The International Molecular Epidemiology Task Force (IMETAF). A Situational Analysis For Argentina

Argentinean Scientific Committee of IMETAF

Introduction

Molecular epidemiology has recently been defined as "a science that focuses on the contribution of potential genetic and environmental risk factors, identified at the molecular level, to the etiology, distribution and prevention of disease within families and across populations".[1] This field has emerged from the integration of molecular biology into traditional epidemiologic research. Its objective includes 1) descriptive and analyticalstudies to evaluate host / environmental interactions in disease, 2) the development of strategies for the control of bacterial, parasitic and viral disorders through molecular diagnosis, and 3) the prevention of noncommunicable diseases and genetic disorders by assessing risk and identifving susceptible individuals through genetic screening.

As yet, few countries have significant capabilities in molecular epidemiology due to a lack of trained molecularepidemiologistsanda pervasiveshortage of appropriate equipment, reagents and supplies. As a result, the International Molecular Epidemiology Task Force (IMETAF) was recently established.[1] Its mission is: 1) to facilitate the development and implementation of programs in molecular epidemiology in alí regions of tile world, and 2) to promote advanced biotechnology transfer for scientific research and its integration into medicine and public health for disease prevention. The organization of the IMETAF includes international representatives, as well as National Scientific Committees, which are established for participating countries.[2,3]

The Argentinean Scientific Committee of IMETAF formally began their activities in October, 1994.[3] They represent a mulfi-disciplinary collaborative network of scienfists, epidemiologists, and health professionals who are currently working to develop a molecular epidemiology program for Argentina. The foundation of this program is an assessment of the current health problems in Argentina, and a situational analyses of the nation's state-of-the-art in epidemiology and molecular biology. The situational analyses was periormed by conducting a national survey of institutions actively engaged in research utilizing advanced biotechnology, as well as those involved in epidemiology and public health. Scientists at these institutions were contacted to identify primary research activities, to assess available human, technical and financial resources, to ascertain existing training opportunities, and to outline approaches for developing molecular epidemiology in Argentina. The survey was designed to emphasize the existing national scientific expertise and infrastructure, and to identify the resources that will be required for further development of molecular epidemiology in the country. This report summarizes the results of this situational analyses.

Methods

A. Target Group

Universities, clinical facilities and research organizations utilizing advanced biotechnology, as well as those involved in epiderniology and

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public health were identified by the Argentinean National Scientific Committee of IMETAF. A review of relevant literature was also conducted to ascertain additional institutions that would be appropriate for the survey. One or more individuals from each institution were identified as contact persons for that organization. They were also invited to refer additional persons or institutions to the Scientific Cornrnittee for participation in the survey. Using these various resources, a total of 81 institutions were identified; their major areas of investigation included biochemistry, molecular biology, medicine, epidemiology and public health.

The contact persons for each institution received information about the objectives and activities of IMETAF, as well as a copy of the survey instrument, which is described in detail in the following section. They were requested to complete the questionnaire and return it to the chairmen of the Scientific Committee within three weeks. Approximately one month after the surveys were sent, individuals who had not responded were contacted again by phone, and they received another copy of the questionnaire. The final contacts were made approximately two months after the mailing, encouraging those who had not yet participated to complete the survey.

A total of 47 institutions, representing 58% of the study population, participated in the survey. Of those who responded, 68% were located in Buenos Aires, 17% in Rosario, 9% in Mendoza, and 2% in Cordoba, Santa Fe and San Luis, respectively. Most of the contact persons (48%) held positions as Directors of departments or institutioris. Ten percent were Professors, 13 % were Associate Professors, 15% were Assistant Professors, and 14% held more junior level positions. The majority of respondents were trained in biochemistry (53%) or medicine (28%); 15 % had degrees in biology and 4% had other areas of expertise.

B. *Survey Instrument*

A copy of the survey instuument is included in the Appendix. Information regarding the specific infectious, chronic. genetic and other disorders that are currently being investigated at the institutions, as well as their available resources in terms of financial support, equipment, materials and personnel, were obtained from the survey. Additional questions regarding possible sources of future funding, training opportunities, approaches to developing multi-disciplinary national and international networks, and the transfer of scientific and technical information that would be required to initiate a molecular epidemiology program for Argentina were also included.

C. Assessment of National Health Problems

In 1994, the Pan American Health Organization (PAHO) published a new edition of Health *Conditions in* the *Americas*.[4] this resource provides reliable data regarding the leading health trends for individual countries in Latin America, and for the Region as a whole. It emphasizes the changes that have occurred during recent years. The data are based on information from a variety of sources, and they assist with the development of national and international health programs. Thus, this resource was chosen as the primary source of data for the situational analyses for Argentina.

