SHORT REPORT

Spatial distribution of contraceptive usage by district in Pakistan: Percent change in 'couple years of protection' in 2015-16 compared to 2014-15

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Abstract

Pakistan's population will cross the 200 million-mark in 2017. 'Couple Years of Protection' (CYP) is a proxy indicator for various contraceptive methods used. The Pakistan 'Contraceptive Performance Report 2015-2016' (CPR) in Pakistan, provides comparison with the previous year i.e. 2014-2015 in terms of CYP percent change at the district level in the country. In this study, CPR percent change data were mapped and cluster analysis was conducted, using GIS programmes to visualize spatial distribution in the country by district. No statistical evidence of clustering at the global/country level was found. The percent change in CYP 2015-16, compared to 2014-15 at the district level ranged from -90.4% to 316.9% in the 113 districts for which data was available. Sixty-five districts reported negative CYP percent change, while 48 reported positive CYP change. With the exception of Balochistan province, all provinces and FATA had districts with percent change in CYP ranging from -90.4% to -50.0%.

Keywords: Contraception, Geographic Information Systems, Pakistan

Introduction

Pakistan is poised to cross the 200 million-population mark in 2017. Based on one estimate, as of May 20, 2017, its population was 196,258,895, with median age of 22.7 years.[1] The 2015 fertility rate, defined as total births per woman, was reported as3.5 by the World Bank.[2] For developing countries, there is a negative relationship between fertility level and economic development.[3,4]

The 'Contraceptive Performance Report 2015-2016' prepared by the Pakistan Bureau of Statistics, provides detailed profile of contraceptive performance in the country.[5] This report also provides comparison with the previous year i.e. 2014-2015 in terms of 'Couple Years of Protection' (CYP), at the district level in the country. The CYP is "the estimated protection provided by contraceptive methods during a one-year period, based upon the volume of all contraceptives sold or distributed free of charge to clients during that period".[6] As such, CYP is a proxy for contraceptive use, as distribution of contraceptives does not equate its actual usage.

Using geographic Information Systems (GIS) for mapping health indices like CYP helps to better visualize, and explore the relationship between space e.g. district and the health variable being studied. In this study, data provided in the 'Contraceptive Performance Report 2015-2016', collected from the country's Population Welfare Departments on CYP comparison of 2015-16 with the year 2014-2015 for CYP, in terms of percent change was mapped as well as cluster identification analysis was conducted, using GIS programmes to visualize spatial distribution in the country by district.

Methods and Results

The Pakistan Bureau of Statistics compiled and prepared the Contraceptive Performance Report (CPR) for the year 2015-2016 and released it in April 2017. CPR, now in its sixth iteration, helps estimate country's annual contraceptive requirements and distribution. Moreover, the report assesses contraceptive performance in the country by province, contraceptive methods used, and outlets of contraceptive products using the CYP indicator for public and private sectors. CPR 2015-2016 also provides comparisons with the CPR 2014-2015, by district in the country, in terms of CYP percent change for the Population Welfare Departments.

The CPR 2015-2016 report, including details on methodology and tabular data are available on the Pakistan Bureau of Statistics website.[5] The Population Welfare Departments (PWDs) provide services through their Family Welfare Centers, Reproductive Health Services Centers, Mobile Service Units, and Social Mobilizers in the country. The provincial PWDs, and PWDs of Federally Administered Tribal Areas (FATA), Gilgit Baltistan (GB), and the District Population Welfare Office of Islamabad Capital

