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Spatial analysis of population density, birth rate and death rate in Sri Lanka (2015 and 2016)

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Lack of open space, shortage of clean water, and pollution are major concerns of higher population densities. In 2015, United Nations (UN) identified 17 Sustainable Development Goals (SDG) expected to fulfill by 2030 with the help of the governments of countries, which many researches reveals to lower the population growth. This study aims to analyze the distribution pattern of population density in Sri Lanka. Population density depends on resource, natural growth of population and migration. In this study, spatial pattern of population density, birth rate and death rates in Sri Lanka were analyzed for 2015 and 2016. The spatial relationships of population density with birth and death rate of 25 districts were also analyzed. The population data were collected from Department of Census and Statistics of Sri Lanka and analyzed using Geo-statistics tools in ArcGIS 10.2. Spatial patterns and relationships among the data sets were identified. Spatial Autocorrelation (Moran's I) was carried out for population density, birth and death rate for the 25 districts. Spatial pattern of population density is highly clustered ($p=0.001$, Moran's I: 0.198) while spatial pattern of birth rates of each district is randomly distributed in 2015 and 2016. High population density restricted areas are Colombo and Gampaha (99% and 90% CI) for both years. Death rates of districts are slightly clustered in 2015 ($p=0.035$, Moran's I: 0.198) and 2016 ($p=0.022$, Moran's I: 0.218). Hot Spot Analysis tool was used to identify the clustered areas. High death rate prevailing districts are Colombo (95% CI), Kandy and Galle (90% CI) in 2015. Low death rate prevailing district is Killinochchi (90% CI). In 2016, high death rate is observed in Colombo (99% CI) and Jaffna districts (90% CI). Spatial relationship was identified by using Ordinary Least Squares (OLS) tool. 44.25% of the population density variation can be explained by death rate (adjusted $R^2=0.4425$) in 2015 and, 49.96% can be explained by death rate (adjusted $R^2=0.4996$) in 2016. Regression equation can be developed according to the coefficient output ($p<0.05$) in 2015 and 2016. There is a significant relationship between death rate and population density ($p=0.00017$) in 2015 and 2016. The overall results of the present study can be used for planning development projects in the country to fulfill the SDG of UN. Colombo and Gampaha districts should have projects leading to decrease the population density. Colombo and Jaffna districts need to decrease death rates by improving their living standards with better health facilities. This study has to continue with emigration and immigration rate data to develop a better model for population density in the country.

Keywords: Death rate, hot spot analysis, Ordinary Least Squares, population density, spatial autocorrelation (Moran's I)