



AMERICAN JOURNAL OF INTERDISCIPLINARY RESEARCH AND INNOVATION (AJIRI)

ISSN: 2833-2237 (ONLINE)

SPECIAL ISSUE (2nd EIC-2024)

PUBLISHED BY
E-PALLI PUBLISHERS, DELAWARE, USA

A Comprehensive Analysis on Non-Communicable Diseases by Quantitative Approach: Using Graphical Visualization

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ABSTRACT

Non-communicable diseases (NCDs) have already become major killers in Bangladesh. Once NCDs are developed, they become chronic health and economic problems. Their primary prevention is linked to their common risk factors. This study was conducted to visualize the trend of the diseases along with the age factor in rural areas of Bangladesh. A quantitative method was used throughout the research to reach the desired goal of this study. The data was collected from a medical association to use in this research and for processing the graphical visualization some preprocessing techniques are also applied on the raw data. After completing the research, the researchers found the percentage of the patients according to the diseases and the disease count along with the patients' age. The outcome is totally represented in graphical visualization. This research will help to find the numeric measurement of a particular disease considering age factor which can help to reduce the issues in medical sectors.

Keywords: Graphical Visualization, Non-Communicable Diseases, Rural Area

INTRODUCTION

The population density of Bangladesh is 1050 people per km which had 1.55 million inhabitants in 2012, is among the world's most densely inhabited nations (Zaman, *et al.*, 2006). A 1.37% annual population growth rate is observed, with a male to female ratio of 104.9/100. Bangladesh has a relatively youthful population according to its wide-based population pyramid. In Bangladesh, there are 118 teenage (15–19-year-old) fertility cases per one thousand women, and in the year of 2011 the life expectancy at birth is 69 years (Khanam, *et al.*, 2011). This is partially explained by the fact that a sizable portion of the youth would reach reproductive age in the upcoming decades. It won't be anticipated for decades that the Bangladesh Demographic and Health Survey would decline noticeably.

There are some diseases which can be prevented through vaccine like HIV, malaria, pneumonia, and neglected tropical diseases (lumbago, fever and knee pain, chronic sinusitis and fever, asthma, venous disease, pain, blood pressure) are the main infectious diseases in Bangladesh. But non-communicable diseases (NCDs) like cancer, diabetes, cardiovascular disease, and chronic respiratory illnesses are now more common in Bangladesh than communicable diseases. NCDs are the cause of more than half of hospital mortality. The information indicates an increasing trend in NCD-related mortality between the ages of 17 and 80. The purpose of the study was to determine the prevalence of prevalent human illnesses in Bangladeshi rural regions as a function of age.

There are lots of diseases like Lumbago and knee pain, Chest pain, Knee pain, Stomachache, Lumbago, Hormonal disorder, Allergy, Fever and knee pain, Chronic sinusitis and fever, Asthma, Venous disease, Pain, Blood pressure which are not even collectively come forward through any research along with age factor visualization. This research will try to represent the trend of the diseases over age factors which is the novelty of this research.

LITERATURE REVIEW

Major non-communicable diseases (NCDs) such hormone disorder illness, lumbago, and knee pain, as well as chest, knee, and stomachaches, have already developed into significant public health issues in Bangladesh. The World Health Organization

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(WHO) states in its Global Status Report on NCDs 2014 (Ahsan, *et al.*, 2009) that there is an estimated 17.5% chance of early deaths from any of the aforementioned NCDs occurring between the ages of 30 and 70. Due to NCDs, there were 277,500 fatalities in 2012 overall, translating to a mortality rate of 564.1 per 100,000 for men and 531.9 per 100,000 for women (Weycker, *et al.*, 2007). NCDs were the cause of nearly half (49%) of fatalities. These NCD rates are already part of the growing trend online (Bennett, *et al.*, 2018), which also includes the rising trends of diabetes and high blood pressure in Bangladesh (Zaman, *et al.*, 2006). A few prevalent risk factors for NCDs include a diet poor in fruits and vegetables, a lack of physical exercise, tobacco use, alcohol abuse, obesity, elevated blood pressure, elevated blood cholesterol, and elevated glucose. Compared to NCDs, these risk factors are more prevalent and simpler to identify. The risk factors of today will develop into NCDs of tomorrow. The cost of controlling them is lower than that of treating fully developed NCDs. As a result, the risk factor strategy has gained popularity for NCD prevention. The fact that NCDs are complex illnesses is well acknowledged. Early NCD maturation is typically caused by a combination of factors. These illnesses are found in nearly all age groups of individuals.

There have been findings on the clustering of risk factors, particularly in hypertension patients, from the populations in the United States (Barreto, *et al.*, 2001), Brazil (Katzmarzyk, *et al.*, 2004), and India (Ramachandran, 1998). Even very young toddlers, clustering may be seen (Siddique, *et al.*, 2007). There is evidence that Bangladeshis are more likely than other groups to exhibit the clustering of NCD risk factors (Jesmin, *et al.*, 2012). This clustering phenomenon may make them more susceptible to the burden of NCDs. However, to assert national representation for Bangladeshi people, a thorough investigation of the clustering of all significant risk variables is essentially absent.

