

# **CRP 514**

# **GIS APPLICATIONS IN**

# **HEALTH CARE SECTOR**

Case Studies Review

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# OUTLINES

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- ✘ Introduction
- ✘ Case Study 1 (In India)
- ✘ Case Study 2 (S. A. Jeddah)
- ✘ Conclusion

# INTRODUCTION

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- ✘ The tremendous potential of GIS to benefit the health care industry is started to be realized.
  
- ✘ Both, public and private sectors , are developing innovative ways to utilize the data integration and spatial visualization power of GIS.
  
- ✘ GIS plays a critical role in determining
  - + where and when to intervene,
  - + improving the quality of care,
  - + Increasing accessibility of service,
  - + finding more cost-effective delivery modes,
  - + Preserving patient confidentiality while satisfying the needs of the research community for data accessibility.



# INTRODUCTION

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## Using GIS for Public Health

- ✘ In 1854, an English physician, John Snow, provided the classic example of how mapping can be used in epidemiological research.
  
- ✘ Public health uses of GIS include:
  - + tracking child immunizations,
  
  - + conducting health policy research,
  
  - + Establishing service areas and districts.

# INTRODUCTION

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- ✘ Using GIS,
  - + Clinical and administrative information can be presented in a visual and geographic manner that is readily understood.
  - + data can be easily accessed using an Intranet or the Internet
  
- ✘ Balancing individual privacy with data accessibility is the challenge for public health agencies.
  
- ✘ A case in South Carolina Department of Health and Environmental Control's program for managing geo-referenced health records.
  - + They aggregated health record data so that the privacy of individual patients was preserved while allowing easy access to data.

# INTRODUCTION

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- ✘ The use of GIS in the private health sector has grown substantially in the last decade.
- ✘ They use applications in marketing and business management as well as those concerned with patient care.
- ✘ Health care providers can no longer continue with the "build it, and they will come" fallacy. Health care is a repeat business.
- ✘ They have begun to realize that to be competitive you need to be located conveniently to their customer base.



# INTRODUCTION

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- ✘ Using GIS for demographic analysis to estimate the demand for various types of services can benefit individual physicians.
- ✘ Physician specialties are more effectively marketed by locating offices near pools of potential patients.
- ✘ Matching physician locations to where employees live or work assures that primary care physicians are available throughout the network.
- ✘ Employers favor providers with networks that minimize the distance employees must travel to obtain care.

# **CASE STUDY 1:**

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## **A GIS BASED ANALYSIS OF HEALTH CARE SERVICES IN THE CITY OF PUNE**



# CASE STUDY 1

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- ✘ In spite of the various healthcare programs, still challenges appear in
  - + lack of management of facilities,
  - + optimum route to the hospital,
  - + slum area development and lack of knowledge about technologies.
  
- ✘ Health analysis and studies can be grouped into three main areas, which are
  - + a. Different diseases
  - + b. Distribution of hospital in different areas
  - + c. Health care facility and utilization

# CASE STUDY 1

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- ✘ This study concentrated on the two points of
  - + distribution and availability,
  - + and utilization of health care facility .
  
- ✘ Health care facility and utilization include:
  - + the optimal location of hospitals and clinics,
  - + the relationship between existing locations and health care needs
  - + and assessment of hospitals and the assessment of facilities.
  
- ✘ This study is focused on the City of PUNE and the distribution of hospitals in the region.
  
- ✘ This results in recommendations of possible areas for the setting up of new hospitals and clinics.

# CASE STUDY 1

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## ✘ OBJECTIVES:

- + To analyze the services existing in the city of Pune.
- + To study the service area covered by each health center.

