THE BOLIVIAN DISASTER SURVEILLANCE DATA SYSTEM

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INTRODUCTION

The term "surveillance," originally derived from the epidemiology of infectious disease, has been applied to various facets of public health. Nutritional surveillance programs, for instance, attempt to provide timely collection and interpretation of data for decision-making with the purpose of improving nutrition in communities (1). In the same manner, the concept of a surveillance program for disaster relief has been proposed and developed by the Pan American Health Organization (PAHO/WHO) (2). The aim of such programs is to obtain information so as to plan and mobilize appropriate assistance for stricken communities. The current literature *vis-a-vis* disaster epidemiology points to the use of such data systems during the aftermath of the disaster (2,3,4). While many natural disasters such as earthquakes are not precisely predictable, others such as droughts and floods can be anticipated more readily. Given an "early warning" system, the prediction of the effects of impending disaster can be made and appropriate measures taken to ameliorate possible mortality and morbidity.

Although the development of such systems to aid in the improvement of relief programs was recommended in the early 1960s, little has been done to implement the suggestions (5). Where operational programs do exist, as in the cases of Botswana, Indonesia, and Ethiopia, information is limited by incomplete documentation or by the newness of the program (6). This paper examines an early warning system for droughts and floods in the context of Latin America.

The purpose of this paper is to describe a surveillance system that was developed in 1984 under the auspices of the United

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States Agency for International Development (USAID) for monitoring conditions related to drought and severe weather conditions in six departments of Bolivia.

BACKGROUND

The reversal of normal oceanic currents off the west coast of South America, known as the El Niño phenomenon, in 1981-1982 led to a pattern of severe flooding and prolonged drought in Santa Cruz, a southern tropical area, and in the northern Andean region known as the Altiplano, respectively, in 1983 (7). As a consequence, widespread shortages of food, seed, and livestock accompanied the drought, while migration to less stricken areas exceeded usual migratory patterns. Damages to rice crops and livestock in non-drought areas occurred as a result of flooding, which in addition, severely affected communications and transportation infrastructures.

In light of the above events and with the current political and economic instability of the country, the USAID Mission and other international organizations have provided assistance to Bolivia. Effective aid by the Mission, however, has been hampered by the lack of essential information on the status of health, economic, and agricultural conditions. A review of existing sources of data in government and non-government institutions had indicated that a permanent system allowing for the rapid and efficient collection of data for immediate use was virtually non-existent. For example, according to data as of mid-1984 from the Ministry of Meteorology and Hydrology, the drought that occurred in 1983 would not have been observed until 1986 (8). Hence, the necessity for a data system at the national level that can address immediate needs related to droughts and severe weather conditions was recognized.

Given the dearth of current and reliable information, the proposed system attempts to anticipate problems regarding health, economic, meteorologic, and agricultural conditions particularly in the rural sector, to determine priorities in times of emergency, to facilitate evaluation of the impact of certain programs in critical regions, and to observe the rehabilitation and recuperation of affected areas.

THE DATA COLLECTION SYSTEM

Central to the surveillance system is the use of appropriate

indicators that can signal the impact of drought and can provide information regarding the effects of flooding on health, agriculture, meteorology, economics, transportation, and migration. The selected topics are thought to be valid variables that would be most sensitive to changes in existing conditions in the affected regions. The indicators include rates of infant mortality, morbidity in children less than 5 years of age (with particular emphasis on respiratory diseases and gastrointestinal disorders), rainfall, market prices (for rice, potatoes, wheat flour, and noodles), daily wages, livestock depletion, migration, crop program development, seed survival, and water supply in terms of daily consumption and depth of wells.

Data are collected approximately every twenty-eight days by six field agents from randomly stratified samples of communities in each of six targeted departments of the country, namely La Paz, Oruro, Potosí, Cochabamba, Chuquisaca, and Tarija. Selection of the communities is based mainly on the identification of the community by the National Institute of Statistics (INE) and on the accessibility of the community to main thoroughfares and existing roads.

In such communities, visits are made to key leaders within the community and/or to institutions that may have information of interest to the purposes of the surveillance system. The town mayor, for one, is interviewed for his perception of the physical and geographical size of his community. Vital statistics are obtained by querying other community leaders, such as the nurse and the civil registrar, for their estimations as to the population, boundaries, and jurisdiction of their respective communities.

