

**HEALTH REGIONS DEMARCATION IN ZIMBABWE: A CLUSTER BASED APPROACH****Dr. Evans Chazireni\* and Manasa Sibanda**

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**ABSTRACT**

Disparities in levels of health between regions within a country are normally regarded as a problem. Zimbabwe is characterised by unequal conditions of health in the administrative districts. The current study examined the spatial inequalities health conditions in Zimbabwe. Simple indices were used to determine the conditions of health in the administrative districts of Zimbabwe. Data was collected on various health variables in order to perform the demarcation. The data was collected from the Ministry of health and Child Welfare (2014) National health profile and the ZIMSTAT (2014) published census reports. Cluster analysis was performed to demarcate administrative districts according the level of health conditions. Districts with minimum difference were demarcated in a single cluster. Clusters were delineated using data on patterns of diseases, health and healthcare and such clusters were used to demarcate the country's spatial health system into health regions. It emerged from the research that generally the administrative districts in the country have very poor and poor health conditions. In addition, the spatial health system is characterised by severe spatial inequalities. Some districts are experiencing poor and very poor health conditions and serious health challenges but others comparatively have good and very good health conditions.

**KEYWORDS:** Health, indicators, Cluster analysis; index; Healthcare; Health region and Zimbabwe.**1. INTRODUCTION**

Health is generally uneven at all levels, at local, national, continental and even global level. Perhaps the most evident manifestation of disparities in health at the national level is the differences in levels of health between urban and rural areas. Health inequalities between regions within a country arise over a long period of time and are the result of the interaction between people and their political, physical, social, economic and cultural environments. Certain areas in Zimbabwe have relatively good conditions of health while others have poor conditions of health. The degree of spatial variation in health in the country can have far reaching implications in terms of development planning and policy formation. Such health inequalities within a national economy often create social, political and economic problems. The objective of this paper is to examine the spatial pattern of health among the administrative district of Zimbabwe and demarcate the country into health regions.

**2. Study area**

Zimbabwe is a developing country in Southern Africa and is land locked. It is bounded on the northwest by Zambia, on the south by South Africa, on the northeast by Mozambique, and on the southwest by Botswana and

the Caprivi Strip of Namibia. Harare is the capital city of the country. The country has sixty-one administrative districts. Conditions of health are highly unequal among the administrative districts. This can be attributed to various economic, physical, social and historical factors. In this study, administrative districts are used as spatial units of analyses for the demarcation health regions in Zimbabwe. The administrative districts are shown in Figure 1.

