Time Series Community Healthcare Analysis

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ABSTRACT
Community is the smallest type of government in the Philippines they usually call it as the Barangay. Here, authorities are headed by the Chairman and Councilors. The barangay is where all of the records of each individual living in it can be found including their health records. Each individual living on it is being take care of Barangay's health workers, secretary and others. Barangay secretary holds the records of all person within it, while health workers holds the health record of each individual who undergo consultation and medication through public health center.

Keywords
Barangay, Health Record, Health Worker, K-Means

1. INTRODUCTION

Clinical trials have always represented the gold standard in healthcare. However, there are limitations that include cost, time, question, randomization, and sample size. When the gold standard is not available, we must rely upon information that we do have for analysis purposes. Clinical and administrative databases that are collected routinely have considerable value in terms of patient treatments and outcomes. However, these data are observational, and observational data can always introduce the possibility of confounding factors. [1]

Some important problem in healthcare that can be examined using data mining has to do with identifying of personal given patient needs. To examine solutions we can use time series. We can also examine physician prescribing habits to determine the impact of new procedures and how they change patient care. Time series methods currently are utilized in data analysis of clinical databases. [1]

One of the most important aspects of data mining is that of problem formulation as well as preprocessing of the data. Because we don't have always a precise question when investigating the data, exploration using data mining allows us to narrow the problem down until we have enough information for decision making purposes. [1]

Barangay should deliver efficient and effective services. Community information can enhance decision-making planning and activity and in accession monitoring the improvement of community health, information is used to shape the foundation of decision that impact change in all areas within the barangay.[2] Even though there are a lot of needs, little has been done to improve the generation of data in the Barangay. Provided with the right data, Provided with the right data, it is important to note that short-term forecasts must be given importance for their predictive accuracy because they aim to predict events where there is little action that may be taken to change the outcome, similar to a weather forecast. On the other hand, to support policy planning and decision-making, medium-to-long term projections should be valued. Such models only shows where a society may be leading to if future trends continue and give policy makers an opportunity to continue to act to modify the course of events. As a result, policy support models must not be under prejudice against the standard of making precise future projections [3].

The objective of the study is to describe the health situation of the community residents in terms of common ailments, causes of death, and life span of its residents.

2. RELATED LITERATURE

In the literature, researcher have also proposed several forecasting techniques particularly focusing on various issues in the healthcare domain. [4]propose a methodology to forecast medium-term expenditure in the healthcare sector in the Netherlands during the period 2011 – 2015. They identify several sub-sectors in the healthcare sector of the Netherlands and then decompose the healthcare expenditure into four categories: demographic, epidemiologic, budgetary and residuals. Based on this decomposition, they propose a novel forecasting approach for forecasting expenditure under the healthcare sector. [5] provide a broad framework for theoretical analysis and forecasting methods for health status. The authors discuss the key issues in health forecasting and properties of health data that influence the choice of a particular forecasting technique.

The demand scenarios envisioned by the authors account for different drivers: demography, service utilization rates and hospital beds. Based on the model output the framework proposed by the authors uses a mixed integer programming model to determine the optimal assignment of medical specialization grants for different years under the period of study. [6] proposed a novel approach for quantifying the economic significance of the oral healthcare sector in Germany. The authors presented a model for forecasting the growth in the oral healthcare sector based on various explanatory variables such as demographic change, take-up behavior, medical-technical progress, oral morbidity, aggregated supply, and income levels. Based on their study, the authors predict that by 2030, the healthcare sector in Germany will experience 19.2% increase in its gross value add.

The data sets that the author used contained information on primary as well as secondary service areas, service-area populations by various demographic groupings, discharge utilization rates, market size and market share by service lines. The authors observed that market dynamics can allow development of trend models that can effectively forecast future demands. [7] proposed a forecasting approach for predicting future demands in hospitals and developed a facility master plan based on the
projected capacity.

Vicente et al. worked on the development of the certified environmental management in hospital and outpatient hemodialysis units. Their goals were to decide the level of usage of ecological administration frameworks in doctor's facility units and outpatient

hemodialysis in the Spanish National Health System to give a gathering of reference focuses in natural administration in this social insurance action. [8].

Nicolas and Bliznakov examined on the doctor's facility innovation administration, in clinical engineering [9]. They said that the therapeutic gadgets are utilized today in for all intents and purposes each medicinal services conveyance process, and the range and multifaceted nature of issues that can emerge from their utilization is extremely different. Ahayalimudin and Osman dealt with calamity administration: Emergency nursing and therapeutic faculty's learning, state of mind and practices of the East Coast locale healing centers of Malaysia [10]. Lee, considered competitive methodology for successful national university administration in the Republic of Korea. [11]. His investigation gives data to help basic leadership for managers and the staff of national university hospitals through breaking down their money related articulations or financial statements. Zepeda, Nyaga, Young worked on the supply chain risk management and hospital inventory and the impacts of framework association [12]. In this study they analyzed the effects of horizontal inter-organizational arrangements on stock expenses for hospitals confronting two key environmental conditions, to be specific the logistics services framework where the doctor's facility is found and the request vulnerability for clinical necessities that a doctor's facility encounters. Sabapathy and Bhardwaj attempted to set the objectives in the administration of mutilated injuries of the hand. [13].

