

A GIS BASED ANALYSIS SHOWING THE RELATIONSHIP BETWEEN THE NUMBER OF HOSPITALS AND POPULATION IN UGANDA FOR THE YEARS 2002 – 2010

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Data source: Uganda Bureau of statistics

This analysis is based on Uganda's districts GIS data sets of health centres and population census in 2002 and 2010. Before 2010, Uganda was divided into 112 districts with the capital city being Kampala. This exercise focused on districts because they are the main administrative units in Uganda.

The first part of this paper analyses the number of hospitals in each district unit considering Health dataset for the year 2002. A map showing Uganda's health centres (hospitals) is shown in figure 1 below;

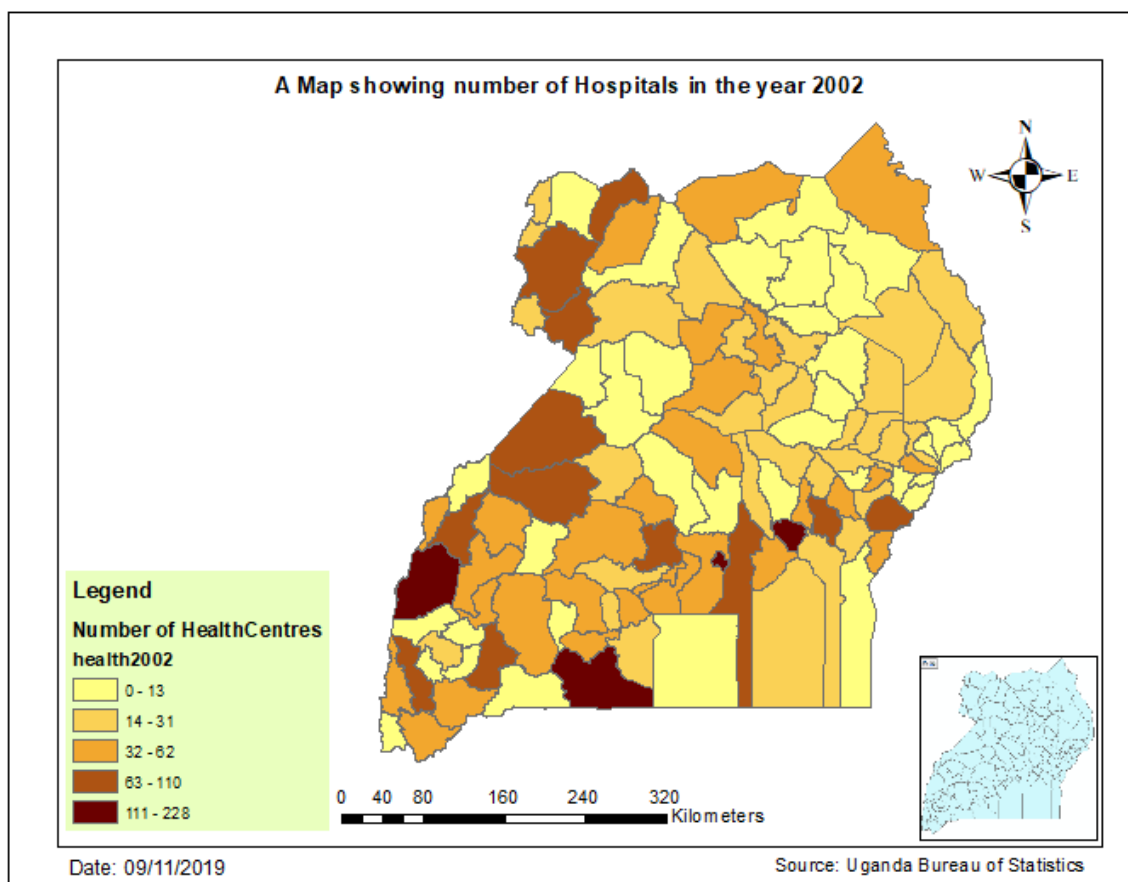


Figure1 showing number of health centres per district.

Uganda's health structure is based on a referral system, each district is at least supposed to have all the five grades of health centres which operate in the smaller units of administration. They include; Health centre II, Health centre III, Health centre IV and the main Referral hospitals. This exercise has considered all grades of health centres existing in the country.

National health coverage can be analysed in figure 1 for the year 2002. We can see a big gap between districts having a higher number of hospitals and those having low number of hospitals. Only four districts are seen to have high number of hospitals in the range of (111-228). Also, there is no proportional relationship between number of health centres and size of districts. A lot of large size districts especially in the northern part of the country are seen to have low number of hospitals ranging from (0-13). Overall districts in the north east part have the lowest number of hospitals while the southern and north western parts show to have relatively higher number of hospitals.