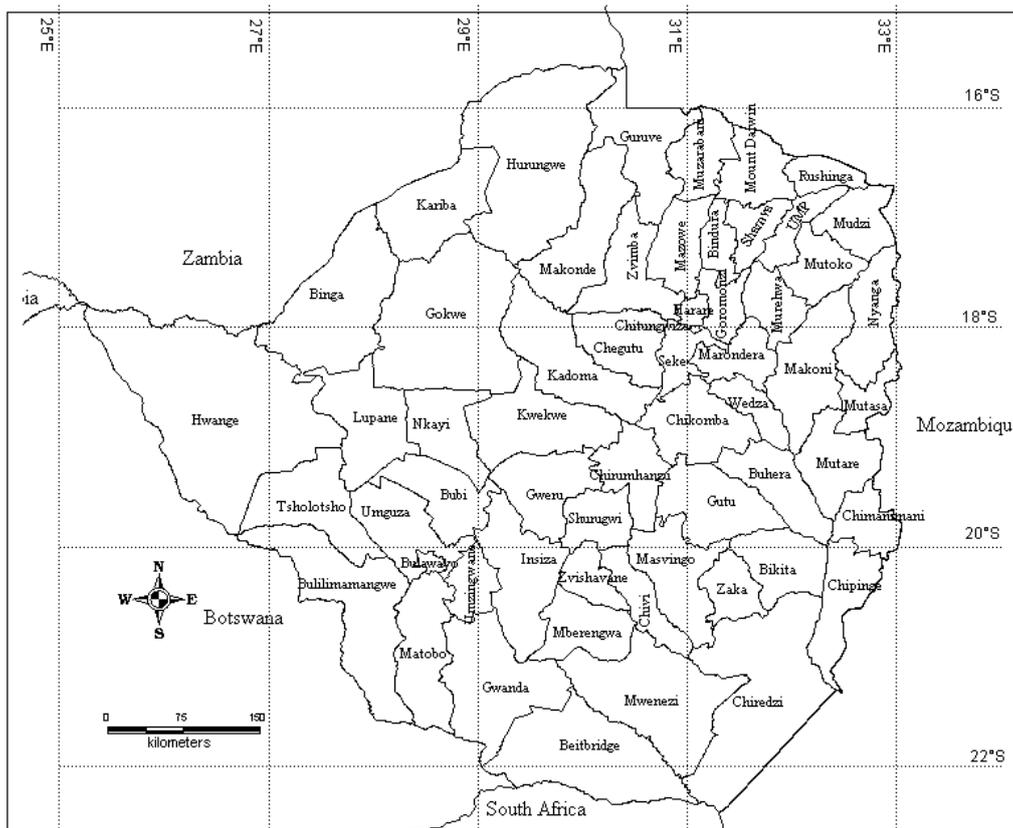


Figure 1: Location of Chipinge district in Zimbabwe (Adapted from Chazireni and Harmse, 2013).

### 3. METHOD AND MATERIALS

Taking account of health indicators used by other researchers to demarcate health regions, 14 indicators were used to perform health regions demarcation in Zimbabwe. Data was collected on various health variables in order to perform the demarcation. The data was collected from the Ministry of health and Child Welfare (2014) National health profile and the ZIMSTAT (2014) published census reports. Taking into account health indicators were used by other researchers (Khang *et al.*, 2004; Marcus and Makanjuola, 2011; Lehohla, 2004 and Sutherland and Coyle, 2009) in other parts of the world indicators which were used to demarcate health regions in Zimbabwe are: The number of hospitals per district, The number of clinics per district, The number of doctors per district, The number of qualified nurses per district, The number of hospital beds per district, Maternal mortality rate per 100 000 people, Infant mortality rate, Measles incidence rate per 100 000 people, Diarrhoea incidence rate per 1 000 people, crude death rate, Life Expectancy, Unemployment rate, Underweight for ages 0-4years by district (% below line) and Dysentery incidence rate per 1 000 people. The fact that developing countries tend to have a scarcity of information also meant that the choice indicators for measurement of health conditions in the country was influenced by availability of relevant data.

To measure the level of health conditions in each district, data was first standardised by conversion of health

indicators into simple indices. An index is defined as a ratio, calculated with a denominator that is a standard base number, such as a national average (Rogerson, 1989: 22). Where the indicators had negative relationship with development, the reciprocals of the variables were calculated first before calculating the simple indices. Dividing the indicator value into 1, the reciprocal is obtained. The calculation of reciprocals was done so that the indicator values would move in the same direction with level of health. Simple indices were calculated using the following formula:

$$I = IV / \text{Base number}$$

Where 1 = the simple index for the indicator, IV = the observed indicator value and Base number = is the base number used as a standard. In this case it is the average of the organised indicator values. Data on simple indices were used to measure the level of health of each administrative district.

Once simple indices were calculated for each district, on all indicators, health regions were demarcated using cluster analysis. Clustering or cluster analysis is the process of assigning a set of objects into groups (called clusters) so that the objects in the same group are more similar (in some way or another) to each other than to those in other groups (Chazireni, 2015). Romesburg (2004: 2) defines a cluster as a mathematical grouping of objects with similar descriptions. In this study, a cluster

is defined as a group of the similar elements gathered together. In the case of administrative districts in Zimbabwe, the districts in the same cluster basically have similar health conditions. They are basically dissimilar to those belonging to other clusters. Data on the calculated simple indices for indicators on the provision of health services in the districts was entered into the Minitab spreadsheet. Using a combination of Complete Linkage method and Manhattan similarity measure in Minitab 17 Statistical software (2010) administrative districts were demarcated into clusters depending on the level of the provision of health services they offer. The Complete Linkage method clusters objects based on the maximum distance between. Manhattan similarity measure uses the sum of the absolute differences in value for any variable. The formula for computation of the Manhattan similarity measure is given by:

$$d_{(x,y)} = \sum_{i=1}^n |(x_i - y_i)|$$

Where  $x$  and  $y$  represent values of the variables. This implies that Manhattan distance computes the absolute differences between coordinates of pair of objects. The use of the combination of complete linkage method and Manhattan similarity measure was more appealing than other measures in the Minitab 17 Statistical software (2010) because the clusters created were clearly distinct,

particularly on the dendrograms that were generated by the Minitab worksheet.

In this study, hierarchical clustering was used to organise administrative districts into a hierarchical structure. More specifically, divisive clustering (divisive algorithms) was used. Divisive clustering begins with the whole and successively proceeds to divide it into smaller clusters. In this procedure, administrative districts are initially treated as if they are part of a single large cluster, then they are divided into smaller and smaller clusters. Cluster analysis arranges the objects and groups them into clusters.

