception of the district hospitals) with key officials were held. The public health institutions are listed below.

The Queen Elizabeth Hospital (QEH) – 547 bed acute care and teaching hospital
 8 Polyclinics – covering catchments of between 20,000 to 60,000 inhabitants each
 Geriatric Hospital - 361 bed hospital
 4 District Hospitals – associated with the Geriatric Hospital
 Psychiatric Hospital – 625 bed hospital, with firm plans for another hospital facility
 AIDS Information Centers.

The report findings also derive from participation in a two-day workshop on distance education and health, held by the Barbados Community College in collaboration with the Pan American Health Organization, November 1-2, 2001. A telemedicine presentation on health and distance education at the workshop (M.O. Smith) is attached as Annex 2.

The report draws on two important secondary sources: (i) the Report on Primary Care, prepared for the Ministry of Health and the Environment by the Center for International Health, Boston University (January 1997) and, (ii) the Report of the Advisory Commission of Inquiry into the Queen Elizabeth Hospital (the Haynes Report, December 1998) concerning QEH provision of specialized preventive and curative services, its role as a teaching hospital, and provision of specialized services on a referral basis

II. Summary of Findings and of Recommendations.

1. Finding: Education and Training for Health Care Professionals

Shortages of 40% or more in nursing staff and shortfalls in physicians, particularly those with medical expertise in specialized fields such as neurology, cardiac surgery and pediatric cardiology, make urgent the requirement for increased access to health care professional education and to medical specialized education and training.

Recommendations:

- Support the University of West Indies' Distance Education Center (UWIDEC) and School of Clinical Medicine and Research (SCMR) to deliver expanded distance education programs for medical professionals in Barbados and the region, taking advantage of international centers of excellence.
- Support Barbados Community College (BCC) commitment to expand programs in nursing and health care, including pharmacy, medical laboratory technicians and health information management, and support its work with PAHO on rationalizing existing training programs regionally and developing continuing education programs for health professionals using distance learning technology.
- Equip the Queen Elizabeth Hospital's teaching auditorium with advanced multimedia capabilities and features for supplementing the hospital education activities and consultations to facilitate:

- virtual attendance in international medical conferences
- access to continually evolving medical practices
- participation in medical findings
- collaboration among researchers
- consultations and referrals on specific patient cases
- guidance in applications of specialized techniques.

2. Finding: Medical Information Systems

A comprehensive medical information system is an urgent need at the QEH and the polyclinics. Patient registration and records are paper based and compiled manually, and are partial and incomplete, slow in storage and retrieval and totally inadequate to today's medical standards. PAHO mounted a workshop in June 2000 to address the requirements for a national health information system, and in October 2001 supported work to identify a pilot project.

Recommendations:

- Support the PAHO pilot project for management information system (MIS) support for patient registration and immunization to develop organization support in the QEH, polyclinics and other key health institutions necessary for implementation of a more comprehensive medical information system.
- Institute a standardized Minimum Data Set (MDS) to be administered by the Ministry of Health and Data Processing Unit to improve clinical information exchange between participating Barbados health authorities and providers. A MDS standard would be the foundation for any scaleable electronic medical records system.

3. Finding: Cost-effective and Efficient Collaborative Health Care Networking

The national health care system in Barbados is well structured to become an efficient and effective collaborative network. The functions of the public health institutions – the QEH acute care and teaching hospital and regional referral center; the primary care polyclinics; the geriatric and psychiatric hospitals; the AIDS clinics and half-way houses - are relatively clear and complementary. The infrastructure and general information and communications capacity of the QEH and the rest of the health care network, however, require attention in nearly every respect. Some of the key deficiencies are:

- paper-based patient file management
- single information technology manager
- decaying facility and exposed wiring
- non-integrated network administrative procedures
- limited dedicated funds for network upgrades
- no general Internet connection for the hospital.

The QEH and surrounding healthcare system could be analyzed as underperforming in terms of efficient health care service delivery, because of lack of maintenance and upgrading of infrastructure, and attendant lag in hospital administration and professional capability.

Recommendations:

- Employ external funding in concert with government allocations critical to rebuilding and upgrading the health care infrastructure of QEH, the polyclinics and other national health institutions. This should include the Ministry of Health headquarters, where offices are currently housed in condemned buildings precluding sound application of computer technology.
- Develop long term telemedicine goals and plans to guide implementation of an IT internal and external network capacity necessary to support a fully integrated health care system. Telemedicine applications are modular and can be built on an “as needed” basis, but it is critical that applications are interoperable, compatible, scaleable and reliable.
- Probe network sharing with existing and planned computerized systems, such as the government-wide computerized financial and human resource management system (Smart Stream) which connects to QEH at 256 kpbs, or with the government’s EDUTECH 2000 program which is providing advanced IT connectivity to the public schools.
- Seek a special network arrangement, such as a special “public service” license to use alternative telecommunication access, or a virtual private network or concessionary tariff pricing, to reduce health network costs commensurate with government priorities for national health service delivery.

4. Finding: Public Health Information System

The Government of Barbados has focused public attention on health care. It has managed many public health campaigns, including the current campaign to educate the population on HIV/AIDs. Information technology offers many new ways and means to inform the consumer about public health alerts, responses and needs. It offers new channels of outreach to susceptible populations, as well as a means of combining treatment, testing, prevention and education. The government needs to take advantage of IT in bringing public health education into the schools and into the workplace.