3. METHODOLOGY

In the analysis of data, time series methods are being used. There are basic patterns of most demand time series: One is horizontal pattern which the fluctuation of data around a constant mean is. Other one is Trend which is the systematic increase or decrease in the mean of the series over time. Next is seasonal which is repeatable pattern of increase or decrease in demand over long periods of time, and the random which the unforecastable variation in demand. To project the future size of the demand of the data and recognize trends and patterns, we could use the time series analysis [14].

Data Collection

Individual record of each person living in the Barangay was taken from the corresponding Barangay record as well as their health records. The record consist of 1,311 individuals. Table 1 presents the attributes that was taken from the database.

Table 1: Community Database

Attribute	Description	Possible Value
	Defines the gender of	
Gender	individual	M or F
Age	Defines age bracket	0-10, 11-20, 21-30, 31-40, 41-50, 51-60, 61-70, 71-80, 81-90, 91-100
Health Status	Defines the health condition	Normal, Malnourished, Illed
Common Ailments	Defines the common ailments acquired by children and adult	Fever, Colds, Cough, Flu, Asthma, High Blood Pressure, Fever

Data Processing

Using the KDD Model (Figure 1), data sets was summarized and was shown in Table 1.

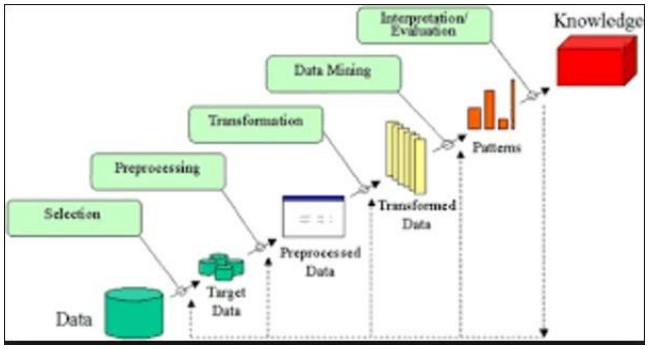

Figure 1 Knowledge Data Discovery Model

The chosen data sets was uploaded to Rapidminer software. This is used in Industries to help them see and understand their data.

Classification model / method was then used to classify their Age, Gender, and Health Status. Figure 2 shows the Classification Model / Method found in the data sets.

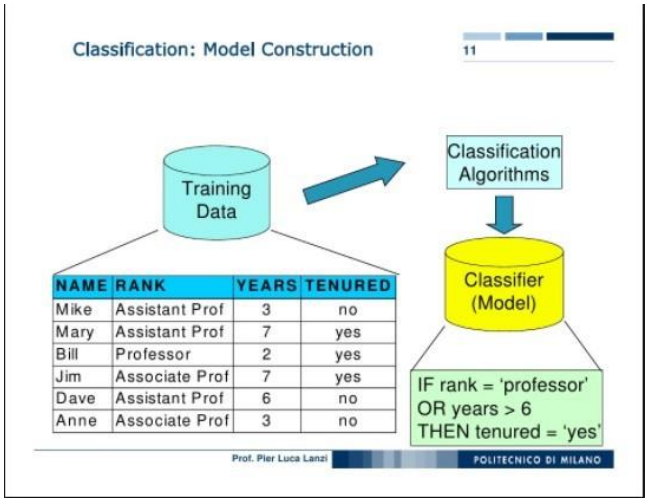

Figure 2 Classification Model

Table 2. Total number of Male and Female using the Decision Tree Classification Model.

	Male	Female
2012	612	577
2013	628	504
2014	631	634
2015	683	667
2016	674	619

To validate the figures above, the total number of population must be identified. Figure 3 will shows the total number of population from 2012 up to 2017. Figure 4 will sum up the number of male and female identified.