One institution that appears to be found in almost all communities is the office of the civil registry. Vital statistics, specifically natality and mortality, are recorded continuously and are sent to the National Institute of Statistics on a quarterly basis. Registration fees, however nominal, are charged of residents within the jurisdiction of the civil registry.

Health data, or information concerning morbidity, are obtained from community health centers or posts in remote areas, or *centros o puestos de salud*. In most cases, tabulation of a range of diseases by age and sex is maintained on a monthly basis by the clinic nurse or by a newly graduated physician at work during his *año de provincia*. In health centers that served larger or several communities, data specific for nutritional status and childhood im-

munization are available. In remote health posts where a single nurse and her assistant administer to the needs of the community. Information about the availabilty and distribution of oral rehydration therapy packets for diarrheal disease at the community level can be obtained.

Agriculture and credit/market systems are monitored periodically by the Bolivian Institute for Agricultural Technology (IBTA). Branches of the institute, usually found in large communities, initiate projects related to farming and animal husbandry and perform periodic surveys of harvest and livestock ownership within a particular area. The availability of produce and livestock and their corresponding prices in the market are reviewed as well for any fluctuations in the type of produce available by season and on the stability of prices in the market.

Another source of secondary data within the existing system is the experimental station whose activities primarily revolve around the raising of livestock, including llamas, alpacas, and vicuñas, and the monitoring of weather conditions for a specific zone of influence. Meteorological information, particularly with repsect to temperature, precipitation, and barometric pressure, is collected on a daily basis and is readily available at such stations.

Field visits by the data collectors include an initial assessment of the community in terms of the availability of existing data, the establishment of contacts between local leaders of the community and other persons who can provide information regarding the generation, the recording, and the verification of the data. In addition, a directory of routine and special projects and services for community development is made. In the process, an understanding of the operation of the community under study is developed from the collection of both qualitative and quantitative information.

The data are then transmitted on a periodic basis from the field to the central office in La Paz, where analysis is executed with use of the IBM-XT microcomputer, LOTUS 123 spreadsheets, Wordstar for word processing, Knowledgeman for data entry and record management, and SPSS for statistical packaging to generate rapid results for efficient interpretation. Results of the system are directed to potential users of the data, including other components of USAID's Disaster Assistance Program, the Ministry of Planning of the government of Bolivia, and other international relief organizations so that appropriate action may be

taken. After a two-year operation under the direction of USAID, the surveillance system will be incorporated into the activities of the Ministry of Planning.

SYSTEM PERFORMANCE

Visits to the communities of Batallas, Achacachi, Viacha, Comanche, Coro Coro, Cutty, and Luribay in the department of La Paz for pretesting the survey instrument indicated that the quality of the existing data was below the level of what had been anticipated during earlier planning stages. Although civil registries, health posts, agriculture institutions, and meteorological stations were found in most communities, other data sources clearly were needed.

Subsequent revision of the questionnaires following the pretest entailed contact with such institutions as the Ministry of Agriculture (MACA), IBTA, and Office of Meteorology of the Ministry of Transportation, and the Office of Epidemiology of the Ministry of Social Welfare and Public Health for the purpose of obtaining existing data and for acquainting one with communication channels for those data. Where the information of interest already existed, the survey instruments were adapted to accomodate the reporting schedule of the report forms in those institutions.

Didactic training of the data collectors, most of whom were agricultural engineers, included a two-week series of lectures on vital statistics, epidemiology, meteorology, transport, agriculture and credit systems, census, migration, and oral rehydration therapy from USAID personnel and from various representatives from such institutions as INE, CARITAS, the Office of Epidemiology of the Ministry of Social Welfare and Public Health, and the Ministry of Agriculture. Practical training was conducted in various Altiplano communities including Patacamaya, Ayo Ayo, Huarina, and Copacabana, where visits were made to the civil registry, IBTA, and the health post of each town.

