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RESEARCH ARTICLES

Spatial and Temporal Epidemiology of Vector-Borne Diseases In Punjab Province of Pakistan - 2018

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Abstract

Background: Vector-borne diseases are a major public health problem worldwide. Dengue Fever (DF), Dengue Hemorrhagic Fever (DHF), and Malaria are endemic in Pakistan. The current study aimed to find out the temporal and spatial distribution of vector-borne diseases in the Punjab province of Pakistan.

Materials & Methods: Secondary data of vector-borne disease that were reported in Punjab were retrieved from all data repositories from 1 July, 2016 to 30 June, 2017. Our objective was to determine the temporal and spatial distribution of diseases and personal characteristics of the confirmed cases in Punjab. Descriptive analyses were run using Microsoft Excel and SPSS version 24.0.

Results: Malaria and dengue fever were the only vector-borne disease identified in the data repository. A total of 2,640 cases of malaria were reported from 1 July, 2016 to 30 June, 2017 and with 1,415 (53%) male cases (male: female, 1:1). A total of 2,520 cases of dengue fever were reported with 1,829 (72%) male cases (male: female, 3:1). The mean age was 17 ±9years for malaria and 32 ±12 years for dengue fever. For malaria, the most affected age group was 5-9 years (n=709, 27%), while for dengue fever it was 20-24 years. The highest number of malaria cases (n=821) were reported from Muzaffargarh (southern Punjab) and the highest number of dengue cases (n=1139) were reported from Rawalpindi (northern Punjab). Temporal characteristics of dengue indicated the highest frequency from September to November, while malaria showed high incidence patterns from August to October.

Conclusion: Our results direct health policy makers towards a data driven policy where they need to target two different poles of Punjab for the two mosquito borne diseases. Social, temporal and spatial distribution is suggestive of besieged interventions for both diseases, yet integrated with their respective vector control measures.

Key words: Dengue fever, Malaria, Spatial trends, Temporal trends, Vector-borne diseases

Introduction

Vector-borne diseases (VBD) are caused by a group of parasites and viruses which are a permanent threat leading to significant mortality and morbidity across the world (1). The common determinant factors for spread of vector-borne diseases include hot and humid environments, high population density areas, poor socioeconomic status, inappropriate housing types, and poor waste management and water supply systems (2). Malaria, Dengue Fever, and Chikungunya are important VBDs, with a major share to overall disease burden in Pakistan. In 2017, Pakistan experienced the highest number of VBD outbreaks, namely; malaria, dengue fever, and chikungunya. There were approximately 300,000 confirmed cases reported during the year. These preeminent infectious diseases have been threatening the health of six million people in Pakistan (3, 4).

Malaria is considered a life-threatening disease in developing countries. According to the World Health Organization (WHO), in 2011, the number of deaths attributed to malaria was 212 million and in 2015, it was reduced up to 429,000 (5). The vector, *Anopheles Gambiae,* is a complex mosquito species which is responsible for the transmission of maximum vector-

diseases and are found sensitive to climate change. If the temperature of the water increases, the larva matures early leading to more production and increased intensity of infection (7, 8).

Dengue incidents have increased dramatically in the whole world in recent decades and so in Pakistan. Recent estimates showed 390 million dengue infections per year, out of which 96 million are clinical cases (9). Dengue fever is primarily an urban disease, but with very poor water bodies and solid waste management in almost all weak communities, it can spread to any community (10). In Pakistan, the first major outbreak of dengue fever was reported in 1994, and later in November 2005 a major outbreak was reported from Karachi. In 2010 another epidemic of dengue fever resulted in 16,580 cases and 257 deaths in the district of Lahore and a total of 5,000 cases and 60 deaths in the rest of the country (11, 12). Despite large outbreaks in recent decades, little literature is available on its epidemiology and spatial-temporal trends in the thickly populated Punjab province of Pakistan.

The current study aimed to identify reported vector-borne diseases to explore the demographic epidemiology and spatial and temporal distribution of confirmed cases in the Punjab province.

