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GEO-CODING OF HEALTH AND DEMOGRAPHIC DATA AS A RESOURCE FOR ENVIRONMENTAL INCIDENTS PREPAREDNESS AND RESPONSE

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SUMMARY

Assessment of health and hazards requires geographic information with a short analysis time. Traditional approaches involve complex systems developed after an event posing serious deficiencies. The Medical University of South Carolina is developing an applied system using a geo-coding process enabling investigation of environmental hazards and health outcomes from the state to the census block level. This comprehensive system is capable of assessing multiple data sets. The Project is a collaborative effort with the Office of Research and Statistics of the South Carolina Budget and Control Board. Future research is discussed to facilitate dialogue from potential users.

I. INTRODUCTION

The assessment of health hazards and the relation to public should consider the geography and population density. A surveillance system is considered the systematic collection of disease occurrence information in a defined population. Disease and exposure surveillance systems have been used to identify many hazards and health effects. Thus, the implications and ramifications of the results of such a program are great with long-term effects. Numerous studies and investigations have determined and identified strong correlation between geographic location and the disease incidence/environmental hazard exposure.¹ One example of such an assessment involves the study of disease clusters and patterns, and the investigation of potential effects from environmental exposures.²

A well recognized investigation involves the study of women residing in the Love Canal, New York area and the occurrence of undesirable pregnancy outcomes.³ Such investigations involve the traditional epidemiological approach to a problem as well as a traditional method of data collection. In a typical

assessment, the investigation will select a population considered to be at risk of disease and/or exposure and will collect data and physical samples in an effort to determine cases of exposure and potential health outcomes. This approach has been used with success in many studies, however such methodology has several limitations which should be considered. One limitation involves the selection of individuals to be studied which involves only those subjects who agree and are able to participate in the study. These individuals must first be located and convinced to participate. Another limitation involves the collection of data necessary to complete a comprehensive assessment of a population after an event. For example, collection of data from water quality records, health records and population demographics is time-consuming and biased after an event. In summary, the traditional assessment approach involves a methodology which is useful for the study of single household units, but only cursory investigations are possible for regions and populations.

II. APPROACH

A. An alternative approach is proposed which involves the utilization of existing data sets which are available.

Numerous environmental data sets and health outcome data are routinely collected by regulatory and service agencies. Most of this data is organized by geographic location. This type of data can be organized into a Geographic Information System (GIS). Such systems have been effectively used for environmental assessments.^{4,5} Potential components of a typical GIS include the computer hardware and software for data input and merger, data storage, data processing and display of digital maps. The major processing functions of the System include computer mapping, spatial data base management, spatial stations, and cartographic modeling.

This System can be simply described as an overlay of geographic maps with different thematic attributes.

Spatial data base management organizes the products from the computer mapping and digitalization process. This organization allows the incorporation of a variety of population and geographic themes such as the location of environmental hazards, population demographics, socio-economic characterization as well as health outcome prevalence. These data can then be assessed with traditional statistics to assess the association of various patterns.

B. Several activities must be successfully completed in order for the System to be effective.

The first efforts involve the establishment of a collaborative network with groups such as the Office of Research and Statistics of the South Carolina Budget and Control Board, South Carolina Department of Health and Environmental Control, Agency for Toxic Substances and Disease Registry, and Savannah River Region Health Information System. A major effort involves the establishment of a comprehensive geo-coded area. The approach will involve the merger of specific health and environmental data information with the Bureau of the Census Tiger File Street Index. This merger requires the alignment of the environmental and health data with the geographic locations of the Census data set. Each county in South Carolina has been geographically patterned into Census Tracts, Census Block Groups and Census Blocks as a result of the enumeration and tabulation process of the Census. In addition, some counties have implemented modified geographic pattern schemes with the advent of the "911" emergency phone system. Regardless of the scheme, the objective of this activity is to establish a comprehensive arrangement where each household address is arranged in a small defined geographic area on a map.

The matching of the addresses of the outcome data and the Tiger files is the critical component of the Project. Nonetheless, several obstacles must be overcome for success in the matching process. These obstacles include resolution of several problems which exist with the data sets. The Tiger files include incomplete street names, address ranges, etc. due to new construction, misinformation, etc. The problem is of particular concern in rural areas. Likewise, information from environmental and health data sets also contains data which is missing and/or incomplete. These problems are rectified with intensive field work, and the corrections and modifications can then be augmented to the permanent data set. Another problem involves the creation of the different data sets which were not established for the purpose of merger with other files. Discrepancies in data coding, file types and systems may exist, but can be corrected with computer programs designed to standardize different data sets. In addition, rural routes and post office box numbers are

obvious problems to the system. Field workers will geo-code all addresses and update the data files. Likewise, apartment complexes will be assigned street addresses.

Clearly, such a system provides a valuable resource for the investigation of potential health hazards in a population. However, extreme care must be incorporated in the system to ensure that confidentiality of the individuals is protected. It is important to note that this project involves the establishment of the System. The data is maintained and protected by the agencies responsible for being the custodian of the information. Use of the data in an assessment will be determined by this agency. Particular concern is given to analyses which may characterize a population or area.

III. SIGNIFICANCE

Development of a geographic analysis system will significantly enhance risk assessment by increasing the speed of the process and cost-effectiveness by using existing data sets. Furthermore, such a system would allow the initial process of an assessment without alarming the community unnecessarily. A major attribute of the system is the capability of redefining geographic areas for specific studies.

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