Recommendations:

- Develop telemedicine services in the public schools, making use of the advanced network capacity and Internet connectivity being brought into the schools under the government’s EDUTECH 2000 program. Clinical diagnostic and referral services could be introduced to school health clinics through telemedicine techniques, and health care education and information services to the classroom.

- Explore shared network services with the EDUTECH schools for after school uses for health education and training. The provision of health care services should have a priority call on maximizing the advanced network capacity and computers being developed in the schools.
- Place one or two “touch screen” medical information kiosks in workplaces where pedestrian traffic is heavy, such as in the downtown area or QEH waiting area, to provide new opportunities for health awareness and education.

Steering Committee and Telemedicine Application Plan

These findings and recommendations are analyzed in more detail in the balance of this report. However, in line with the methodology guiding the strategic information assessment of telemedicine needs, two major outcomes are expected at the completion of the assessment. The first is the formation of a **Steering Committee** responsible for guiding the development of specific telemedicine applications. Key participants would be those directly involved in the telemedicine application, in the coordination processes involved within and outside of the health community, in the resources required to meet the commitment, in computer and communications technology. The Committee formulation would vary depending on applications being pursued. The second outcome is a **Telemedicine Application Plan** that identifies the health care services to be supported through telemedicine, setting forth priorities and strategies for action. This report is intended to provide background, analysis and momentum to the formation of the Steering Committee and development of a Telemedicine Application Plan.

III. Strategic Needs Assessment

Ministry of Health: Shared Goals and Objectives.

There is strong commitment by the Minister of Health and the staff of the Ministry to national health service. This commitment is longstanding and shared by hospital administrators, physicians, health care providers, community leaders, and the general public. The expectation is that national health care services will be accessible to the entire population of Barbados, and that service delivery will be high quality and satisfactory to the patient.

These goals translate into distinct objectives and needs for the principal institutions involved.

Existing Health Care Services

The Queen Elizabeth Hospital (QEH) is the major acute care and teaching hospital in Barbados, and a regional referral center in the Caribbean. The Hospital provides limited primary care, as well as secondary and tertiary medical care. The QEH seeks to strengthen its performance and thereby enhance its roles as an acute care, teaching and referral hospital

The polyclinics are primary health clinics, in eight locations or catchment areas that provide island-wide coverage. The polyclinics offer preventative and general medical services, and are committed to comprehensive primary health services delivery.

The QEH and polyclinics form the backbone of the national health care system, and are the focus of this report. The geriatric and psychiatric hospitals are important members of this system, along with the other public health entities. Telemedicine responses to needs in this report, while directed towards QEH and polyclinics, have similar applications to these other hospitals.

The gaps in health service delivery and needs are addressed below, followed by responses using telemedicine applications. The applications will be evaluated in relation to existing IT infrastructure and requirements.

Health Care Service Needs.

1. Shortages of Physicians and Nursing Services – Requirements for Education and Training

Undergraduate, postgraduate and continuing education, is a first priority for the health sector in Barbados. Shortages in professional staff (a 40% shortage in nurses and shortfalls in medical expertise) require increasing access to health care professional education and to medical specialized education and training. A brief survey of the needs of the polyclinics and QEH, and the respective roles in health education and training, of the University of West Indies (UWI) and the Barbados Community College (BCC) follows.

Polyclinics. The clinics are experiencing serious shortages in nurses, especially nurse assistants, along with shortages in laboratory technicians, radiology technicians, physicians and psychiatrists. There are also very few personnel with computer capabilities needed for more streamlined processing of data and information.

Training at the polyclinics is limited. Two polyclinics (Sir Winston Scott and Glebe) have clinical training sites for UWI Faculty of Medicine programs, and one (Edgar Cochrane) houses a Family Practice training unit run by UWI with little clinical interaction. The need for in-service training programs and for team and casework consultations is inhibited by staffing shortages and lack of adequate communications system support.

The Queen Elizabeth Hospital. The QEH is a teaching hospital that provides for the undergraduate and postgraduate training of doctors, with the University of West Indies' School of Clinical Medicine and Research (SCMR), headquartered at the QEH. It also participates with the Barbados Community College (BCC) in training of nurses, laboratory technicians and medical records personnel and other health practitioners, providing practical exposure in training to students at QEH.

There are shortages in medical staffing at QEH, reported to occur in neurology, dermatology, respiratory medicine, infectious diseases, cardiac surgery, pediatrics among others. In some

cases, professional medical staffing is limited to just one physician, and in others there are none. Nurses and nursing staff are also in short supply, as in the polyclinics.

Teaching and training needs have been identified in many areas, including in departments of anesthesia and radiotherapy. A number of postgraduate programs have been established in conjunction with UWI, but programs are still being sought in intensive care, cardiology, surgery and others. For medical professionals in specialized areas, short courses, seminars, and conferences are a necessity.

The existing services of the two main educational institutions responsible for medical and nursing care, are reviewed in brief below.