D. Statistical Analyses

All surveys were coded; data were entered and verified using the data entry program Key Entry III. The ascii files were uploaded to a VAX mainframe computer and entered into a 81032 database for data editing and analyses. Descriptive analyses were performed using the statistical package SPSS.

Results

A. Major Health Problems in Argentina

The population of Argentina was estimated to be 32,608,687 in 1991.[4] this represented an increase of approximately 17% from 1980. Eighty-five percent of the population resided in urban areas; proportions in Buenos Aires, Rosario, Mendoza and Cordoba were 9%, 3%, 2% and 3 %, respectively.

Analyses of the causes of death in Argentina during 1990 for children aged 14 years revealed that accidents *(221/100,OOOlyr),* heart disease (9/100,000/yr), congenital anomalies *(8/100,OOOlyr),* pneumonia and influenza *(8/100,000/yr)* and nutritional deficiencies *(8/100,OOOlyr)* were the five leading causes of mortality in this age group.[4] Intestinal infectious diseases (7/100,000/yr) were also common. Among adults age 15-49 years, malignantneoplasms(341100,O00/yr), heartdisease *(34/100,OO0/yr),* accidents (25/100,000/yr), cerebrovascular disease *(13/100, OOOlyr)* and homicide *(7/100,OOOlyr)* were the rnajor causes of mortality. Although chronic disorders were the most significant health problems in Argentina, there were still many individuals who developed fatal infectious disorders, particularly in the youngest and oldest age groups. For example, mortality rates for pneumonia and influenza approximated 1641 100,000/yr among persons age *65* years and older, representing 3% of all deaths in this age group.

B. Research *Using* Advanced Biotechnology

Eighty-three percent of the respondents indicated that their institutions were involved in research using advanced biotechnology. Eighty-seven percent were from organizations with a focus on epidemiology, medicine or public health, and 72% indicated that their institutions were engaged in both areas. Thus, there was considerable diversity in terms of the ongoing research projects at institutions in Argentina.

The disorders that were investigated utilizing advanced biotechnology included infectious diseases (73 %), genetic disorders (57%), cancer (49%) and autoimmune diseases (37%). Areas receiving less attention were endocrine (29%), hematologic(23%) and psychiatricdisorders(6%). Thespecificdiseasesunderevaluationare outlined in Table I.

In Argentina. research utilizing advanced biotechnologywasfunded primarilyby public agencies. such asthe Public Health Ministry, CONICET, SECTY and local universities. Private foundations, as well as pharmaceutical and biotechnology companies were also supporting these activities. However, less than 30% of the responding institutions were receiving funds from international organizations, such as the World Health Organization. the Pan American Health Oraanization or the Rockefeller Foundation.

Table I. Investigations of Various Diseases Using Advanced Biotechnology

Infectious Diseases	Viralinfections Parasiticdisorders Mycobacterium
Autoimmune Diseases	Diabetes Celiac Disease Immunodeficiencies
Genetic Diseases	Cystic fibrosis Phenylketonuria Duchennemuscuiardystrophy
Cancer	Retinoblastoma Leukemia/Lymphoma Breastcancer
Cardiovascular Diseases	ApolipoproteinB LDL receptor
Endocrine Diseases	Diabetes Goiter

In terms of equipment, the items required for gel electrophoresis and polyrnerase chain reaction (PCR), such as thermocyclers, were readily available in Argentina. More than 90% of the responding institutions indicatedthat this equipment was accessibleand was being employedforcurrent researchprojects. Materials, reagentsandsupplies required for research using advanced biotechnology were also readily available. Difficulties in obtaining necessary enzymes (i.e., proteinase K, restriction enzymes, Taq polymerase, etc.), oligonucleotide probes or primers for PCR were not reported. However, only a small proportion (22%) of the participants had access to DNA sequencing equipment at their institutions.

The individuals conducting research using advancedbiotechnologywere primarily junior level scientists. More than one-half of the responding institutions indicated that Assistant Professors, Postdoctoral Fellows, Graduate Students and Technical Personnel were conducting many of the

research projects. A smaller number of senior researchers (i e., Professors and Associate Professors) were supervising these activities.