2. The second part analyses the relationship between the number of hospitals in each district and the resident population in the year 2002.

In order to analyse the relationship between number of hospitals and resident population for the year 2002, I applied normalisation and classification approaches to show the variation of the relationship. The population of each district in 2002 was divided by number of hospitals for each district and this gave the relative proportion of the population to the existing health centres (number of people per health centre). This therefore means that the map in figure 2 below gives an indication of the number of persons each hospital could serve in a district;

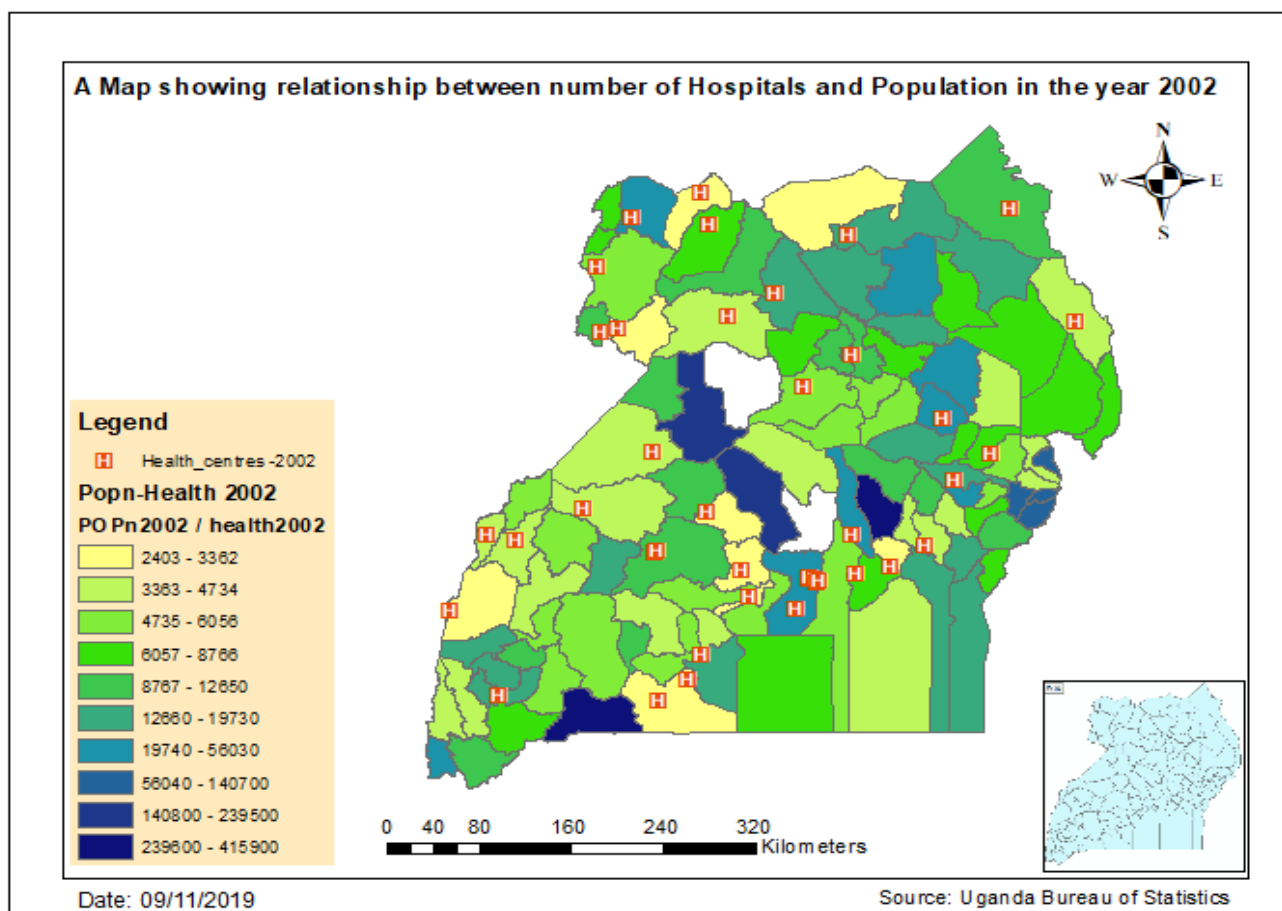


Figure 2 Showing Number of Persons Per Health Centre (relationship between the population and number of hospitals)

The districts shaded white did not have any number of hospitals, this is because, either the health centres did not meet required standards, or the survey of the hospitals was not picked for those districts.