#### 4. DATA ANALYSIS AND DISCUSSION

For the data to be analysed to produce dendrograms in the Minitab worksheet, codes ranging from 1 to 61, were allocated to the administrative districts. Table 1 has the administrative districts of Zimbabwe and the codes allocated to them to allow analysis to be performed in Minitab. It was therefore, necessary to use codes for each and every administrative district. The codes allocated to the districts did not have particular meaning but were based on the alphabetical arrangements of the districts. The codes were simply for identity of the administrative districts they represented for the purpose of analysis.

**Table 1: Administrative districts and the allocated codes.**

District	Code	District	Code	District	Code
Beitbridge	1	Gutu	22	Mount Darwin	42
Bikita	2	Gwanda	23	Mudzi	43
Bindura	3	Gweru	24	Murehwa	44
Binga	4	Harare	25	Mutare	45
Bubi	5	Hurungwe	26	Mutasa	46
Buhera	6	Hwange	27	Mutoko	47
Bulawayo	7	Hwedza	28	Mwenezi	48
Bulilima	8	Insiza	29	Nkayi	49
Centenary	9	Kadoma	30	Nyanga	50
Chegutu	10	Kariba	31	Rushinga	51
Chikomba	11	Kwekwe	32	Seke	52
Chimanimani	12	Lupane	33	Shamva	53
Chipinge	13	Makonde	34	Shurugwi	54
Chiredzi	14	Makoni	35	Tsholotsho	55
Chirumanzi	15	Mangwe	36	Umguza	56
Chitungwiza	16	Marondera	37	UMP	57
Chivi	17	Masvingo	38	Umzingwane	58
Gokwe North	18	Matobo	39	Zaka	59
Gokwe south	19	Mberengwa	40	Zvimba	60
Goromonzi	20	Mazowe	41	Zvishavane	61
Guruve	21				

Once the codes were allocated, it was then possible to use the Minitab worksheet to generate the dendrograms and health clusters in the spatial health system of Zimbabwe. A dendrogram is a branching diagram that represents the relationships of similarity among a group

of entities. In this case the entities are the administrative districts. Figures 2 to 5 represent the health clusters or health regions into which Zimbabwe was demarcated. The conditions of health decreases from dendrogram 2 to dendrogram 5 as described below each dendrogram.

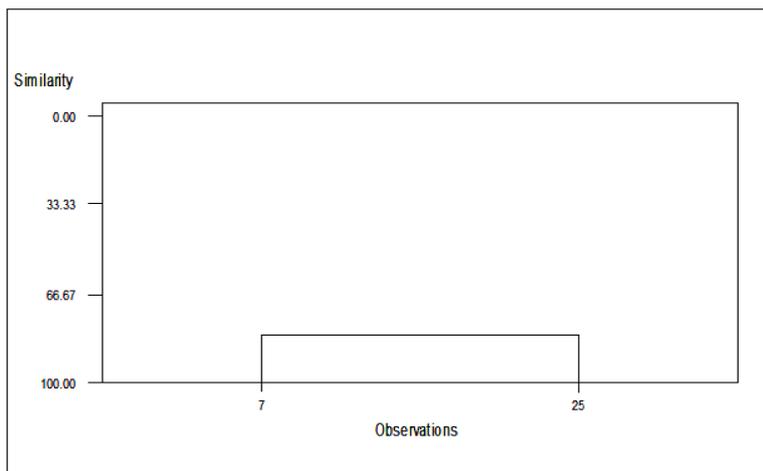


Figure 2: Administrative districts in cluster 1 (Source: Computer generated field data, 27-12-2018).

Figure 2 is the dendrogram representing district with comparatively very good conditions of health.

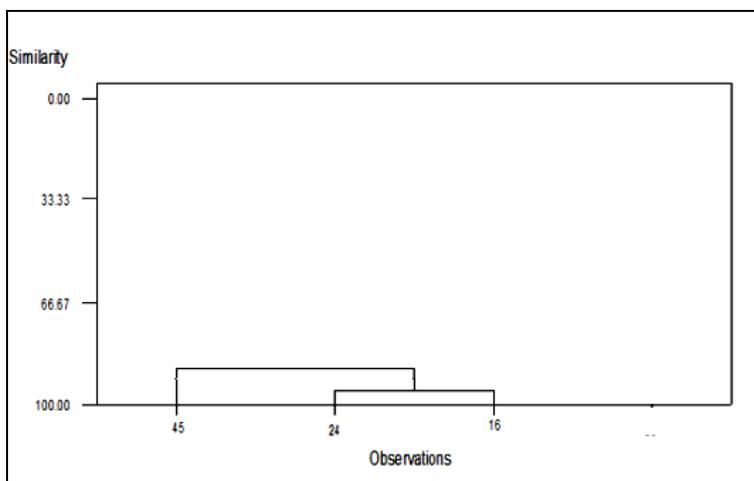


Figure 3: Administrative districts in cluster 2 (Source: Computer generated field data, 27-12-2018).