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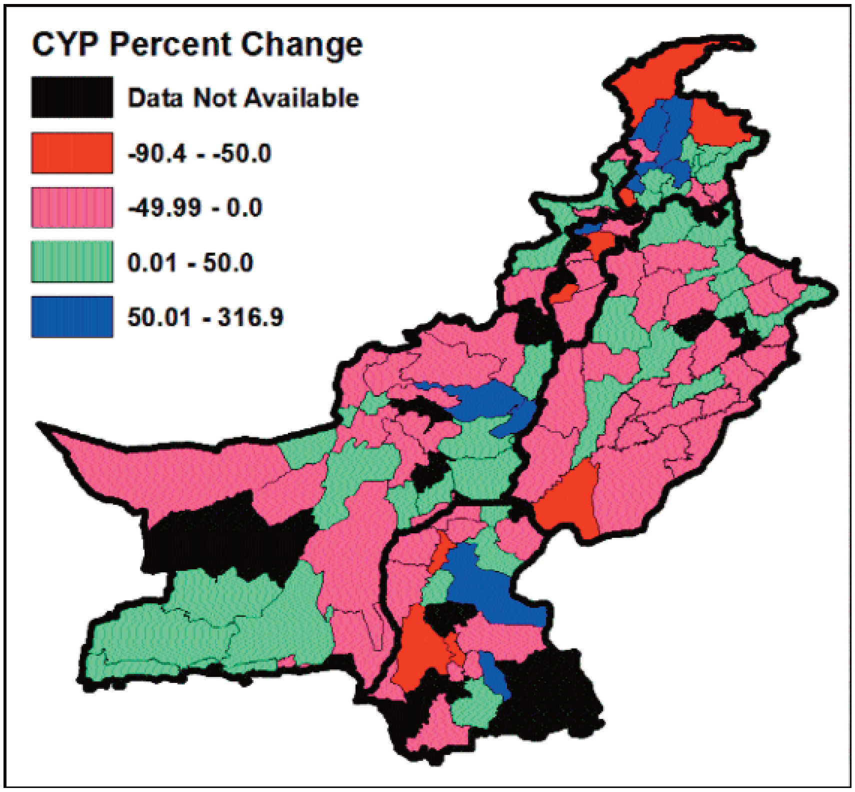


Figure-1: Map showing the 'Couple Years of Protection' (CYP) percent change in 2015-16 compared to 2014-15, by district in Pakistan.

Territory (ICT) provided information to the Pakistan Bureau of Statistics for compiling CPR 2015-2016 report. The tabular data from CPR 2015-2016 report, for percent change in CYP in 2015-16 compared to 2014-15, was entered in an Excel spreadsheet. For creating maps, the geographic (GIS) data/shapefiles for districts were downloaded from the Humanitarian Data Exchange website.[7]

The GIS shapefile included five districts of Balochistan province (Harnai, Lehri, Sheerani, Sobhatpur, Washuk), two districts of Punjab province (Chiniot, Nankana Sahib), and five districts of Sindh province (Tando Muhammad Khan, Tharparkar, Thatta, UmerKot, Benazirabad) for which no CYP percent changes were reported in the CPR 2015-2016 report. While the Nawabshah district of Sindh province was not present in the GIS shapefile. For FATA region, CYP percent changes were reported and GIS shapefile included areas of Bajaur, Khyber, Kurrum, Mohmand, Orakzai agencies, and South and North Waziristan. For Karachi, the CPR 2015-2016 report included CYP percent changes for Karachi Central (-62.2), Karachi East (-83.7), Karachi South (14.6), Karachi West (-10.3), Korangi Town-Karachi (-60.1), and Malir Town-Karachi (4.2). Since GIS shapefile only had Karachi i.e. without further any administrative subdivisions, the average of these six areas i.e. -32.9% was used as percent change in CYP for Karachi. For Gilgit-Baltistan, and Azad Jammu and Kashmir (AJK) regions, GIS shapefiles were not available in the GIS shapefiles.