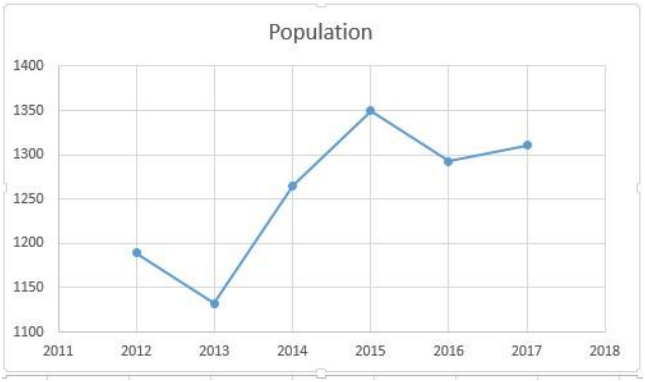

Figure 3 Total Number of Population from 2012 to 2017 (As of June 2017)

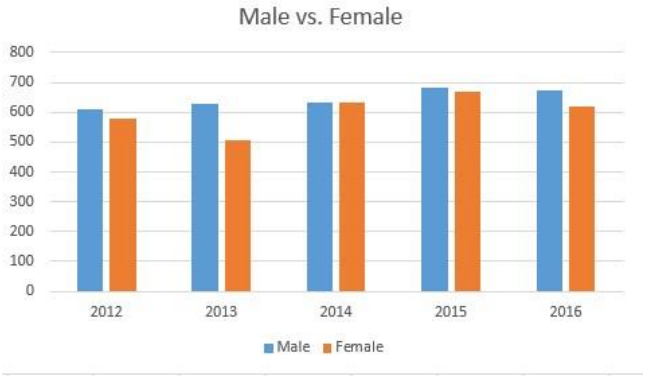

Figure 4. Total number of Male and Female according to year.

Another parameter used in analyzing the data with regards to health care is k-means Method. We analyze the data sets to see the top 5 common aliments acquired by most of the residents in the Barangay. To verify the result of these data please refer to Table 3.

From the paper "Mining Student Learning Behavior in Library Usage Using K-Means Algorithm" [15] defines that the algorithm works by selecting k points as the initial cluster centers ("means"). Each point in the dataset is assigned to the closed cluster, based upon the Euclidean distance between each point and each cluster center. Each cluster center is recomputed as the average of the points in that cluster. Steps 2 and 3 repeat until the clusters converge.

4. RESULTS AND DISCUSSION

Figure 5 to 7 shows the result of the common ailments suffered by its residents from 2014 up to 2016. With this figure we could say that common ailments suffered was cold, cough, and flu.

The result shows that the common ailments that the Barangay residents acquire is fever, then common cough and colds due to weather condition. Some most of the residents prefer to consult to private hospitals and clinic. But we can see that it is very alarming knowing that Asthma is having great impact on their health condition.

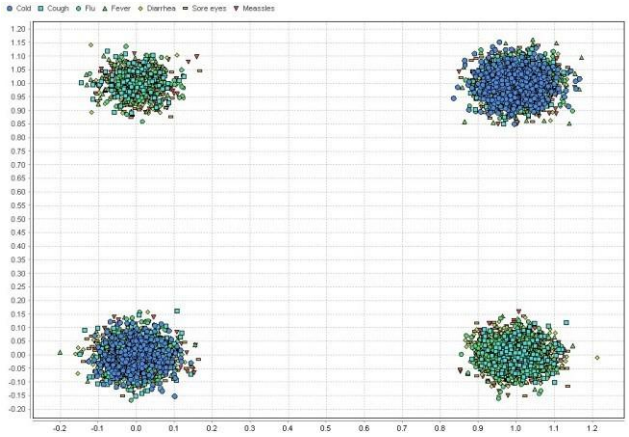

Figure 5. Common Ailments 2014

Common ailment suffered this year was Fever as the highest followed by Flu. Some of the residents having fever tries to medicate themselves by taking usual drug for fever and flu.

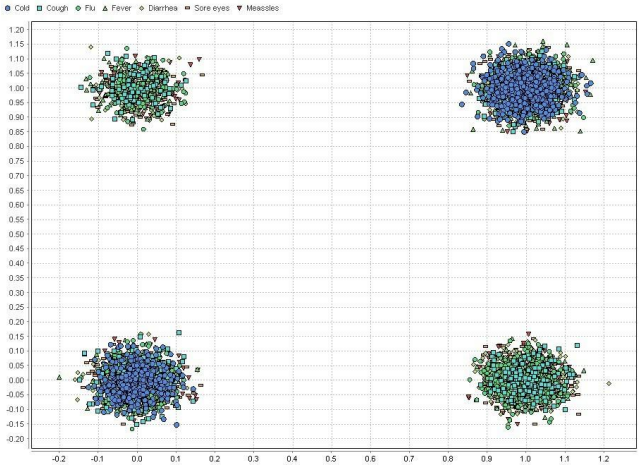

Figure 6. Common Ailments 2015

Common ailment suffered this year was Fever also as the highest followed by cough. Residents usually done self medication rather than consulting a doctor.

