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Dengue Disease in Pakistan: Graph Visualization Based On Different Groups

Abdul Ghaffar Anjum* and Muhammad Tanvir Afzal

Department of Computer Science, Capital University of Science and Technology Islamabad, Pakistan

Abstract

Dengue fever is one of the major causes of hospitalization and death in several areas of Pakistan. There is a serious need to investigate the causes and factor through which Dengue fever happens. Lot of precautions and treatments are facilitated but every year thousands of people are affected by this disease. In this research Pakistan dengue patient information is grouped on basis of their location, season, gender and disease type in order to apply preventive and control strategies against this disease.

Introduction

Dengue [1] is mosquito borne disease caused by four closely related viruses (Den1 to Den4). These viruses are called serotypes; each has separate relation with antibodies in human blood serum. However these four viruses are similar in some aspects, as they share 65% of their genomes, but they have some genetic variation. Beside these variations they result in same disease. In 1970's [2] Den1, Den2 were found in Central America/Africa and in south Asia all four viruses (Den1-4) were found. Geographical circulation of all these serotypes had extended to almost all region of the world by 2004. Millions of dengue cases occurred worldwide every year, about 24.7% resulting in illness. Symptoms include high fever, headache, pain in eyes and muscle, vomiting, skin rash, mild bleeding.

Dengue [3] is a fast spreading disease; nine countries reported the dengue epidemics in 1970, since than dengue cases has been increased rapidly, till 2015 it has spread in more than 100 countries. In Pakistan Dengue first case was reported in 1994. From (2006 to 2011), Dengue suspected cases were 275872, out of which 34792(12.6%) were confirmed, 348 (1.01%) leads to death. Serotype-dv2 was the cause of first dengue attack in Pakistan, therefore DF and DHF cases rapidly increase and DHF is going to be one of the major causes of hospitalization and deaths in Pakistan.

Related Work

Cholera disease

In [4] Sep 1854, lots of people were affected due to cholera disease in square area of London. Lot of people died due to this disease. The first spot map of cholera deaths was designed by Dr. John Snow 1854, earlier 26 Sep 1854 Edmund Cooper draw a spot map for Cholera disease.

He map the deaths occurred due to cholera disease and found that addresses near sewer holes did not contain higher numbers of deaths. Since that cholera was assumed that it is airborne disease, however Snow himself had log postulated a waterborne link.

Snow's map was not used as an analytical tool, but rather as an illustration after the event, to illustrate his finding that cholera was a waterborne disease. Workers in the nearby brewery, which had its own water (and beer) supply.

Cancer disease

The following visualization techniques [5] which are all available in TerraSeer's Space-Information Intelligence System are commonly used to overcome the limitations of one-dimensional displays.

Temporal animation: Country level maps for cancer disease, incidence rates per 100,000 person-years were estimated by Poisson kriging [5] for nine different years.

Similar color scale was used for the maps that were captured as screen shots of an animation generated by TerraSeer's Space-Information Intelligence System and that included 25 slides (1981-2005). This time sequence highlights how the incidence rates peaked in the early 1990s when PSA became widely available, followed by a decline caused by the advanced diagnosis of cancer cases. Examples of choropleth and isopleths maps of health outcomes that have been contextualized through the addition of topographic details and geographically positioned names of major cities and highways.

Methodology

The study was conducted to visualize the dengue by grouping data on basis of Dengue Serotypes, fever types and patients location. To get control on Dengue serotypes, Dengue fevers, it is important group the data to find the region or regions which are more affected.

Data grouping

Data is grouped by different sequences e.g. by region, by gender, Prevalent Serotype, Condition. Different colors and shapes are used to distinguish the groups and symptoms. Pre-attentive attributes includes, color, size, shape. While attentive attributes includes, region, gender, diseases type, symptoms, seasons etc.

Data sources

I have collected data from different resources, resources include, WHO (world health organization), Journal of Pakistan Medical Association, Newspapers, friends/families. Data includes Patient gender, region, area, condition of patient (condition include either Expired, under treatment and recovered), Prevalent serotypes (Den1,

Den2, Den3, Den4), and symptoms which include DF, DHF and DSS.

WHO (World Health Organization)

WHO (world health organization) has offices in Pakistan to support and strength health services. I have taken data from WHO website. Figure 1 shows that how I collect the data from WHO website. The first block is the main page of the website. The next blocks are the pages that show the detail of dengue diseases and total number of dengue patients in Pakistan.

Journal of Pakistan medical association

From Journal of Pakistan medical association, I took overall dengue cases that were admitted to hospitals from (2000-2004).The information included Dengue serotypes, total number of patients, recovered, expired, season and fever type. The purpose was to find which serotype or fever is most found and cause of Dengue fever and death.

Friends/families

In order to facilitate precautions it is important to know whether which area patients are more affected, so area wise mapping can be helpful in this aspect. I have collected different patient's data with their complete location. To collect this data I meet with friends and family members which were affected from this disease.