## ✘ MATERIALS USED:

- + Survey of India map,
- + road map ,
- + population data

## ✘ SOFTWARE USED:

- + ARC GIS



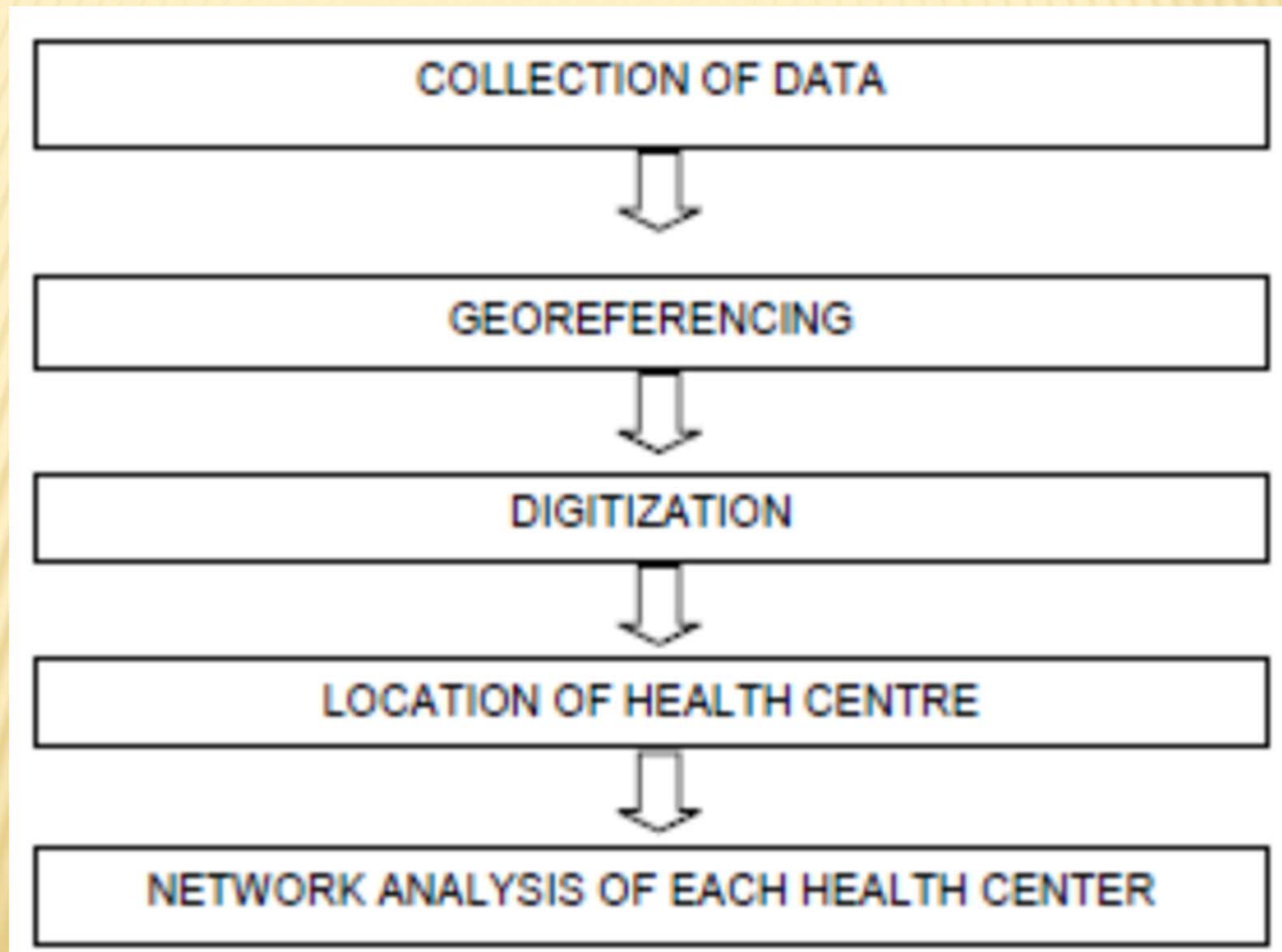
# CASE STUDY 1

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- ✘ Pune western India, It is the seventh largest city in India.
- ✘ It has a population of 5 million (2008) and covers an area of 450 km<sup>2</sup>.
- ✘ The health care facility which the focus of the study is in a good state but has not been updated in terms of its capacity for serving the population .
- ✘ Network analysis using Arc GIS software has been done and subsequently deprived areas have been identified .

# CASE STUDY 1

+ METHODOLOGY:



# CASE STUDY 1

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- ✘ The road map and the district map was geo-referenced using the survey of India Toposheet.
- ✘ The maps digitized using ArcGIS.
- ✘ Then a point feature layer was created of the hospitals.
- ✘ Then, a network analysis was done which determines the extent of service area of each.



# CASE STUDY 1

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## FACTORS CONSIDERED FOR THE ANALYSIS

- + Population
- + Area
- + Travel Time

## RESULT OF THE NETWORK ANALYSIS

- ✘ It was found although the central part of Pune was well served with the hospital, the western side of Pune are lacking in hospital services.
- ✘ The services of hospitals need to be more dispersed rather than concentrated in a particular area.

# CASE STUDY 1: CONCLUSION

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- ✘ With the help of GIS, although the hospitals in Pune City were sustainable, However needed an appropriate update in terms of their numbers.
  
- ✘ Also found that being a cosmopolitan city, although the roads are good there were problems due to congestion in a couple of areas .
  