University of West Indies (UWI) – Training in Medical Services

The UWI is a regional university in the Caribbean, headquartered in Barbados serving about 2,660 students and 16 countries. (Anguilla, Antigua and Barbuda, the Bahamas, Barbados, Belize, the British Virgin Islands, Cayman Islands, Dominica, Grenada, Jamaica, Montserrat, St Kitts & Nevis, St. Lucia, St. Vincent and the Grenadines, Trinidad & Tobago and Turks & Caicos). The UWI has three on-site campuses: the Mona Campus in Jamaica; the St. Augustine Campus in Trinidad & Tobago; and the Cave Hill Campus in Barbados.

UWI offers a Degree in Medical Sciences, which is awarded upon completion of a combined attendance at two of its three on-site campuses. Final year residency is required at the SCMR in Barbados.

The SCMR has been actively supporting the extension and expansion of its medical courses to meet growing demands for continuing education and specialized education.

The Barbados Community College (BCC) – Training in Nursing and Health Care Services

The BCC, established in 1969 as a community college, serves day (2,000) as well as evening (1,500) students. It has certificate programs in nursing and health care, covering health sciences, pharmacy, medical laboratory technicians, environmental health services, health information management, rehabilitation therapy and computer studies.

BCC is in the process of developing into the University College of Barbados. As part of this process BCC is upgrading its Associate Degree program in nursing to a Bachelor's program, and ultimately will develop Advanced Degree programs. It is moving from three terms to semester-based delivery, and will expand onto a new campus site.

2. Requirement for a Comprehensive Medical Information System

A comprehensive medical information system is an urgent and widely identified need among administrators, physicians, nurses and patients at the QEH and the Polyclinics. Medical records

are still compiled manually in large part, posing difficulties for all concerned. The records are often partial and incomplete, slow in storage and retrieval, and unsatisfactory in providing a unified file regarding patient information, health care services and results.

There is critical need for medical information system support to streamline record processing and to integrate registration and referral information, patient information, departmental information and diagnoses and results. There is also a need to make more efficient use of large spaces both in the Hospital and the Polyclinics, taken up by manual record files. The need for more efficient storage carries over to a number of the QEH Departments as well, such as Radiology, which need to store and retrieve x-rays and imagery.

PAHO/CPC (the Pan American Health Organization, Caribbean Program Coordination) has mounted an active response to the health information systems needs of Barbados, by launching a workshop on the Development of a National Health Information System for Barbados on June 26-28, 2000. The objective of the Workshop was to identify strategies for development of a national health information system; to examine information needs of end-users and methods in practice; to obtain consensus on stakeholder participation in developing a national health information system; and to identify a pilot project. Excerpts from the summary findings contained in the Report of the Workshop (July 2000) are as follows:

- “Data are fragmented ... at the QEH, clinical and administrative data exist in silos and are not integrated
- There is need to improve the quality of data.. and use in annual work plans
- There is need to streamline and standardize data that is collected
- The minimum data sets (MDS) need to be clearly defined and implemented
- There is need to review and revise data collection forms
- There is need to improve data sharing...storage and retrieval.
- There is need to enhance the protection of active and archived data
- There is need to improve the continuity of patient care...referral system...diagnostic reporting... and to reduce the paper trail
- There is need for continuous training and retraining of staff in information systems”

The Report emphasized the need to develop human resource capabilities in information technology to manage a transition to computer based information management.

3. Requirement for a More Efficient, Cost-effective Collaborative Health Care Network.

The health system in Barbados is structured to be a collaborative system. A central acute care, teaching hospital and referral center is surrounded by a set of primary health care clinics, and linked to geriatric, and psychiatric hospitals. The hospitals and primary clinics are all designed to work together as a collective unit. To a large extent the national health system does work as a collective unit, with the respective functions of the main health institutions performing related and complementary services. The need is for the health care system to take advantage of its structure and to operate more efficiently and cost-effectively.

Network Infrastructure and Services. The infrastructure and general information and communications capacity of the QEH and the other public health institutions, however, require serious attention. Key deficiencies include:

- paper-based patient file management
- single information technology manager
- decaying facility and exposed wiring
- non-integrated network administrative procedures
- limited dedicated funds for network upgrades
- no general Internet connection for the hospital
- lack of computer support services

Improvements in infrastructure and services would vastly improve the efficiencies and costs of health delivery within the national health care system. In addition, there are needs for regional and international health care collaboration that are central to QEH's role in the region.

Referrals. The health care system in Barbados involves referrals between polyclinics and the QEH as well as with the geriatric and psychiatric hospitals. The system also extends to the private sector, with private physicians and the Bay View Hospital referring patients to the QEH for its more comprehensive and specialized services. However, as noted earlier, the referral process in place among hospitals and clinics is inadequate in the face of growing patient numbers and a more sophisticated medical environment. This has implications for the national health care system in Barbados, but also for QEH's role as a referral center for the Caribbean.

Clinical Consultations. Today's scheduling and practice of clinical consultations are inefficient and costly. Long waiting lines in the polyclinics and the QEH are the common practice, and scheduled appointments are difficult to make. There are no easy means for polyclinics or the QEH to gain second opinions on medical cases. Clinical consultations in advance of patient transfers, say from the geriatric hospital to the QEH, could result in significant costs savings in ambulatory service and care and hospitalization. Regionally, there would be similar efficiencies and cost savings to be gained through clinical consultations in advance of hospital referrals.