C. Research In Epidemíology, Medicine and *Public* Health

Because most of the participating institutions with capabilities in advanced biotechnology were also involved with epidemiology, medicine and public health, the specific areas of investigation in these fields were similar to those being evaluated by basic scientists. Infectious diseases (64%), genetic disorders *(50%),* autoirnrnune diseases (42%) and cancer (40%) were the major areas of epidemiologic research. There was limited focus on endocrine (29%), hernatologic (26%), or psychiatric disorders (8%). Few institutions were involved evaluating the epidemiology of cardiovascular disease (8%). The specific disorders under investigation are outlined in Table II

Table **II.** Investigations of Various **Diseases In** Epidemiology **/Public** Health

Infectious Diseases	Viraiinfections Parasiticdisorders Respiratoryinfections in children Nocosomialinfections
Autoimmune Diseases	Diabetes Thyroid disease Systemic lupuserythematosus Rheumatoid arthritis
Genetic Diseases	Cysticfibrosis Phenylketonuria Thalassemia
Cancer	Retinoblastoma Leukemia/Lymphoma Lung cancer
Cardiovascular Diseases	Apolipoprotein B LDL receptor
Endocrine Diseases	Diabetes Goiter

Epidemiologic research and public health investigations were primarily funded by public agencies (i.e., the Public Health Ministry, CONICET, SECTY and local universities). Private foundations, pharmaceutical and biotechnology companies, international organizations (i.e., WHO, PAHO, Rockefeller Foundation) and banks were also supporting these activities.

With regards to necessary equipment for epidemiologic and public health research, rnost respondents (97%) indicated that personal computers were accessible at their institutions. However, mainframe computers *(51%),* computer software (53%), and access to electronic mail and the Internet (55%) were not readily available in Argentina.

Most individuals involved in epidemiology and public health were junior level professionals (i. e., Assistant Professors, Post-doctoral Fellows, Graduate Students and Technical Personnel). A smaller number of senior level researchers (i. e., Professors and Associate Professors) were directing epidemiology and public health projects in the country.

D. Molecular Epidemiology Program for Argentina

Ninety-six percent of the respondents indicated that they would be interested in participating in a molecular epidemiology program for Argentina. Most individuals suggested that infectious diseases (88%), autoimmune disorders (48%), cancer (40%) and cardiovascular diseases (38%) should be emphasized. Although infectious diseases, autoimmune disorders and cancer are areas of active research in the country, there is currently less emphasis on the cardiovascular diseases. Thus, the development of a molecular epidemiology program will provide an oppoltunity to expand current research efforts and encompass the most prevalent chronic and infectious diseases in the country.

Additional biotechnology equipment, reagents and supplies will be required to develop molecular epidemiology in Argentina. Items most urgently needed included thermocyclers for PCR, as well as DNA sequencing equipment. In terms of reagents and supplies, access to additional oligonucleotide probes and primers will be most important for supporting new initiatives using advanced biotechnology.

For the epidemiologic and public health aspects of molecular epidemiology, existing personal and mainframe computer facilities must be expanded to support a molecular epidemiology program.

Improvements in connectivity, through the availability of electronic mail and the Internet, as well as better access to analytical programs (i.e., computer software) will be the major priorities for the development of molecular epidemiology in Argentina.

Survey participants indicated that sources of funding for various components of a molecular epidemiology program will likely come from the public and private organizations mentioned above. However, problems in obtaining the support necessary to develop molecular epidemiology in Argentina will likely be encountered due to limited funding opportunities in the country. In addition to the lack of availability of equipment and financial resources, respondents indicated that organization difficulties, problems in maintaining current research facilities, and inadequate training must be overcome to successfully initiate and maintain a national molecular epidemiology program. These issues are discussed in great detail in the following sections.

E. Training in Molecular Epidemiology in Argentina

Participants were asked about existing local training opportunities in areas related to molecular epidemiology. Short courses and workshops in epidemiology (77%) and molecular biology (88%) were available at most institutions. Formal graduate programs (80%) and post-graduate training opportunities (84%) in the basic sciences, where students are exposed to molecular biology and immunogenetics, were also well-developed in Argentina. However, formal training in epidemiology was limited (47%). There were also few post-doctoral positions (59%) or fellowships (0%) available for epidemiology in the country.

As a result of the limited educational opportunities, there was considerable interest in expanding the existing short courses that focus on either epidemiology or molecular biology to include components related to the other discipline. For example, current short courses in epiderniology could be expanded to include sessions on the principies of human genetics and molecular biology. In addition, programs focusing on molecular biology could be broadened by adding lectures and practical examples related to epidemiology. Symposiums (93%), integrated short courses or workshops specific to molecular epidemiology (79%), and formal graduate programs (87%) were also indicated to be priorities for the development of a molecular epidemiology program for Argentina.

F. Development of Multi-disciplinary Scientiflc Networks

Molecular epidemiology requires the collaboration of individuals with expertise in a variety of disciplines, including the basic sciences, epidemiology, medicine, and public health practice. Thus, the survey participants were asked about possible approaches to developing multidisciplinary networks, which would serve as a basis for future collaborative activities in molecular epidemiology. Strategies thought to be most important included the development of inter-departmental and inter-institutional collaboration through activities such as joint seminars, projects, etc. Tbese may help to overcome sorne of the organizational difficulties mentioned previously. In addition, the exchange of technology and scientific literature among scientists, clinicians, epidemiologists and public health professionals in Argentina and other countries was also viewed as a priority for the development of collaborative networks. These activities could be easily facilitated through the establishment of directories of individuals and institutions involved molecular epidemiology. Such directories, as well as current publications, etc., could be placed on Internet for international access and to encourage the development of molecular epidemiology.