Methodology

A retrospective record review was conducted at the provincial health office of Punjab where we retrieved data on laboratory confirmed vector-borne diseases. No human subjects were enrolled in this study, therefore, an informed written consent was exempted. However, approval from the Ethical Review Committee of the University of Lahore, Punjab was obtained and a departmental permission was attained from the office of directorate general of health services (DGHS) and center for disease control (CDC) Punjab conferring the confidentiality of the patients and the purpose of the research. The records of one year, i.e. 1 July 2016 to 30 June 2017, were obtained in terms of demographics, time and location of cases. All registered public health laboratories were approached. Reports of non-residents of Punjab and/or incomplete entries from the line list were excluded from analyses. The line lists were collected by researchers themselves and no external teams were hired, nor were any incentives offered to the laboratories. The data was double entered, validated and stored in Microsoft Excel and SPSS version 24.0. The qualitative variables were calculated as numbers and percentages, while quantitative variables were calculated as means and standard deviation.

Results

Malaria and Dengue Fever were the only reported vector-borne diseases in the study period. A total of 2,640 cases of malaria were reported during the study period, with 1,415 (53%) male (male: female, 1:1). The mean age of the patients was 17 ±9 years. It affected almost all the age groups of the community but the highest number was reported among 5-9 years age group (n=709, 27%) followed by 0-4 years (n=479, 18%) (Table 1).

A total 2,520 cases of dengue fever were reported in Punjab during the year with 1,829 (72%) males (male: female, 3:1). The mean age was 32±12 years. It affected the adult age group, where most of the reported cases belonged to 20-24 years age group (n=460, 18.3%) (Table 1).

The highest incidence of malaria was observed during the month of September, followed by August and October, while the lowest frequency was observed during March, followed by April, February and January. Dengue fever showed a peak in October and the lowest incidence of dengue fever was observed in March (Figure 1).

The highest frequency of malaria was found in Muzaffargarh, followed by Bhakkar and DG Khan in south Punjab, while central and north Punjab showed minimum incidences. The highest frequency of reported dengue fever cases was in Rawalpindi, followed by Lahore, showing an endemic situation in these thickly populated cities. South Punjab had no reported case.

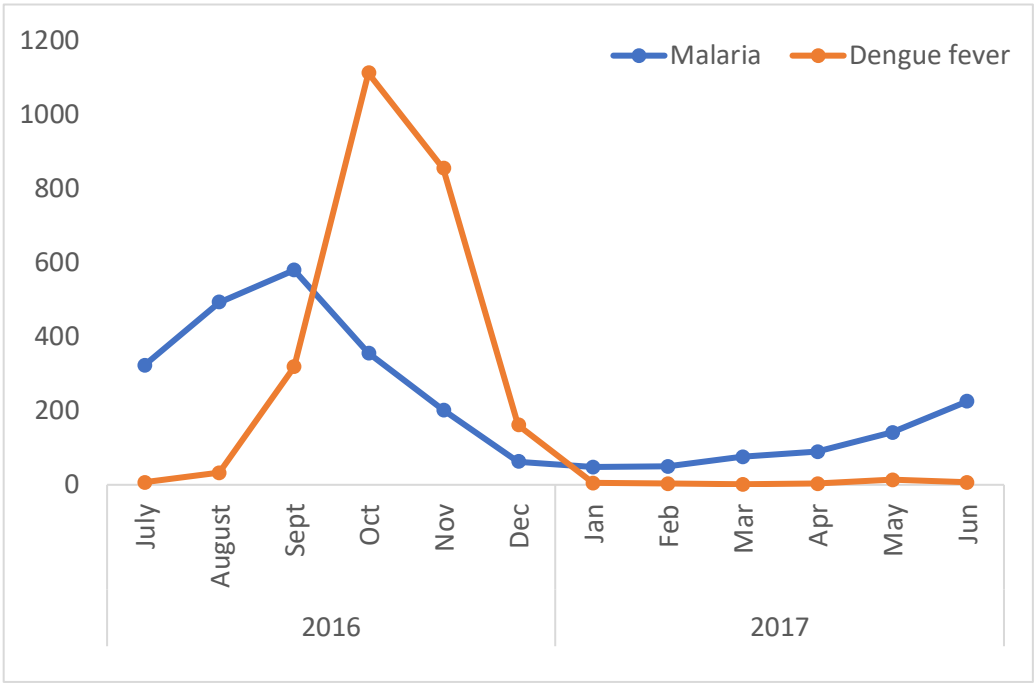
The case fatality rate of dengue fever was 63.4/10,000 cases, while no death from malaria was reported in the study period.