- ✘ Further analysis should be taken into consideration factors like:
  - + population,
  - + thorough road network analysis,
  - + urban dilate and disease prevalence

## **CASE STUDY 2:**

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# **CREATING A GIS APPLICATION FOR HEALTH SERVICES AT JEDDAH CITY**



# CASE STUDY 2:

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- ✘ This study explores the possibilities of using GIS for private hospitals at Jeddah city, Saudi Arabia.
  
- ✘ A GIS application is created to cover three main health planning issues which are:
  - + distribution of health demand,
  - + classification of hospital patients
  - + the definition of hospital service area.
  
- ✘ Each one of these issues is covered using several GIS functions including network analysis and overlay analysis.
  - + The network analysis is used to produce drive-time hospital service area
  - + Overlay analysis is applied to calculate the size of hospital served demand.

## CASE STUDY 2:

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- ✘ All the produced models can be applied on any private or public hospital in Jeddah city.
- ✘ They can be used to build a spatial decision support system for hospitals in Jeddah city.

# CASE STUDY 2:

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## STUDY AREA

- ✘ Jeddah city has a population of over 2.9 million people.
  
- ✘ There are two main types of health facilities at this city. They are called public and private health facilities.
  - + There are 72 health centers and seven hospitals at Jeddah.
  
  - + The private health organizations provide 29 hospitals with a total capacity of 2,836 beds and also provide 151 clinics at different parts of the city.
  
- ✘ Both are faced with different planning issues that can be handled with GIS techniques.



# CASE STUDY 2:

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- ✘ The study has selected one major private hospital and applies GIS on it.
- ✘ A number of factors were considered include:
  - + accessibility to health demand data
  - + and the types of health services that are available at this hospital.
  - + In addition, all the planning issues that are dealt with at this hospital are relevant to the remaining hospitals of Jeddah city.
- ✘ This hospital has a capacity of 300 beds and 120 doctors working at different
- ✘ It is located at the north of the city but expected to serve most parts of city districts!!

# CASE STUDY 2:

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- ✘ This study has selected three major planning issues and uses GIS for analyzing these issues.
  
- ✘ The first issue is defining health demand location.
  - + GIS has different tools that can be used for defining any location on the map.
  - + ArcGIS software is used to define all hospital demands location.
  - + These data are collected on city districts level. Therefore, GIS coverage is digitized at the Arcmap application.
  - + The following step was to enter the collected attributes about hospital demand. These include:
    - ✘ number of patients,
    - ✘ age–sex
    - ✘ and hospital utilization types (emergency clinics patients, specialized and general clinics patients and admitted patients).

# CASE STUDY 2:

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- ✘ These data are linked to the demand coverage and used for the second issue of this study which is the **classification of health demand**.
- ✘ The third main issue is defining hospital service area.
  - + This issue is covered using network analysis and overlay analysis.
- ✘ These elements are used together to perform the required GIS functions.



## CASE STUDY 2: RESULTS AND DISCUSSION

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- ✘ This paper discusses a GIS application for hospital facility planning in Jeddah city.
- ✘ The application covers three main hospital issues that are location of health demand, types of patients and the extent of hospital service area.
- ✘ Each one of these issues has a direct spatial dimension. Therefore, the use of GIS for analyzing and manipulating them was of greater value and benefit.

## CASE STUDY 2: RESULTS AND DISCUSSION

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- ✘ For example, GIS is used to define all hospital demand location and produces an output showing city districts that are producing remarkable demand to the selected hospital.
- ✘ This output can be used by health planners to define the real catchment of health facilities.
- ✘ Classification of health demand is another important issue covered by this study.
- ✘ Patients are classified based on their usages for the selected hospital and the results of this classification show city districts such as Alzahra that have high hospitalization rates.

# CASE STUDY 2: RESULTS AND DISCUSSION

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- ✘ The third main issue that was covered by the presented study is related to defining hospital service area.
- ✘ GIS is used to produce a 15-min drive-time service area for the selected hospital.
- ✘ This output is used further to define the amount of patients living inside hospital service area and to test the market share of the selected hospital.



# CONCLUSION

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## Tomorrow's Health Care

- ✘ GIS has helped the health care industry manage resources and personnel in of the same ways it has helped other consumer service enterprises.
- ✘ Use of GIS for business function—marketing, sales, and facility and materials management will continue to grow.

# CONCLUSION

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- ✘ However, in the increasingly information-intensive environment of tomorrow's health care, the role of GIS will have greater importance due to
  - + its abilities to integrate a wide range of data sources, from legacy systems to image data,
  - + and to make complex data more quickly and easily understood.

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**THANKS**