Discussion

The purpose of the situational analyses for Argentina, conducted by the National Scientific Committee of IMETAF, was to assess the current health problems and the state-of-the art in molecular biology and epidemiology in the country. This will serve as the foundation for a molecular epidemiology program based on an evaluation of existing capabilities and expertise, as well as an assessment of needs and future priorities. The

situational analyses for Argentina will also serve as a model for developing molecular epidemiology programs in other countries.

Many institutions in Argentina are involved in research utilizing advanced biotechnology. However, at the same facility, the work being conducted also has an epidemiologic, clinical or public health perspective. Areas of current emphasis included infectious diseases, cancer, autoinirnune disorders and genetic diseases, which are among the major health problems in the country. Thus, future molecular epidemiology research projects related to these areas will be easily facilitated by the excellent outongoing investigations. However, cardiovascular disease, which is not currently an area of active research, was indicated as a future priority for molecular epidemiology in Argentina. Its significance from a national public health perspective,[4] warrants the allocation of new resources in this area.

Equipment, reagents and supplies needed for advanced biotechnology and epidemiologic research were generally available in Argentina. Exceptions included DNA sequencing equipment, mainframe computers, computer software and access to electronic mail and the Internet. This represented a great improvement compared to the situation several years ago, when equipment and materials were in very short supply and exceedingly difficult to obtain. Access to modern facilities for basic science and epidemiologic research will greatly facilitate the development of a molecular epidemiology program in Argentina, as the needed technical resources and level of scientific expertise are available throughout the country. However, existing capabilities will not be sufficient to support clinical and public health applications using molecular analyses. As a result, additional equipment, reagents, supplies and other resources will be required.

The development of molecular epidemiology in Argentina will be facilitated not only by the available resources, but also through the development of multi-disciplinary national and international networks. Survey participants indicated that such activities could be promoted through inter-departmental / inter-institutional meetings, the exchange of technology on an international level and the development of training programs. In addition, information related to molecular techniques, research methods, approaches to risk factor assessment, statistical methodology and disease prevention strategies should be available to basic scientists, epidemiologists, physicians, public health professionals and government officials. mis could easily be facilitated through access to the Internet. Such efforts will support a molecular epidemiology program in Argentina.

Because of these suggestions, the Scientific Committee of IMETAF is currently plaing to hold several workshops for specific chronic and infectious diseases in Argentina. For example, individuals who participated in the national survey and are currendy conducting research on viruses will be invited to a "Virus Workshop". Presentations will be made by basic scientists, epidemiologists, clinicians and public health professionals, providing unique perspectives to the study of viral disorders, as weíl as possible approaches to their prevention. The workshops will include discussion groups so that specific recommendations regarding future initiatives can be made. These may relate to the development of new projects, representing an integrated molecular epidemiology approach, specific training objectives, etc.

In terms of training young scientists, there were considerable opportunities for molecular biology in Argentina. These included short courses and workshops, as well as formal graduate programs and post-graduate fellowships. However, opportunities for training in epidemiology were limited. There were few graduate epidemiology programs, and most institutions were involved in informal courses or workshops. Moreover, there were no ongoing programs in molecular epidemiology or integrated activities related to the fleid. Thus, in addition to expanding existing courses and workshops to include components related to both epidemiology and molecular biology, more integrated training programs in molecular epidemiology are needed. Thus, the Scientific Committee is currently planning to hold a molecular epidemiology workshop in 1996 in Buenos Aires. Training will remain as an important priority for the development of a molecular epidemiology program in Argentina.

Many of the individuals conducting research in the basic sciences or in epidemiology in Argentina

were at a junior level, under the supervision of a smaller number of senior investigators. Thus, more senior level scientists will be required to direct activities related to molecular epidemiology in the future. mis can be achieved tlirough the prornotion of junior scientists or the recruitrnent of well-trained and experienced individuals working in related fields.

The attainment of "health for all by the year 2000 is a goal which all nations are actively pursuing. Although better social and economic conditions, health care delivery and education programs rnust continue to be developed, international health can also be realized through traming molecular epidemiology and the utilization of advanced biotechnology. The development of a molecular epidemiology program in Argentina will increase capabilities in molecular epidemiology, which will strengthen national scientific expertise, enhance technology development, increase human resources and reduce the morbidity and mortality associated with the rnost prevalent diseases in both developing and industrialized countries. The Argentinean National Scientific Cornmittee of IMETAF is greatly contributing to this effort.

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