Following the field visits, problem areas and other possible sources of data were identified. For one, the manner of introducing the project to representatives of the communities required clarification. In order for the project to be accepted by the local people, data collectors introduced the project as an activity of the Ministry of Planning of the Government of Bolivia and of

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USAID, rather than of ‹ or the other. This was attributed to the lack of confidence on part of the community in its national organizations and to its s· ıcion of foreign interests. A dual representation, it was thougl would alleviate hesitation on the part of the community to parti· ate in the project, as it would emphasize the credibility of the oject.

A definition for the · a of influence of a community raised considerable confusion. I: nost instances, geographical boundaries could not be delinea·, although the project had access to government maps. Data,] ticularly those from the civil registries and from health posts, in· ded *procedencias* and *domicilios*, the definitions of which diffe d from place to place. In the same manner, teachers in certai communties kept a census of their students based on the *area a rimario*. The area of influence of the school, however, differed om the area of influence of the civil registry and/or the healtl ost of the same "community". In the department of Tarija, co· unities are dispersed so that a standard definition may be di· ult. In epidemiologic terms, any comparison of the effects of t indicators in question would require the use of different deno· ators.

The quality of incom data raised questions with respect to reliability and validity. ' en asked separately about the estimated population of their mmunity, the mayor and nurse of one community responded wit a range of several thousand. To validate responses may prove ficult, particularly in situations where a wide range for an esti ted single summary figure is given. Moreover, the recording c atality and mortality from civil registers was at best sketchy Many births were registered several years later, once the chi was ready to begin school in which birth certificates were re· red upon registration. Also, the fees required by the civil regis· may have deterred prompt registration of birth or death.

Selection of the 180 nmunities for the study was not randomly stratified. These co unities were selected by their respective data collector for th· easy identification on maps provided by the National Institute Statistics and for their proximity to main thoroughfares. Sinc· omplete maps of all communities do not exist, a random stratif· ion of the communities for study was not possible.

Thus, it appears that e thrust of the surveillance system is to generalize from weak d given a myriad of sources of varying

degrees of confidence and reliability. Rather than focusing on the notion of probabilistic samples, emphasis for data analysis is place on the relationship between representativeness and exceptions. The existence of outliers, blips in curves, problems and inconsistencies, quick changes, which statistics tend to obscure, presents issues for consideration in the operation of the surveillance system.

Survey instruments for agriculture and market/credit systems are in the process of development. Initial field visits indicated a lack of a uniform weighing scale throughout the markets. In addition, responses for harvest yields and losses and for the quantity of livestock per farmer were at best educated guesses. These and others were similar problems that were faced by local agricultural organizations (MACA and IBTA) in their surveys.

Because the project was tested initially in the Altiplano where drought was a major problem, indicators for the effects of the former rather than for flood, a phenomenon more common in the valleys, were emphasized. Appropriate indicators for the latter will be added upon full operation of the surveillance system.

Possible data sources that were identified were the programs of the *clubes de madres*, a women's organization found in almost all communities with feeding programs for children, and the *Plan de Padrinos*, an international organization with multisectorial development programs that encompassed health and agriculture. A possible source for transport data were police records from road blocks in certain towns where vehicles were inspected for contraband. Lastly, priests and other ministers were able to provide some mortality information.

Can such surveillance data system predict the effects of drought and severe weather conditions? In a country beset with spiralling inflation and numerous daily strikes (9), it appears that the success or failure of a surveillance system in its attempt to detect any normal or non-normal changes is largely affected by the spectrum of socioeconomic events outside the system itself. Hence, any attributable changes as evidenced by a measure of the indicators cannot be due simply to the surveillance system per se, but must be viewed as the possible result of competing causes as well. Moreoever, criteria for the particular surveillance system, or of any diaster surveillance system for that matter, have yet to be developed. Whether or not the system can in fact predict the impacts of drought and other severe weather conditions remains to be seen.

In any event, the system is an attempt to provide early warning and intervention to prevent epidemic inadequacies with respect to the effects of drought and flood. Through the timely, rapid, and short-term exchange of information, the operation is essentially a methodology for addressing needs given an imminent deterioriation in health, economic, meteorological, and agricultural conditions. The system, in addition, creates an infrastructure by which sensitive and specific data are collected to reflect prevaling conditions. In light of the impacts of competing causes on the system, perhaps in time a similar methodology also may be developed for addressing such causes (e.g., spiralling inflation).

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