Figure 3 is the dendrogram representing district with comparatively good conditions of health.

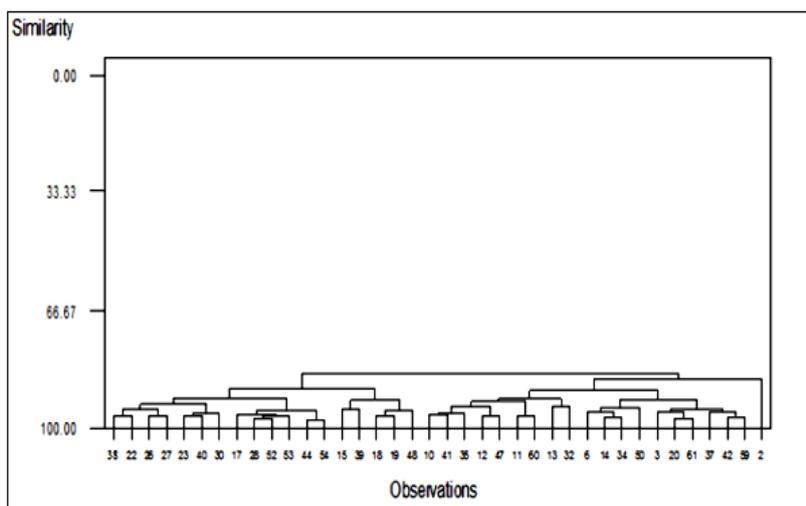


Figure 4: Administrative districts in cluster 3 (Source: Computer generated field data, 27-12-2018).

Figure 4 is the dendrogram representing district with comparatively poor conditions of health.

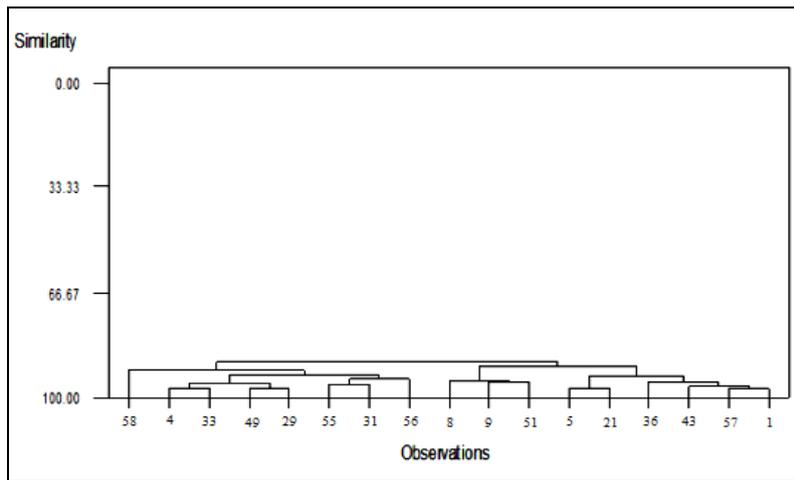


Figure 5: Administrative districts in cluster 4 (Source: Computer generated field data, 27-11-2018).

Figure 5 is the dendrogram representing district with comparatively very poor conditions of health.

Figure 6 shows the demarcated health regions of Zimbabwe. The country is demarcated in four health regions. It is evident from Figure 6 that districts which have comparatively very good and good health conditions are mainly found along the highveld of Zimbabwe which constitutes the central axis of the country (which extends from the east to the south-western part of the country). Administrative districts

with comparatively poor and very poor health conditions are mainly found in the western, northern and southern and some parts of the country fringing the central axis. The southern and the northern parts constitute the lowveld of the country. As the Figure 6 depicts, the spatial pattern of health conditions in Zimbabwe is characterised by a small number of districts with very good and good health conditions surrounded by a sea of a multitude of districts with poor and very poor health conditions.