Only 8 districts, some of which are seen to have a high number of hospitals in figure 1 are seen to have a good proportionality to the population (i.e. number of persons per hospital is ranging from 2403-3362). This is also an indication that the health coverage in those districts was good and health facilities are accessible to the population. A number of 32 districts have a proportion of over (>12650) people per health centre, in most cases health centres in these districts are more far away from people. This does not show good health care coverage with highest 4 districts showing a proportion of over 239600 people per hospital. The lowest number of people per hospital is 2403 and the highest number of people per hospital is falls in the range of (239600-415900).

In addition, the health 2002 database was queried to only show the distribution of Referral Hospitals (specialised class health care service) which were over laid in order to see the accessibility of the population to specialised healthcare services across the country. Several districts in the southwest, north-eastern and part of the central region; 65 districts out of the total 112 districts did not have referral hospitals, the population had to travel long distances to nearby districts to access specialised health care (see figure 2).

3.The third part analyses the distribution of hospitals considering the existing population for the years 2002 and 2010.

a) We will refer to figure 2 above Showing number of Persons per Health Centre for the year 2002 and figure 3 below showing number of persons per Health Centre for the year 2010 in order to do comparison analysis for the two years. Both maps show the proportion of population to number of health centres. The resident population was divided by number of hospitals in each district. As was done in figure 2, distribution of Referral hospitals (specialised health care) was overlaid for the year 2010. We can see an increase in the number of Hospitals in southern, north-eastern and central Uganda compared to 2002. Also, we can see that in 2010, eastern Uganda had better specialised health care coverage compared to other parts of the country.

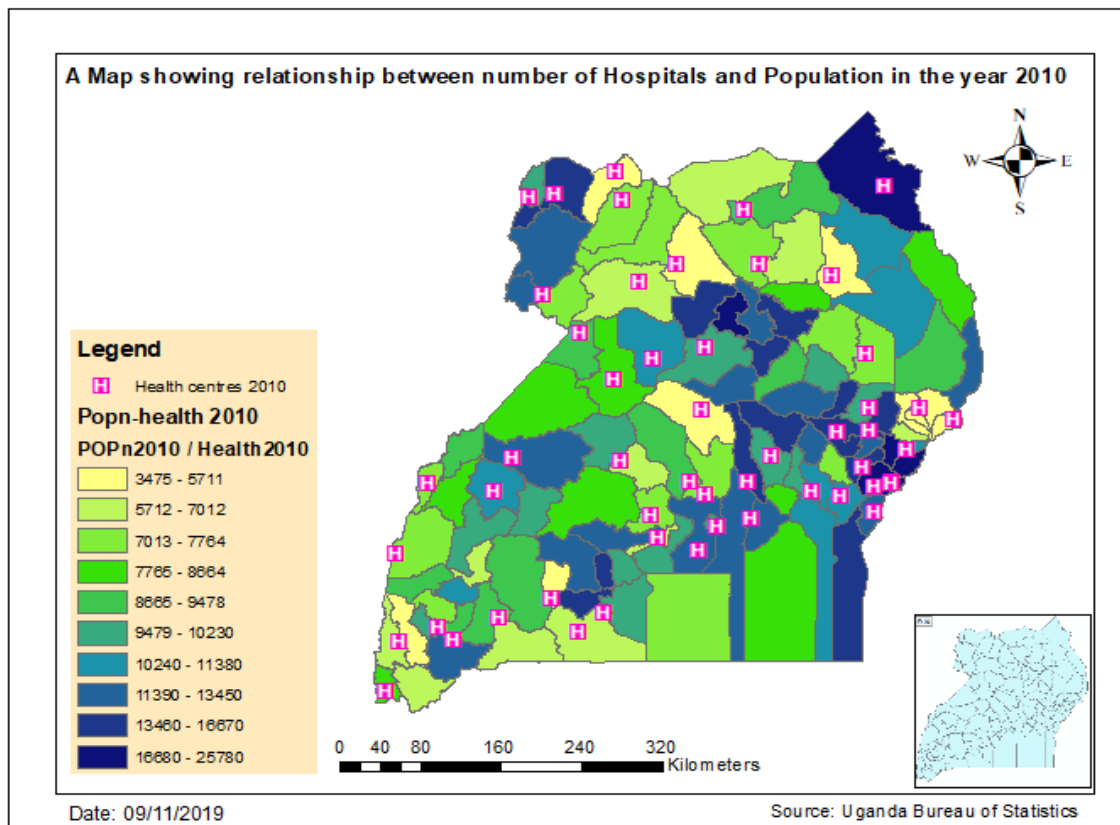


Figure 3 Showing Number of Persons Per Health Centre (relationship between the population and number of hospitals year 2010)