Internationally, clinical consultations with medical experts could have enormous cost savings. Interactive operating room consultations, for example in surgery for scoliosis, has been cited as one such application, along with consultations on pediatrics, neurology and other specialized areas. Another need is to strengthen access to international health support services, and preferably to family and family physicians, for tourists and other expatriates who fall victim to accident or ill health.

Educational Consultation. Collaborative needs of the health care system extend also to education and training beyond that provided in medical school and nursing program classrooms.

The following needs have been voiced by QEH highly trained doctors, many of whom need reinforcement in staff, training and consultations in their field of specialty.

- Virtual attendance in international medical conferences
- Access to continually evolving medical practices
- Participation in medical findings
- Collaboration between researchers
- Consultations and referrals on specific patient cases
- Guidance in applications of specialized medical techniques

International medical conferences play an important role in sharing current medical information, medical practices and research among physicians and others in the health community. Staff shortages and budgetary costs impede attendance.

4. Requirement for Public Health Information System

The surge in HIV/AIDs and the establishment of a National HIV/AIDs Commission has heightened the importance of public health education. Barbados has been noteworthy for its vigilance in preventative health care, mounting vaccination campaigns during the past year against rubella, measles, and mumps. With the onslaught of AIDS, the Commission has distributed videocassettes concerning the disease and preventative measures to every Ministry, and health care institution. It has also established AIDs Centers of Information which provide pamphlets and other material on AIDs to the general public and support telephone hot-line services. Television documentaries and radio public service announcements on AIDs have been delivered.

Information technology offers many new ways and means to inform the consumer about public health alerts, responses and needs. It offers new channels of outreach to susceptible populations, as well as a means of combining treatment, testing, prevention and education. The government needs to take advantage of IT in bringing public health education and services into the schools and into the workplace.

IV. Telemedicine Applications Responding to Health Care Service Needs

1. Education and Training for Medical and Health Professionals: Distance Education

Distance learning or delivery of educational services using telemediation capabilities of computers, cable and satellite, along with radio, television, telephone and print, can widen access to medical and health professionals to high quality education efficiently. There are different means (infrastructure), forms (voice, electronic medical records, bio-signals, stored images) and modes (communication paths or bandwidth) involved in design of medical and health education programs. Ultimately the access and cost of infrastructure tends to be the controlling factor.

The communication paths most commonly used, for example, are POTS (plain old telephone service) that can support bandwidth transmissions of 28-56 kbps; ISDN lines that provide bandwidth transmissions of 128-384 kbps, or T-1 lines that provide 1.5 mbps. Bandwidth permits ever higher resolutions of picture and motion; and, as expected, bandwidth is costly.

There are effective low-bandwidth applications for distance education, as well as high-bandwidth applications. The ideal educational delivery using the new technologies, involves both. (See Annex 2, Presentation (Oakes International) on Distance Education and Health PAHO and BCC Workshop, November 1-2, 2001). The Internet offers to provide health professional education locally, regionally and internationally on a relatively cost effective basis. Videoconferencing offers higher bandwidth and more robust solutions to health education and training, but at far higher cost. Regardless of decisions on bandwidth, a multi-media approach to learning is favored that recognizes the importance of face-to-face education and print material.

The Internet. The Internet offers solutions to the need for increased access to, and cost effective delivery of medical health education in Barbados and the region. Many medical courses have been put on-line (www) for access through the Internet, including 1200 medical courses by the Telemedicine Center (ECU, University of North Carolina) and several hundred in the basic sciences and across departments recently by MIT available to anyone anywhere at no charge. In addition there are numerous software course development programs that permit teachers to place their own courses on-line for their students. Blackboard.com is among these, but there are others to choose from.

Internet services are offered through Internet Service Providers (ISP) at fixed monthly rates, and can be quite cost efficient in delivery of courses as well as access to on-line journals and libraries. The NIH National Library of Medicine's MEDLINE offers on-line a collection of some 11 million bibliographic citations to the world's medical journals, and full text of certain journal articles. And, PAHO has recently placed its health library on-line (the Virtual Health Library). PAHO has supported CREAD, a distance education program for health professionals at Penn State University, and a UN program for selected countries in the Caribbean to provide Internet access to public health information and knowledge, use of the Internet for clinical and administrative communications and to participate in on-line educational courses.

The Internet offers a variety of applications using low bandwidth (28–56 kbps) that can serve the classroom well. These include electronic mail (permitting transmission of text, pictures, charts, diagrams sounds and compressed live video screens) that facilitate classroom work. The Internet also supports student conferencing on-line, such as through text-posted chat rooms or bulletin boards. Audio and video streaming, where discreet audio and video clips are stored on-line for downloading when needed, is another effective educational application. Lectures or seminars can be stored as audio clips and used by students at their discretion. These applications can be made for the most part using low bandwidth connectivity of 56 mbps. Internet-based live video capabilities are available and require somewhat higher bandwidth (128 kbps).

The UWI's computer labs, based on current arrangements for leased lines of 56 kbps, elsewhere, would support Internet capability to provide wide access to medical and health courses, and provide impetus to developing further undergraduate and graduate courses for national and regional delivery. Interaction, however, with students would be limited to compressed video screens and to call back, keypad and textual returns. Quality of resolution of medical imagery would similarly be limited.