Table 1. Age distribution of Malaria and Dengue Fever cases in Punjab province-Pakistan (July 1, 2016-June 30, 2017**).**

Age Groups	Malaria (n=2,640)			Dengue Fever (n= 2,520)		
	N	%	AR*	N	%	AR
0-4 Years	479	18.2	0.7	10	0.4	3.2
5-9 Years	709	26.9	0.2	27	1.1	4.9
10-14 Years	381	14.5	0.7	94	3.7	3.0
15-19 Years	117	4.4	2.6	320	12.7	0.9
20-24 Years	158	6	4.3	460	18.3	1.5
25-29 Years	265	10.1	4.2	362	14.4	3.0
30-34 Years	135	5.1	4.0	296	11.7	2.0
35-39 Years	117	4.1	3.8	226	9.0	2.0
40-44 Years	91	3.5	3.2	182	5.7	2.0
45-49 Years	53	2	5.6	143	5.0	1.2
50-54 Years	39	1.5	3.0	165	6.5	1.3
55-59 Years	20	0.8	3.0	89	3.5	0.7
60-64 Years	33	1.3	1.7	71	2.8	1.3
65+	44	1,7	2.3	75	3.0	0.9
Overall attack rate			**2.3**			**2.4**

*AR=Attack rate/100,000 population

Figure 1. Temporal trend of Malaria and Dengue Fever cases in Punjab province, Pakistan (1 July, 2016 to 30 June, 2017)



Discussion

Lower age groups are the most affected by Malaria, while Dengue fever has shown a more obvious attack rate among the young working age group (20-29 years) representing the young outdoor working group. Similarly, males are more affected which goes against the concept of the indoor prevalence of the vector. In a male dominant society, men usually engage in outdoor activities. Our results confirm the findings of other researchers where mechanical/tire shops, graveyards and other outdoor water bodies determine the spread of diseases and hence the working age group of males seem more affected (13-15). Peak season has been observed as other researchers have mentioned it in their studies. Here comes the most talked about integrated disease surveillance concept that needs to be practiced. Therefore, an incredible need to expand the mindfulness about the blended contaminations is identified, whereas administration and clinicians need to work together toward ramifications of outdoor activities in peak seasons of the said disease. For the sake of these outcomes, an integrated vector management, disease surveillance, as well as contact tracing is vital, as suggested by many other researcher (11, 15, 16).

In a study by Yang et al., it was found that the ratio of temperature, rainfall, rice cultivation and rural labor was positively linked to malaria incidents (6).

Dengue fever is caused by *Aedes egyptii.* The vector has been found prevalent in northern Punjab, suggesting a reformed spread to relatively cold weathers in this geography since a high incidence is shown in cold moths of October. Previously, in Pakistan, dengue caused a severe outbreak in 2011 in Lahore, central Punjab. After 2011, many dengue cases are reported every year in rainy, summer and winter seasons too as described by some researchers (17, 18). It is worth mentioning that the weather record for the month of October 2016 showed a mean temperature of 27˚C, humidity 59%, and pressure 1,010 mbar. Hence, high humidity seems an indicator for dengue fever. Our results endorse the findings that Rawalpindi and Lahore are seen with the highest frequency of dengue fever patients, rendering their business activities and thick population with large numbers of in-house gardens, farmhouses, canals and waste drains which may serve to be an agent for Aedes growth (19-21). Here it is to point out that Malaria, a disease of tropical countries, has shown to still be a hot season trend where the highest temperature and humidity recorded was 38˚C and 100% respectively, and weather conditions were supportive of anopheles growth (22, 23).

Limitations

Our study has certain limitations; we collected data for one year and we recommend that three to five years worth of data should be collected and analyzed to clear the trends over years. Patients' demographics, risk factors and clinical characteristics were not available with the health department and laboratories' data repository. Therefore, an inference cannot be made about the diseases presentations and severity, which will hamper a data driven policy making and implementation.

Conclusion

Temporal characteristics of dengue and malaria are indicative of a need for more robust public health interventions in comparatively cold topographies, with a special focus on outdoor activities and young working male populations. There is an ominous need to map hotspots within large metropolitan cities like Rawalpindi for prevention at grass roots level where political leadership and integrated vector management approaches should remain the major key.

Conflict of Interest

Authors declare none.

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None.

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