Increased populations in 2010 did not have corresponding increase in healthcare services from 2002. As seen in figure 2 (2002), some districts of north-eastern and western Uganda did not have specialized hospitals in 2010 (figure 3), they still had to travel to nearby districts to get specialised health care. The highest proportion of number of people per hospital in 2002 ranged (239600-415900), and yet in 2010 it was (16680-25780) people. Overall, we can see that there was a reduction in the proportion of number of persons per hospital due to the improved distribution of health care services in from 2002 to 2010. The increase of hospitals in 2010 was however not enough for the growing populations.

b) Figure 4 & 5 on next page show spatial statistics computed using the Anselin Local Moran's statistics tool in ArcGIS for the year 2002 and 2010 respectively. Cluster-outlier maps and histograms were derived and analysed;

In figure 4, two low-low clusters are seen in the western and southern parts meaning that there are low-density people per hospital districts that are surrounded by the same. A low-high cluster is seen at the centre of the study area meaning that there are low density people per hospital districts surrounded by high density people per hospital district. Several districts indicate that spatial autocorrelation is not statistically significant hence high spatial variability. Figure 5 shows two outliers' locations in the south and the east, the one in the south is a high-low outlier meaning that there are high density people per hospital districts surrounded by low density people per hospital districts and this is the vice-versa of the outlier in the east. One low-low cluster is seen in the north there are low-density people per hospital districts that are surrounded by the same and one high-high cluster is seen in the east there are high-density people per hospital districts that are surrounded by the same. This also shows an improvement in health care services in the east in 2010 compared to the year 2002. Overall not statistically significant spatial autocorrelation is seen across the country in both 2002 and 2010 meaning that there was high spatial variability in distribution of hospitals in relation to the population.

Histograms in figure 4 and 5 show summary statistics of the distribution of the distribution of population in relation to number of hospitals. Figure 4 (2002) shows a standard deviation higher than the mean and yet in 2010 we see a lower standard deviation than the mean. This means that there was high spatial variability of number of people per hospital in 2002 than in 2010. This can be seen in the histograms, figure 4, the first bar shows that 103 districts out of 112 districts have Number of people per hospital in the range of (2000-44000). The extreme bars could refer to the spatial outliers seen in the cluster-outlier map. The bars in histogram (figure 5) show a distribution that is closer to the mean, this shows that there is low spatial variability of the proportion of the population to the number of hospitals.