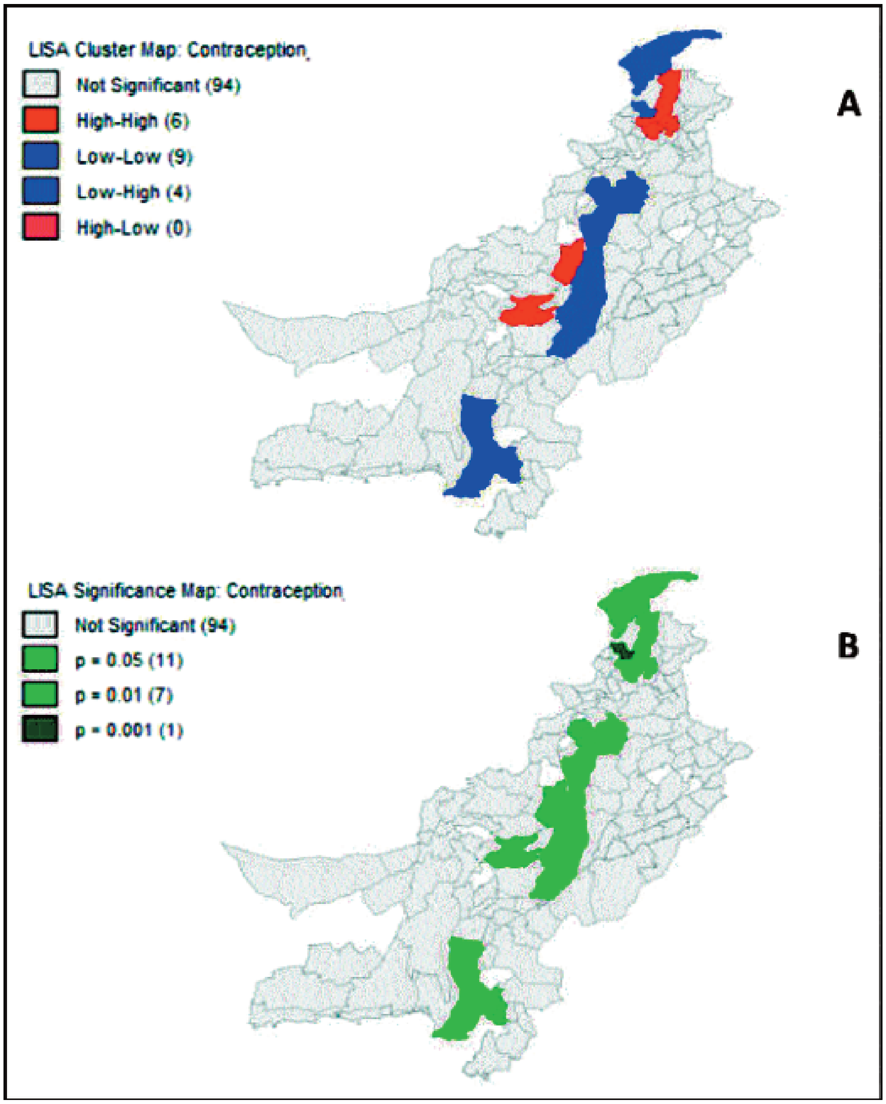
The Excel spreadsheet with CPR 2015-2016 data was joined with the GIS shapefiles. Using ArcGIS 10.5, and GeoDa 1.8, GIS software, statistical analysis and choropleth maps — using colour differences to denote numerical quantity of areas — were created to visualize district-wise pattern and distribution of percent change in CYP 2015-16as compared to 2014-15.

Cumulatively, for 113 districts data were available for both i.e. CYP and GIS shapefiles.

To check for spatial clustering in the distribution of percent change in CYP 2015-16, compared to 2014-15 at the country level, Global Moran's I statistic was used. The number of permutation test was set at 9999 with the significance level at <0.05; using the first order queen contiguity weights. The result showed a positive spatial autocorrelation in percent change in the CYP 2015-16, compared to 2014-15, however it was not statistically significant (Moran's I = 0.0813573, p-value = of 0.074). Finally, local indicators of spatial autocorrelation and local Moran's I were used to identify location of clusters.

The percent change in CYP 2015-16, compared to 2014-15 at the district level ranged from -90.4 to 316.9 percent in the 113 districts for which data were available. Sixty-five districts reported negative CYP percent change, while 48 reported positive CYP change. Figure-1 shows CYP percent change in 2015-16 compared to 2014-15, by district in Pakistan. While figure 2 shows output of Local Moran's I test for the 'Couple Years of Protection' percent change in 2015-16 compared to 2014-15, for 113 districts of Pakistan for which data were available.