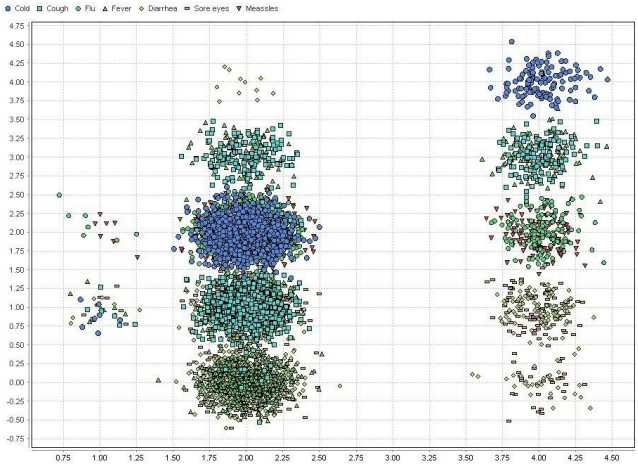

Figure 7. Common Ailments 2016

Same ailment also has been presented last year, but the alarming part is some of the residents are suffering from asthma attact which contributes a lot.

It is also commented that most of the residents prefer to consult on quack doctor rather than consulting on the doctors. Almost 80% of the population consulted first the quack doctor then to doctors as their second opinion.

Common causes of death of the residents living in the community also vary, most of them died by old age and some are ill and there's an instance of animal bite which may cause death to those who are working and living in the most remote area.

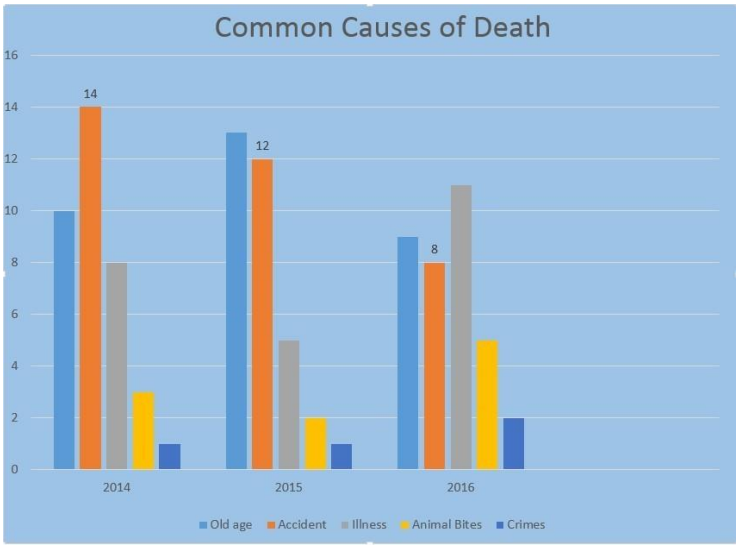

Figure 8. Common Causes of Death

The projected average life expectancy from 2005 to 2010 of Filipinos is 68.8 years, males having an average life expectancy of 66.11 years and females with 71.64 years (National Statistics Office, 2010). It is projected that the average life expectancy will increase to 70.38 years from 2010 to 2015 and 71.59 years from 2015 to 2020 (National Statistics Office). [16].

With regards to life span, using the average method, the result is that the common average age that an individual living last for up to 77 to 82 years old for the last 3 years. Most of the senior citizens

living there reaches the age of 77 as an average estimation and calculation. Most of the residents are male and doing agricultural works.

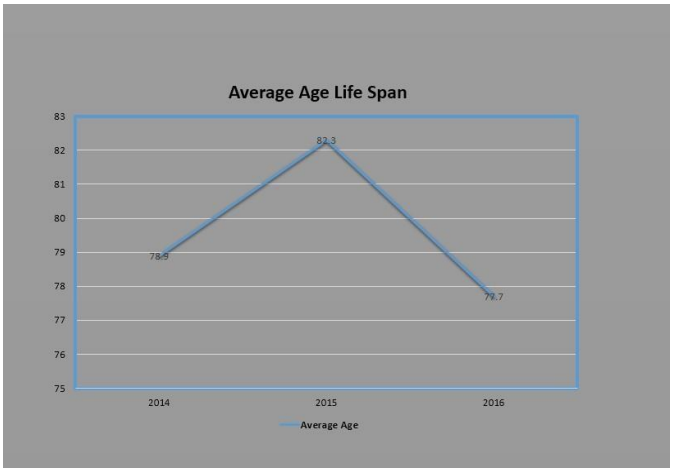

Figure 9. Average Life Span

5. CONCLUSION

Population increases over the time, it is evident that the population increases minimally but as time goes by it can be concluded that it may reach huge number of residents in the next few years.

It is highly recommended that residents living in the Community should learn and appreciate the importance of consulting a doctor. It is obvious that some of the ailments need proper treatment and proper medication. Residents are having difficulty travelling because of the distance of the hospitals and clinics from their houses.

Results shows that people living in Rural Areas have longer life expectancy because they are not too exposed with different harmful environmental conditions. Moreover, they prefer living in a more active and healthy lifestyle.

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