The Internet would likely be one element of a multi-media package of educational delivery that could include printed material, face-to face classes or tutorials, and audioconferencing, with higher-end technology videoconferencing.

Videoconferencing. This form of delivery requires higher bandwidth (128-384 kpbs), and has the advantage of supporting live, real-time diagnostic quality video-conferencing in a classroom setting. The disadvantage is in cost; videoconferencing techniques are often associated with international conferences and business groupings. Classroom software using videoconferencing techniques, nevertheless, has been well developed, and was demonstrated at the recent PAHO/BCC Health and Distance Education Workshop in Barbados by the British Virgin Islands' H. Lavity Stoutt Community College. The College has developed a partnership with Educational Video Conferencing (EVC) in New York, and is promoting a Caribbean-wide network to access this higher end technology. This presents an unforeseen opportunity for the Caribbean to develop a collaborative framework for distance education. The actual costs and benefits of the program, however, and the programmatic dimensions of individual country and Caribbean wide involvement need to be examined. Infrastructure connectivity would need to be established and operating tariffs negotiated.

Distance Learning and Clinical Consultations.

Distance learning can broaden the access provided to students at UWI and BCC and elsewhere to medical, nursing and other health care education and training. Depending on bandwidth connectivity and arrangements with hospitals and medical centers, student learning can be enriched by student virtual participation in real time IT supported clinical consultations and diagnostic visits of physicians with patients. It is proposed in Section 3 below that the QEH equip its teaching auditorium with advanced multimedia features to permit such tele-consultation and distance education uses.

2. Comprehensive Medical Information System.

It will be important that the first step in design of a comprehensive medical information system be compatible, in terms of technology and design, with future plans for a more comprehensive system. A comprehensive system would include, based on assessed needs, the following, and would be further refined at that time.

- electronic medical records
- acquisition, transmission, and archival of imaging data
- integration of laboratory and medical instrumentation data
- billing and administrative data

Pilot project. A pilot project in management information systems has recently been identified as a consequence of the PAHO Workshop referred to earlier. The proposed project (Health Information Assessment Report, P.R. Ramsaroop, MBA, October 2001) is designed to include health entities broadly and to pilot limited applications of MIS for patient registration and

immunizations. The concept is to develop organizational support for MIS in the key health institutions, and to do this efficiently and with results.

While the needs of the national health system are greater than the pilot project being proposed by the PAHO consultants for basic administrative and preventative medicine functions (patient registration and immunization), the approach is a sound one and supported by this report. The behavioral and organizational barriers to implementation of new concepts and methods of information management can be prohibitive. The proposed pilot is built on this premise, and seeks to demonstrate the benefits and outcomes of information technology in hospital management on a limited, cost efficient and effective basis.

A comprehensive medical information system would put all patient and medical information in electronic form that can be governed by the QEH, for example, and shared as needed with the polyclinics, and other hospitals, including the private Bay View Hospital, if desired. Privacy of patient records and secured access to information systems would be required through user authentication, public key encryption or new systems being developed by the University of California at San Diego, together with industry and NIH. The electronic medical record can link to administrative and billing systems as well, forming a comprehensive integrated electronic patient care system that would form the basis for development of a fully integrated collaborative health care network.

Before embarking on any scaleable electronic medical records system, a standardized Minimum Data Set (MDS) needs to be instituted and administered by the Ministry of Health and Data Processing Unit. This requirement was recognized in the PAHO Report of the Workshop for the Development of a National Health Information System for Barbados (July 2000), and is necessary to improving clinical information exchange between participating Barbados health authorities and providers.

3. Cost-effective, Efficient Collaborative Health Care Network.

Telemedicine applications are best used in support of a fully networked health system. Telemedicine applications can streamline and rationalize the administrative requirements of a health system, heighten the quality of health care delivery through regional and international access to best practices, improve professional education in medicine and health, and increase access to public health information. Telemedicine can integrate these functions into a fully networked health system, and support the efficiencies and cost effectiveness implied by such a networked system. Telemedicine provides for health community partnering among local health institutions, and seamlessly to regional and global partners.

Telemedicine applications are modular, and can be built on an “as needed” basis. Specific applications can be applied immediately, while others can be developed later. The importance is that the applications are interoperable, compatible, scalable, and reliable. **Sound telemedicine planning that starts with the overall goals of the system, and includes implementation and evaluation processes to guide developments, should underpin implementation of identified telemedicine applications.**

Most telemedicine systems are hybrid. That is to say that they use different transmission modes (e.g., ISDN, T1, ATM, POTS, microwave and SW56) depending on applications, because one bandwidth does not fit all applications. They also use different infrastructure (satellites, landlines, fiber optic lines, and copper telephone lines) depending on needs, availability, and costs. Advance planning is important to design of a system that is interoperable and that can meet the requirements cost effectively.

Telemedicine needs for a collaborative health care network include the following.

Tele-Consultations: Remote clinical consultations among doctors, and with patients, for specialized needs, for second opinions, and for referral purposes will require real-time, video-based, diagnostic quality interaction. High bandwidth will be needed to support these consultations, although the amount of bandwidth will vary with the degree of video resolution, amount of motion, and speed of transaction required. Consultations, for example, on dermatology, cardiology, neurology, gastroenterology; and allergy, asthma, and immunology, will require bandwidth of 128-384 kbps, while pediatric cardiograms, echocardiograms, and cineo-angiography, for example, will require double the amount of bandwidth (768 kbps).