Figure-1 shows that with the exception of Balochistan province, all provinces and FATA had districts with percent change in CYP ranging from -90.4% to -50.0%. With all provinces showing districts in the-49.9% to 0%



LISA = Local Indicators of Spatial Autocorrelation
A: LISA Cluster Map
B: LISA Significance Map.

Figure-2: Map showing output of Local Moran's I test for the 'Couple Years of Protection' percent change in 2015-16 compared to 2014-15, for 113 districts of Pakistan for which data were available.

change. Figure 2-Aprovides results of local Moran's I which identified 6 districts as high-high, 9 districts as low-low, 4 districts as low-high, and classified 94 districts statistically non-significant. While figure 2-B provides the statistical significance of districts in terms of local indicators of spatial autocorrelation; with cumulatively 19 statistically significant districts from the rest, at the level of <0.05.

Discussion

In this study, GIS was used to visualize percent change in CYP in 2015-2016 compared to 2014-2015, to visualize and better understand its spatial distribution at the district level in Pakistan. Cluster analysis was also carried out and revealed no evidence of clustering at the global i.e. country level. While local indicators of spatial autocorrelation identified 19 statistically significant districts.

The CYP percent change for the country as a whole for the year 2015-16 was -10.4%, based on data collected from the Population Welfare Departments (PWDs) in the country.[5] This cumulative figure for the country masks the district-wise patterns, and does not reflect the contributions of other agencies — both public and private - that work in the area of family planning services. As, in Pakistan the family planning and contraceptive services are provided by Departments of Health, and the national and international Non-Governmental Organizations, in addition to PWDs.[5] CPR for the year 2015-2016 provides district-wise percent CYP change comparisons for PWDs only. Although PWDs are important providers of family planning services in Pakistan, there are other factors involved as well. Hence, the clustering analysis and spatial distribution of percent change in CYP presented in this study, essentially reflects the district-wise performance of PWDs in the country. Other limitation include unavailability of updated GIS file for Pakistan by district.

Studies on the use of GIS for health research in Pakistan are sparse. There is a need to harness the visualization and analytical power of GIS for better health decision making in the country. However, availability of data — both GIS and for health indices by administrative sub-divisions e.g. districts and Union Councils - in the country needs to be collected and provided in public domain, for promoting use of GIS for health.

Conclusion

Comparison of CYP percent change in 2015-2016 to 2014-

2015 was depicted using GIS to visualize and better understand spatial distribution of health indices. Local indicators of spatial autocorrelation identified 19 statistically significant districts, while no evidence of clustering was found at the global/country level. There is a need to promote use of GIS for health analysis in the country.

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References

1. Pakistan Population. [Online][Cited 2017 May 12]. Available from: URL:http://www.worldometers.info/world-population/pakistan-population/.
2. Fertility rate, total (births per woman). [Online] [Cited 2017 June 21]. Available from URL: http://data.worldbank.org/indicator/SP.DYN.TFRT.IN.
3. The Relationship between Fertility Rate and Economic Growth in Developing Countries. [Online] [Cited 2016 May 25]. Available from URL: http://lup.lub.lu.se/luur/download?func=downloadFile&recordOId=8727479&fileOId=8768892.
4. Income and fertility. [Online][Cited 2016Aug 14]. Available from: URL: https://en.wikipedia.org/wiki/Income_and_fertility.
5. Contraceptive Performance Report 2015-2016. [Online][Cited 2016 Feb10]. Available from URL: http://www.pbs.gov.pk/sites/default/files//social_statistics/contraceptive_performance_reports/Final%20Report%20April%2C%202017%28Final%29.pdf.
6. Couple Years of Protection (CYP). [Online] [Cited 2017 March 28]. Available from URL: https://www.usaid.gov/what-we-do/global-health/family-planning/couple-years-protection-cyp.
7. Humanitarian Data Exchange. [Online] [Cited 2016 July 12]. Available from URL: https://data.humdata.org/dataset/44c2b2a4-b1cb-49d3-8299-0e544f1cab52.