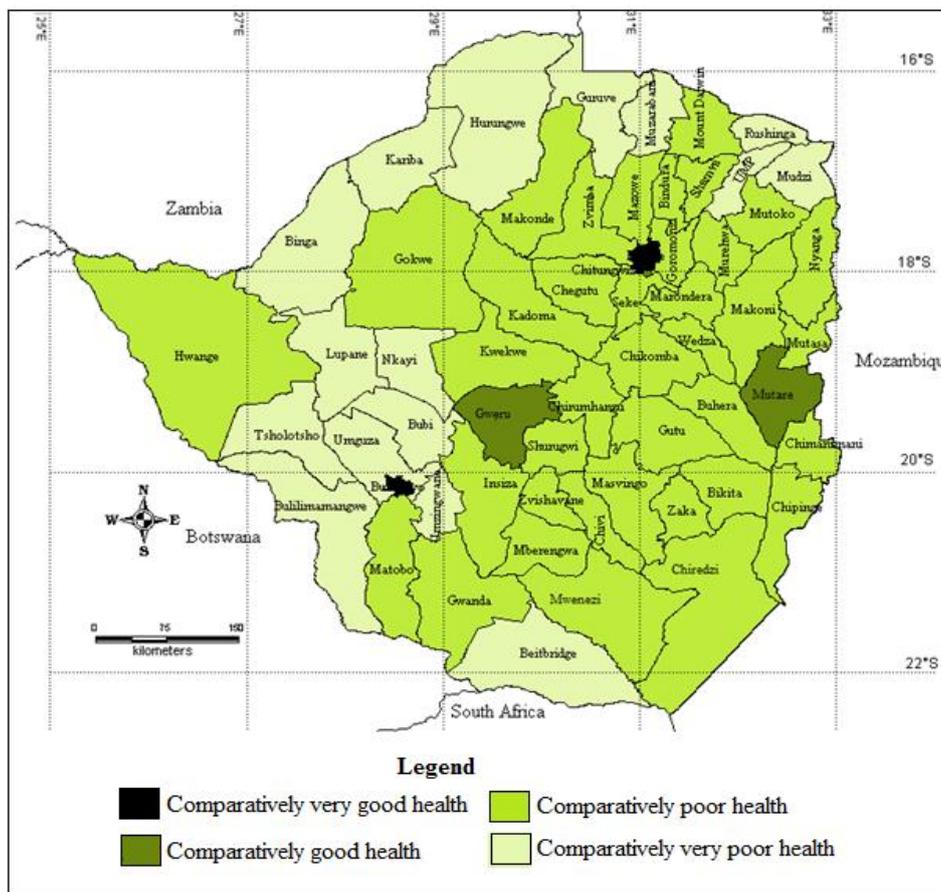


Figure 6: Health regions in Zimbabwe (Source: Computer generated field data, 27-12-2018).

Two major explanations can be advanced to account for such a pattern of health conditions in Zimbabwe. In Zimbabwe, urban centres are concentrated along the Highveld of the country (Musonzi, 2008). Such urban centres have led to improved provision of health services in the respective districts where they are located. Infrastructure (including health infrastructure) is more developed in the urban centres. Therefore, it is not surprising to see that districts which are wholly urban such as Harare and Bulawayo have comparatively very good health conditions in the country. The spatial pattern of health in Zimbabwe is, therefore, considerably affected by the distribution of the main urban areas in the country.

According to Musanga (2009: 49), the highveld of Zimbabwe is relatively wet with a cool climate. The wet climate of the highveld, in contrast to the drier lowveld of the country, stimulates agriculture and related activities. Health workers are also reluctant to go and work in the hot, dry and remote districts in the lowvelds of the country. The cool and wet climate of the highveld of the country can therefore be taken as a stimulus for the comparatively very good and good health conditions of the health clusters in the region. On the contrary, the lowveld of the country which is dry and hot, is experiencing poor health conditions.

## 5. CONCLUSION

It can be concluded from the interpretation of the results in the current study that an uneven spatial distribution of the health exists in the administrative districts of Zimbabwe. Such an unequal pattern of health conditions are due to variations can be ascribed to the different levels of social and economic development in the country as well as physical conditions. The current unequal pattern of health conditions in the districts in the country impacts negatively on health numerous health outcomes in the country's health system. This therefore, implies that there is also spatial variation in people's state of health in the country. Some districts in Zimbabwe have good people's state of health while others have poor state people's state of health. It has also been proved from the current study that using appropriate health indicators, it the Zimbabwe's spatial health system can be demarcated into health clusters or health regions.

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