Clinical protocols, standard operating procedures (SOPS) and technology guidelines for telemedicine applications by specialized clinical service have been developed by the US Office for the Advancement of Telehealth (OATS), Department of Health and Human Services, as well as the Telemedicine Center (ECU, North Carolina) and other telemedicine centers of excellence. The protocols and technology guidelines are comprehensive reference guides to all aspects (for protocols, purpose, scheduling, preparation, telemedicine consult procedure, notes; and, for technology guidelines, equipment and technology, methodology, cost range, assessment) of the various clinical applications that might be considered (see attached References).

Clinical tele-consultations can also be effectively used in distance education programs for medical undergraduate, graduate and continuing education students. Apprenticeship-based clinical education is considered to be highly effective, and video-consultation between physician and patient lends itself to student virtual apprenticeship presence.

Tele-consultations can also be used to link specialized physicians and researchers with regional and international universities, hospitals and research centers of excellence, as well as to international conferences. There are many centers of excellence worldwide from which to

choose, depending on specialized medical interests. A number of these centers in the US are shown below.

Selected Centers of Excellence in Medicine

Johns Hopkins University – tropical diseases and research
 Sloan Kettering Institute – cancer and cancer research
 Baylor University – cardiovascular diseases
 Latter Day Saints – orthopedics
 Mayo Clinic – tropical diseases
 CDC - infectious diseases

Tele-consultations have a role to play within the QEH and Polyclinic health community. General rounds among physicians on a weekly or monthly basis could be supported by tele-consultations, as well as rounds among nursing staff and relevant medical teams.

It is strongly recommended that the QEH's teaching auditorium be equipped with advanced multimedia features for supplementing the hospital education and consultation activities technologically equipped. This would permit virtual attendance at international conferences, consultations within the hospital and other networked public health facilities, international and regional consultations and referrals and distance education support to teaching and training institutes.

The video applications here and the Internet applications referred to earlier should be viewed as complementary tools. There would be efficiencies to be gained in using them in cost effective combination.

Hybrid Communications Network. The QEH is at the nexus of a national health community that includes the surrounding polyclinics and other hospitals, and extends to regional and global health communities. Being at the center of this community, the QEH is the hub, and the Polyclinics are its immediate spokes. The “hub and spoke” telemedicine network is a familiar one, and the information and communications technologies required to support telemedicine applications have traditionally been in this pattern for major hospitals and surrounding systems.

The communications network of a hub and spoke system is most often hybrid in make-up. The central hospital system is supported by a T-1 line, with very high bandwidth (1.5 mbps) that can be parceled out and allocated to differing functions and applications. The remote spokes, in this case the polyclinics, have been supported by high bandwidth (384 kbps) lines, that can support most telemedicine applications including tele-consultations. The amount of bandwidth determines the degree of resolution and motion and speed with which the transactions can be carried out. The means of delivery can be by satellite, landlines, fiber optic cable, microwave, and copper telephone lines

The hub and spoke network of traditional telemedicine systems would meet the needs of a collaborative health network in Barbados. It would permit clinical and administrative

transactions, medical and health consultations, and educational collaboration to take place wherever needed, and provide the necessary communications backbone for regional and international networking. Detailed analysis (number of sites involved, locations, information to be sent, quality and interaction requirements, and infrastructural support) would need to underpin decisions on delivery modes and system design.

4. Public Health Information System

The Internet and the World Wide Web are unlimited in the health information services that are offered to public health officials and the general public. The NIH National Library of Medicine (NLM), for example, has initiated a web-based program to increase the awareness of public health officials to the services of the NLM, the Centers for Disease Control and Prevention (CDC) and other major centers. In addition, the Internet is giving consumer access to information and tools for self assessment of health risks, management of diseases and delivery of health care. The Internet becomes a formidable partner to the public in awareness, prevention and treatment of disease.

In the public schools where advanced network systems, computers and software are being introduced (under EDUTECH 2000), clinical diagnostic and referral services could be introduced to school health clinics through telemedicine techniques; and health care education and information services could be brought into the classroom. Further, the healthcare community should explore sharing network services with the schools for after school uses for health education and training. The provision of health care services should have a priority call on maximizing the advanced network capacity and computers being developed in the schools.

New techniques of information delivery such as kiosks can be extraordinarily effective in delivering health care prevention and treatment information. Appropriately placed, say in the waiting area of the QEH or the downtown National Insurance Building where pedestrian traffic is high, kiosks with touch screens and multiple levels of information regarding AIDS or other diseases could be of good value to the public at large. The AIDS Commission has expressed interest.

V. Existing Network Infrastructure and Infrastructure Requirements.

Network Services.

Cable and Wireless owns and operates all public telecommunications services in Barbados provisioned under exclusive licenses.