Challenges

Thousands of patients admitted due to dengue every year, it's hard to group on the base of location manually from this huge data, for this purpose we need visualize mapping to identify the things easily. E.g. which area people are more affected, did precautions were facilitate or not, if yes than what were other reasons. What is pattern of symptoms?

Tools and technique

Tree map visualization tool is used to map the data. Data is shown in different layouts. Data is group by on the basis of different columns. Color is used for patient condition (Figure 2).

Results

Dengue fever (DF), Dengue Haemorhagic fever (DHF), Dengue shock syndrome (DSS) were found in these patients.

Layout: strip

In Figure 3 data is grouped by region, seasons, gender, Prevalent Serotype /Genotype and condition. There sizes are equal and they are colored by condition. By grouping data seasons wise, it is found that the most number cases were found in autumn. Serotype /Genotype grouping shows that Den2 and Den3 are found more than other Serotype /Genotype. Serotype /Genotype grouping also shows that Combination of Den2, Den3 is very harmful than other, most number of deaths are happened when patients were suffered from Den2 and Den3.Pattern 1 and 0 show symptoms found in patients. Pattern 1, 1, 1 shows that all three DF, DHF, DSS were found in patient. Pattern 1, 1, 0 shows that only DF and DHF were exists in patients. While Pattern
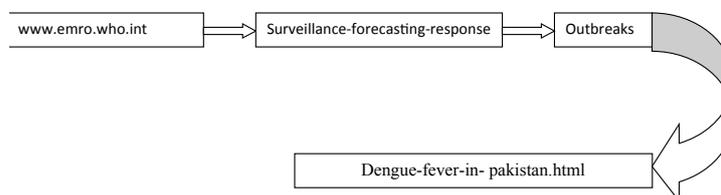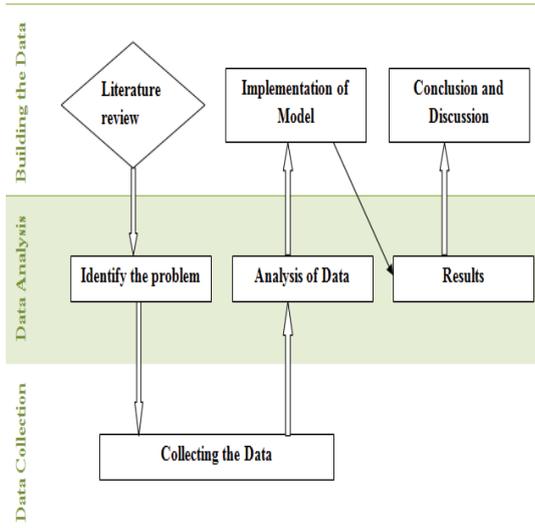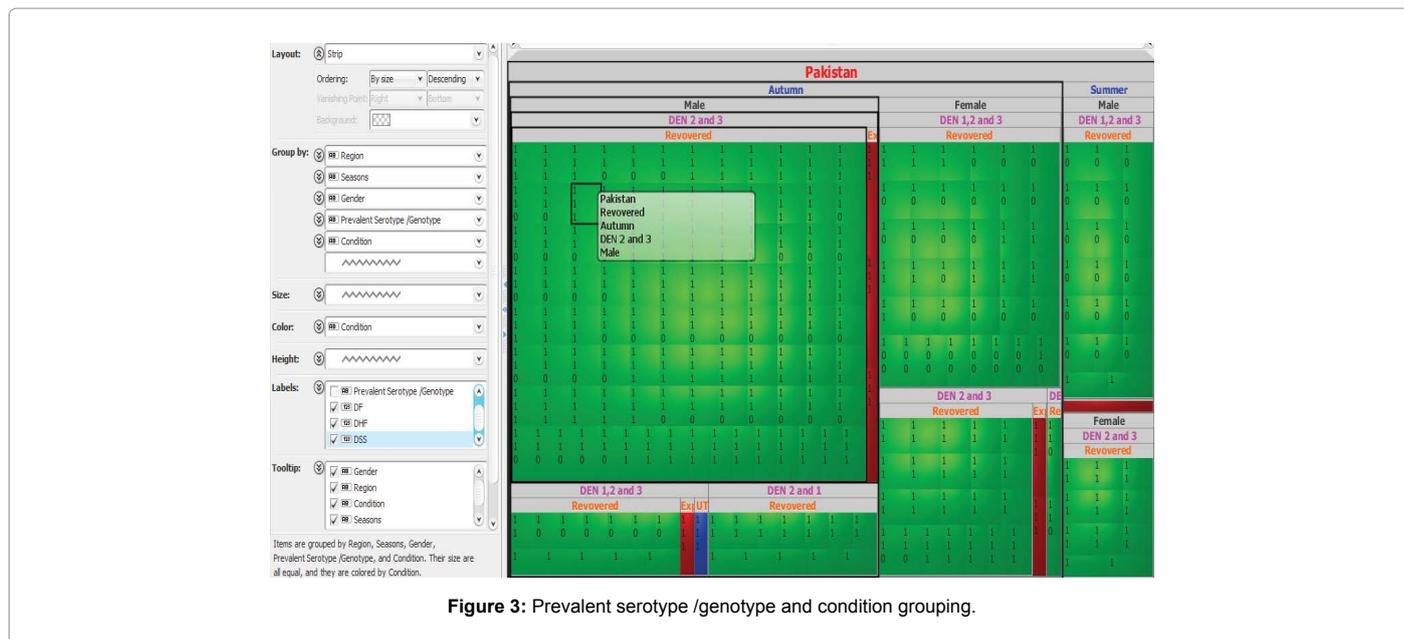

Figure 1: Flow of WHO data source.

