



## Geographic Information System (GIS): A Tool to Manage Vector-borne Diseases



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Recent advances in the understanding and control of vector-borne diseases include the development of new and more effective insecticides, as well as the use of genetic engineering to create mosquitoes that are resistant to the pathogens that cause diseases such as malaria. Additionally, there have been significant efforts to develop and distribute new vaccines and drugs to treat and prevent vector-borne diseases. Another important development is the use of remote sensing and Geographic Information System (GIS) technology to better track and predict the spread of vector-borne diseases.

Geographic Information System (GIS) technology is increasingly being used to track and predict the spread of vector-borne diseases. GIS can be used to map the distribution of vectors, such as mosquitoes and ticks, as well as the distribution of the pathogens they transmit. This information can then identify high-risk areas for transmission and target control measures, such as pesticide application or distribution of bed nets. GIS can also be used to track changes in land use and climate, which can affect the distribution of vectors and the incidence of disease (1). Additionally, GIS can analyze surveillance data to identify outbreaks and monitor the effectiveness of control measures. This technology can be used in combination with Remote Sensing to provide more detailed information and accurate predictions.

Geographic Information System (GIS) technology can be used to enhance surveillance of vector-borne diseases by providing a spatial and temporal perspective on disease occurrence. GIS can be used to map the distribution of cases over time and space, and to identify clusters or hotspots of disease (1). This information can identify areas of high risk for transmission and target control measures, such as pesticide application or distribution of bed nets. GIS can also be used to analyze surveillance data from multiple sources, such as hospitals, clinics, and laboratories, to identify outbreaks and monitor the effectiveness of control measures. Furthermore, GIS can be used to integrate environmental data, such as land use, vegetation and weather patterns, that can affect the distribution of vectors and the incidence of disease. This can provide valuable information to understand the drivers of transmission and in developing more effective control strategies.

There are several examples of the use of Geographic Information System (GIS) in the surveillance and control of vector-borne diseases in

Pakistan. One example is the use of GIS to map the distribution of malaria in Pakistan. By mapping the distribution of cases, researchers were able to identify areas of high risk for transmission and target control measures, such as the distribution of bed nets and indoor residual spraying. A study published in the International Journal of Environmental Health and Public Health in 2018, used GIS to map the spatiotemporal distribution of malaria cases in Pakistan, and identified hotspots of malaria transmission (2). Another example is the use of GIS to map the distribution of dengue fever in Pakistan. A study published in the Journal of Space Technology in 2015, used GIS to map the distribution of dengue cases in Lahore city and identified high-risk areas for transmission. By mapping the distribution of cases and the breeding sites of the mosquito vector, researchers were able to identify areas of high risk for transmission and target control measures, such as the removal of mosquito breeding sites and the distribution of larvicide (3). In addition, GIS has been used to track the spread of Japanese Encephalitis in Pakistan. A study published in the Parasites and Vectors in 2017, used GIS to map the distribution of cases and identify risk factors such as land use, vegetation and weather patterns and identify priority areas for intervention (4).

Besides these, there are several other reasons why GIS should be included as a tool in vector-borne disease control, as adopted by Punjab:

**Integration of multiple data sources:** GIS can integrate data from multiple sources, such as hospitals, clinics, and laboratories, which can help to identify outbreaks and monitor the effectiveness of control measures.

**Cost-effective:** GIS can be an efficient tool for data collection and analysis, which can help reduce the costs associated with disease control and surveillance.

**Better decision-making:** GIS can help public health officials to make informed decisions about where to allocate resources and target control measures based on the data it provides

Overall, GIS provides valuable information that can help to enhance surveillance and control of vector-borne diseases by providing a spatial and temporal perspective on disease occurrence, identifying high-risk areas, and targeting control measures effectively. Based on all these advantages, it can be suggested that all provinces should incorporate GIS as a tool in their vector-borne disease control programs and expand its scope where it is already being used.

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