- Cable & Wireless BARTEL Limited (CWBARTEL), the national domestic service provider, has been providing exclusive telecommunications services under a 1991 license.
- Cable & Wireless BET Limited (CWBET), the external international service provider, has been providing exclusive telecommunications services under license granted in 1984 and extended in 1991. It holds all rights to

international “gateway” telecommunications services, requiring all voice and data traffic coming in and out of Barbados – including Internet Service Providers – to interconnect through their facilities and under their pricing terms.

- Cable & Wireless Caribbean Cellular (CWCC), is a joint venture owned by CWBET and CWBARTEL, under the license of CWBARTEL.

Both C&W exclusive licenses were due to expire in 2011. However, this licensing arrangement has been renegotiated with the Government, and a Memorandum of Understanding (MOU) was signed (October 16, 2001) whereby all public network telecommunication services will be liberalized by the end of 2003. The telecommunications reform developments and their implications for telemedicine network services and public health care facilities are discussed below.

While Barbados enjoys better access to voice and data network services than many of its Caribbean island counterparts, it still falls short of meeting the demands of its customers. Over the years C&W has made notable investments in network upgrades, such as digital switches, underground fiber and advanced Internet access, like ADSL available in a few populated parishes. However, many of C&W intentions to offer an ATM backbone of services are yet unmet, and moderately improved services have been accompanied with comparatively higher costs.

Network Infrastructure

The current network includes six digital multiplex systems and several remote switching modules used to switch telephone calls in Barbados, all which are fully digital. The fiber optic deployment has connected all remote switches to their host switch by fiber, completing three fiber rings in the northern, southern and Bridgetown areas.

International telecommunications connects to a network of submarine fiber optic cable systems. One of these cable systems, the Eastern Caribbean Fibre System (ECFS), runs from Trinidad to Tortola, and allows Barbados access into North America, Europe and other destinations. In addition, connectivity with the Americas I Cable System, via Trinidad, and the Digital Eastern Caribbean Microwave System (DECMS), a terrestrial microwave facility, provide for redundancy services.

Cellular services (CWCC) are reasonably reliable; however, calls are charged for both inbound and outbound traffic at an average of \$.30 per minute. Comparatively, US cellular users don't pay both ends of a call, making Barbados rates more than twice the comparable rates in the US.

Satellite services are provided through an earth station that accesses INTELSAT, PanAmSat and other service providers. These satellite facilities are also available for back-up network services in the event C&W's cable connections are disabled.

There are some five Internet Service Providers (ISPs) in Barbados offering mostly dial-up access to residential customers (about 12,000 Internet subscribers). Two now offer restricted wireless access. Sunbeach, the leading competitor to C&W's Internet Service, is offering wireless local-loop services to a select group of commercial clients. All ISPs must gain access to the international Internet network through Cable & Wireless' facilities and under their cost requirements. The average cost for a dedicated leased line (384 Kbps) runs about \$3,000 per month or about double that in the US. (See Annex 3 for details on bandwidth costs in Barbados.)

Telecommunications Reform Developments.

The MOU signed by C&W and the Government of Barbados in October 2001 stipulates that telecommunications liberalization will be implemented in phases over the period from December 2001 to August 2003. The transition timetable is as follows:

1. The new telecommunications legislation will be enacted no later than thirty days after December 1, 2001. The licensing of carriers and service providers will be initiated when the new law comes into effect.
2. The first phase of the transition is from December 1, 2001 to November 30, 2002.
3. The second phase is from December 2002 to July 31, 2003.
4. The third phase constitutes full liberalization, and commences on August 1, 2003.

Implications of the Reform Program for Telemedicine Network Services.

Starting in phase 1 of the Reform Program, the public hospitals and polyclinics will have some options available to access advanced network services competitively, i.e., outside of the high priced telecommunications system services currently available in the commercial market.

The QEH could, for example, build its own wireless system -- its own Virtual Private Network. Under phase 1, it would also be permitted to interconnect via its own wireless network to the polyclinics and other public hospitals, so long as it did not sell capacity outside the network.

Alternatively, the QEH may wish to delay in building or upgrading its network infrastructure and services until multiple network providers have entered the market on a fully competitive basis, under full liberalization expected in August 2003. Or, it may want to appeal to the government for a special "public service" license to use alternative telecommunications access, or negotiate an independent agreement with the incumbent provider for concessionary pricing.

Under phase 1, the QEH and other public health facilities will gain access to domestic Internet services on a competitive basis; however, the ISPs will not have competitively provided international connectivity until August 2003. At that time, international services should achieve significantly lower prices than currently available. Internet availability has major implications for improving low bandwidth communications within QEH, among the local public health institutions and with the international health community. Advanced telemedicine uses that require high bandwidth applications, such as high resolution medical imagery, high fidelity audio, real-time diagnostics, and multi-point video-conferencing may be delayed pending

competitive provision of fiber optic networks. But other telemedicine applications using low bandwidth, for example, for distance education, hospital and polyclinic consultations, and information system improvements, and communications among the public health network, should be facilitated.

A Telemedicine Applications Plan that determines the overall uses to be made of the new communications technologies in providing clinical care, medical and health care professional education and health information will be important to decisions on network development. Telemedicine applications can be introduced on a phased basis, but planning is required to establish priorities and strategies for implementation, and to ensure applications are interoperable, compatible scaleable and reliable, and network support appropriate. The formation of a Steering Committee to oversee and guide development of this Plan is recommended.