Figure 2: Overview diagram of methodology.

Figure 3: Prevalent serotype /genotype and condition grouping.

1, 0, 0 shows that only DF and DHF were exists in patients. It is found those patients, who were suffered by only DF, and both DF+DHF were recovered or released under observation, but some deaths were occurred of those patients who were suffered from all three symptoms.

Layout: circular

In Figure 4 data is grouped by region, city and area within the city. They are colored by condition. Red color is for expired patient, blue one are under treatment and green are recovered successfully. By this grouping of data, the most affected areas insides the cities of Pakistan can be discovered. By this pattern we can find the reasons, can check whether or not precautions are facilitated. If precautions are not facilitated than immediately facilitate the proper precautions, if facilitated than find other reasons, for this viral disease.
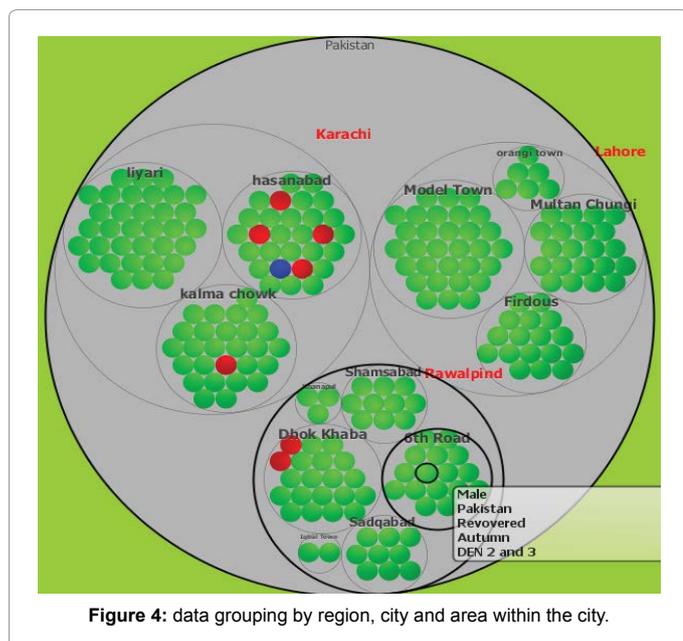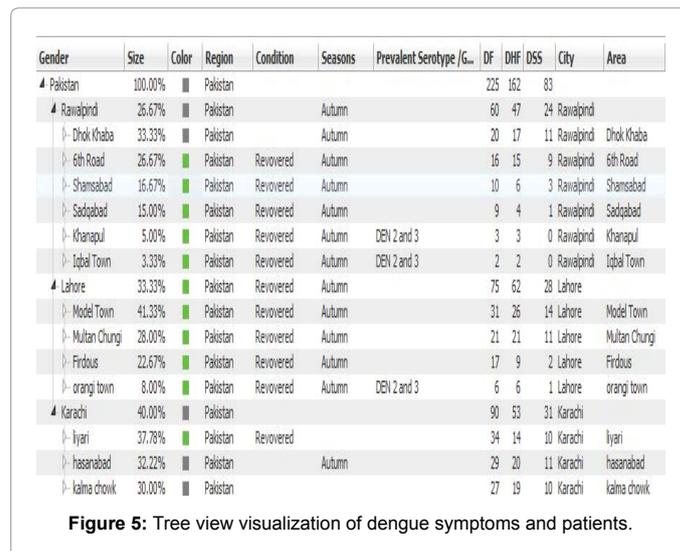
Layout: Tree map

In Figure 5 data is grouped by Region, city, area within the city, total percentage of patient area wise, total percentage of patient disease wise. This shows which serotype and symptoms are more found in patients.

Discussion and Conclusion

Dengue fever has increased tremendously in Pakistan since past 3 decades. During this time different cases and aspects are reported from all over the country. Lot of precautions and treatments are facilitated but every year thousands of people are affected by these diseases out of which some patients leads to death. According to record taken between, 2006-2011 the most cases were found in autumn and winter seasons, very few but in other season's dengue cases also found. Den 1, 2, 3 are serotypes that were found in dengue patients. It is found that those patients who died had all three types of fever (DF, DHF and DSS). From pattern it was found that that patient who had not DHF they also had not DSS and they recovered very quickly. DHF and DSS were most

Figure 4: data grouping by region, city and area within the city.

Figure 5: Tree view visualization of dengue symptoms and patients.

dangerous. Other symptoms include fever, headache, abdominal pain etc. To get control on this disease and to facilitate it, it is important to know, the season in which this virus affect most, the area, and dengue type which is most harmful for human.

References

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