SPATIOTEMPORAL CLUSTER ANALYSIS OF MALARIA INCIDENCE IN PAKISTAN, 2011-2016

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Aim: Despite remarkable progress, malaria remains a grave public health concern in Pakistan. Very few studies are available on spatiotemporal evaluation of malaria in Pakistan. This study aimed to detect the spatiotemporal pattern of malaria infection in Pakistan at district level, and to identify the clusters of high-risk disease areas in the country.

Methods: District level annual (2011-2016) case data for three types of malaria (*P.falciparum*, *P.vivax* and mixed *Plasmodium*) were obtained from Directorate of Malaria Control Program, Pakistan. Population data were downloaded from Pakistan Bureau of Statistics. Geographical information system (GIS) was used to display the spatiotemporal distribution of malaria (incidence rate, relative risk, primary & secondary clusters) at district level throughout Pakistan. Purely spatiotemporal clustering analysis was performed to identify high-risk areas of malaria infection in Pakistan.

Results: A total of 1,593,409 positive cases were included in this study. Maximum number of *P.vivax* cases (474,478) was reported in Khyber Pakhtunkhwa (KPK). Highest burden of *P.falciparum* (145,445) was in Balochistan while highest count of mixed *Plasmodium* cases was reported in Sindh (22,421) and Balochistan (22,229), respectively. Cluster analysis showed that primary clusters of *P.vivax* malaria included same districts in 2014, 15 and 16 (total 24 districts, 12 in FATA, 9 in KPK, 2 in Punjab and 1 in Balochistan); and those of *P.falciparum* malaria were unchanged in 2012 and 13 (total 18 districts, all in Balochistan). While most significant high-risk districts for mixed *Plasmodium* malaria were same in 2014 and 15 (total 7 districts, 6 in Balochistan and 1 in FATA).

Conclusion: This study exhibited the transmission cycles of malaria infection vary in different spatiotemporal settings in Pakistan. Efforts to control most prevalent *P.vivax* malaria need to be enhanced. Further research is needed to investigate the impact of risk factors on transmission of malaria in Pakistan.

Recent Publications

1. Cohen J M, Le Menach A, Pothin E, Eisele T P, Gething P W, Eckhoff P A, Moonen B, Schapira A and Smith D L (2017) Mapping multiple components of malaria risk for improved targeting of elimination interventions. Malaria Journal 16 (1):1–12.

2. Khattak A A, Venkatesan M, Nadeem M F, Satti H S, Yaqoob A, Strauss K, Khatoon L, Malik S A and Plowe C V (2013) Prevalence and distribution of human *Plasmodium* infection in Pakistan. Malaria Journal 12(1):297.

3. Karim A M, Hussain I, Malik S K, Lee J H, Cho I H, Kim Y B and Lee S H (2016) Epidemiology and clinical burden of malaria in the war-torn area, Orakzai agency in Pakistan. PLoS Negl Trop Dis 10(1):e0004399.

4. Faburay B (2015) The case for a "one health" approach to combating vector-borne diseases. Infection Ecology & Epidemiology 1:1–4.

5. Hundessa S H, Williams G, Li S, Guo J, Chen L, Zhang W and Guo Y (2016) Spatial and space time distribution of *Plasmodium vivax* and *Plasmodium falciparum* malaria in China, 2005–2014. Malaria Journal 15(1):595.

Biography

Muhammad Farooq Umer studied Dentistry and specialized in Public Health from Pakistan. Currently he is pursuing his PhD degree in Epidemiology at School of Public Health, Xi'an Jiaotong University, China. His expertise is in the field of epidemiology and management of public health Projects. He is currently exploring modern-day analytical techniques being used in public health research. His current study is a part of his PhD project.

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