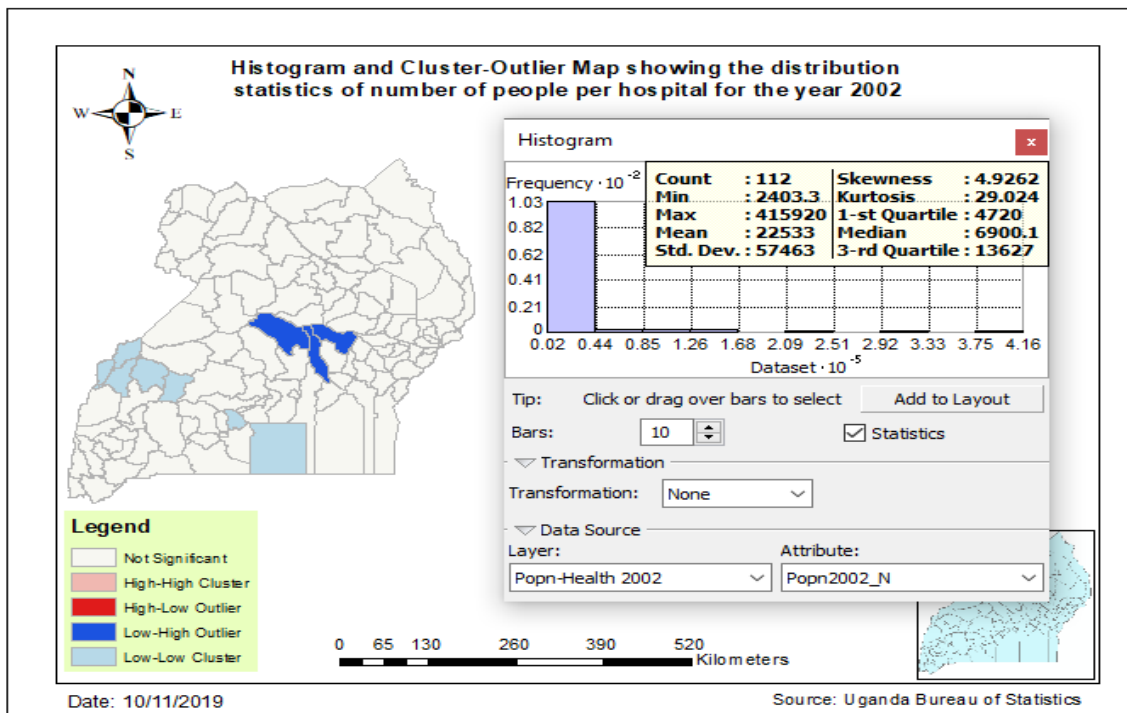


Figure 4 Showing Cluster-Outlier Maps and Histograms (analysis of population and number of hospitals for 2002)

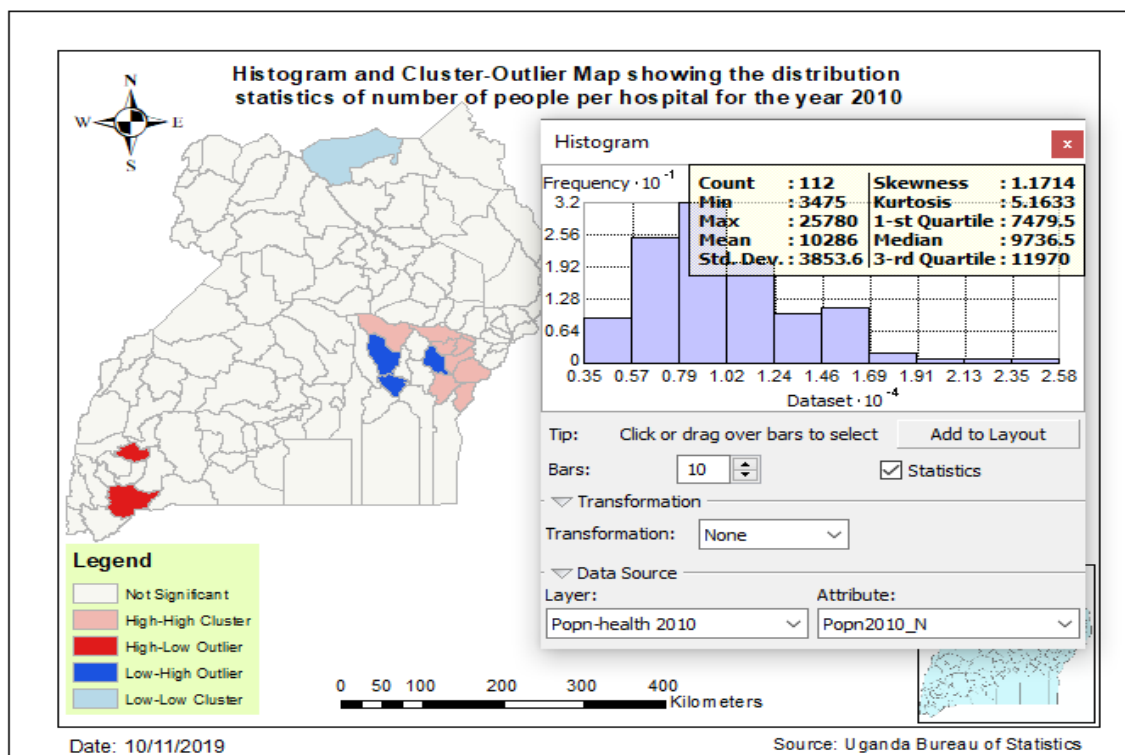


Figure 4 Showing Cluster-Outlier Maps and Histograms (analysis of population and number of hospitals for 2002)

The links below are ArcGis online locations for Maps showing the analysis of the distribution of hospitals considering the existing population on two different dates (2002 and 2010).

1. <http://novagis.maps.arcgis.com/apps/StorytellingSwipe/index.html?appid=1790233e579247f3b59f36dfbfd5631>
2. <http://novagis.maps.arcgis.com/apps/StorytellingSwipe/index.html?appid=04cd6911b437425ba0570f6c65ac3ed3>