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Health Information Assessment Report, P.R. Ramsaroop, MBA, October 2001.

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Telemedicine Technical Assistance Series: Telehealth Technology Guidelines, Office for the Advancement of Telehealth, Health Resources and Services Administration, U.S. Department of Health and Human Services, December 2000.

Annex 1

List of Organizations Visited

Ministry of Health
Ministry for Economic Development

Queen Elizabeth Hospital
University of West Indies, School of Clinical Medicine & Research
University of West Indies, Distance Education Center
Winston Scott Polyclinic
Maurice Byer Polyclinic
Geriatric Hospital
Psychiatric Hospital

Barbados Drug Service
National HIV/AIDS Commission
AIDS Information Center

EDUTECH 2000

Barbados Investment & Development Corporation (BIDC)
Sunbeach

Pan American Health Organization, Caribbean Program Coordination Office

Annex 2

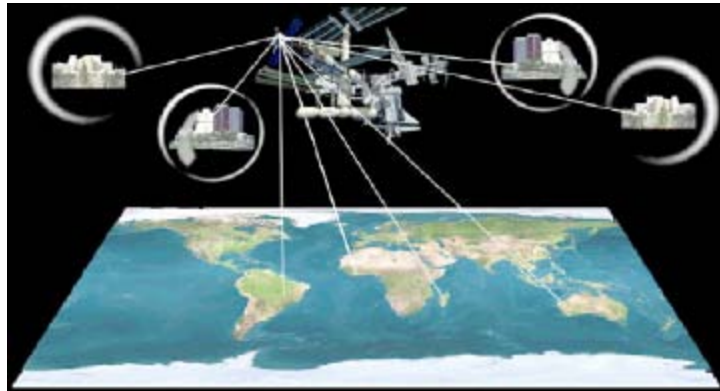
**Workshop on Continuing Education and Distance Learning
for Health Professionals
November 1-2, 2001
PAHO/CPC**

Hosted by: Barbados Community College

**Telemedicine Presentation
On Distance Learning and Health
Oakes International**

health and distance education

Sharing Information and Distributing Knowledge



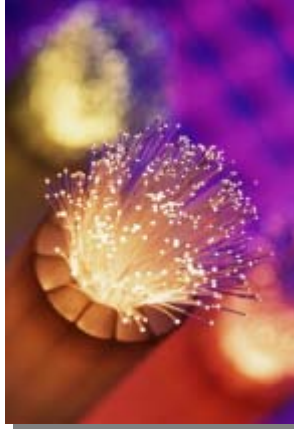
Oakes International

communication paths

POTS: <math>< 56.6 \text{ kb/s}</math>

ISDN: 128kb/s
(x3 = 384 kb/s)

T1: 1.5 mb/s



low-bandwidth applications

Streaming Audio
Text
Images
Bulletin Board
Listserv
Threaded Discussion
World Wide Web
Animation



high-bandwidth applications

Real-time Diagnostic Quality
Interactive Video
High Resolution Video
High Fidelity Audio
Multi-point videoconferencing
Faster Downloads



low bandwidth	high bandwidth
Individual/ Self-paced Education	Classroom Setting
Store and Forward	Real-time Teleconferences
Real Time Audio/ Not Recommended for Video	Real-time Diagnostic Quality

100111001101010110110001

training and education

Increased Access to Graduate Education

Continuing Education

Healthcare Training

Patient Education

Conference Participation

Telemedicine Consultations



bandwidth equals:

CME & CE

Public Health

Second Opinion

Training

Education

Awareness &
Notification





USAID/ Carana Corporation
Oakes International
Washington, D.C.
Oakesint@att.net

Annex 3

Bandwidth Costs in Barbados

(Barbadian \$ per month)

The table below reflects digital international private leased circuit rates offered by Cable and Wireless in Barbados. Each band originates in Barbados and is priced on a month-to-month basis. Conversion to US dollars is 0.5 of Bds\$1.0.

Circuit Bandwidth									
Destinat' n	56/65 Kpbs	128 Kpbs	192 Kpbs	256 Kpbs	320 Kpbs	384 Kpbs	512 Kpbs	1.544 Mbps	2.048 Mbps
Band 1A	1,640	2,952	4,264	5,248	6,232	6,888	57,872	13,120	16,400
Band 1 B	2,800	5,040	7,280	8,960	10,640	11,760	13,440	22,400	28,000
Band 2 A	4,140	7,452	10,764	13,248	15,732	17,388	19,872	33,120	41,400
Band 2 B	5,200	9,360	13,520	16,640	19,960	21,840	24,960	41,600	52,000
Band 3	6,000	10,800	15,600	19,200	22,800	25,200	28,800	47,800	63,800
Band 4	12,400	22,320	32,240	39,680	47,120	52,080	59,520	99,200	124,000

Source: Cable and Wireless, BET.

Key

Band 1A: St. Lucia, St. Vincent

Band 1B: Antigua, Anguilla, B.V.I., Dominica, Grenada, Guadeloupe, Martinique, Montserrat, St Kitts, Trinidad and Tobago

Band 2A: Guyana, Jamaica

Band 2B: Puerto Rico, United States Virgin Islands

Band 3: United States of America, Canada, Bermuda

Band 4: United Kingdom