The previous researches are commonly showing different diseases in the particular situations of rural areas of Bangladesh like which disease affects how much people and their risk factor along with surrounding situations and possible solutions. But no research was found showing or visualizing the trend of NCDs with age factor. This research will try to present this finding with graphical visualizations and documentation in the following sections.

MATERIALS AND METHODS

The research is conducted by following the quantitative method. With help of graphical visualization technique from preprocessed data the researchers get the result from this research. Many related papers were reviewed during the background study.

The inclusion criterion was information about public health issues in Bangladesh; more recent research studies were used. Papers were excluded if the study was not based on public health problems of Bangladesh. The literature review was done through reading the previous publications. Those found to meet the inclusion criteria were selected and finally all results were visualized and documented.

Dataset

The dataset is collected from a medical association. There are multiple types of information in the dataset which is confidential also. So that the research is conducted based on the patient's name, age, and the name of the disease only. The number of total patients is 55 and there are a total of 13 unique diseases in the dataset.

Data Preprocessing

For research purposes sometimes it is necessary to perform a preprocessing in the raw data to prepare the result. There are two

Table 1: Unique Disease Name Along with the Number

Unique Disease Name	Number of Patients	Unique Disease Name	Number of Patients
Lumbago and knee pain	4	Fever and knee pain	2
Chest pain	3	Chronic sinusitis and fever	2
Knee pain	8	Asthma	2
Stomachache	2	Venous disease	8
Lumbago	14	Pain	2
Hormonal disorder	2	Blood pressure	3
Allergy	3		

Table 2: Disease name of all patients along with age of patients

Disease name	Age	Disease name	Age
Allergy	25	Chest pain	40
Allergy	40	Chest pain	50
Allergy	25	Chronic sinusitis and fever	17
Asthma	35	Chronic sinusitis and fever	17
Asthma	35	Fever and knee pain	6 months
Blood pressure	60	Fever and knee pain	6 months
Blood pressure	35	Hormonal disorder	36
Blood pressure	50	Hormonal disorder	36
Chest pain	50	Knee pain	40

preprocessing are applied in this research. The first one is a unique disease list according to the number of patients and the second one is that all the patients' disease name with their age only. Table 1 shows the first preprocessing technique the table 2 shows a simplified data table of the second one. After preprocessing the data, a graph generating tool is used to find out the trend of the diseases by using graphical visualization method. It is described in the following results and discussion section.

RESULTS AND DISCUSSION

The information given presents a full picture of how common different health problems are, which can then be used to build a

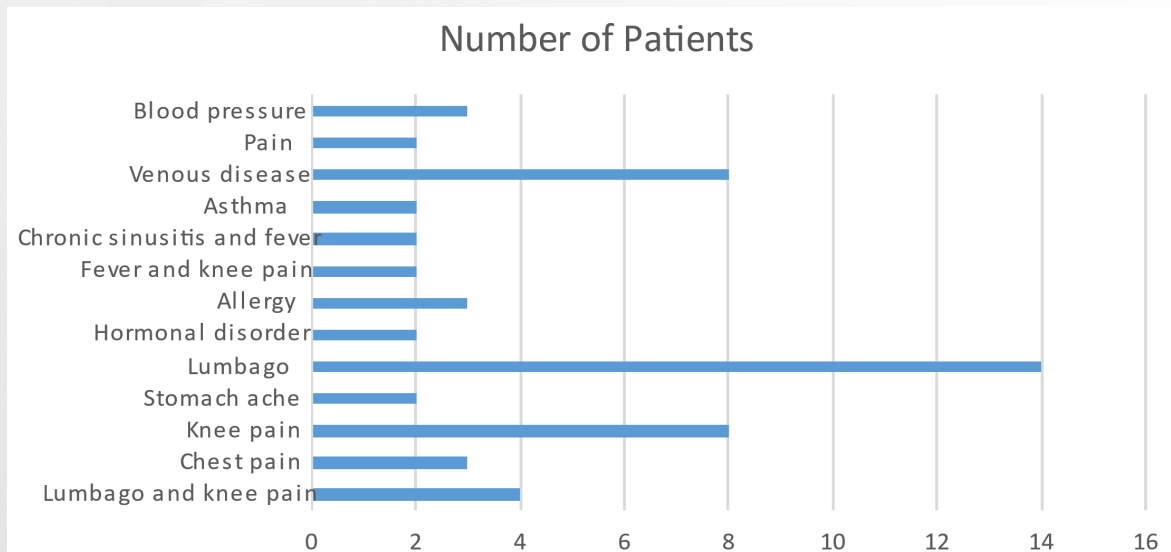


Figure 2: Number of patients for each disease

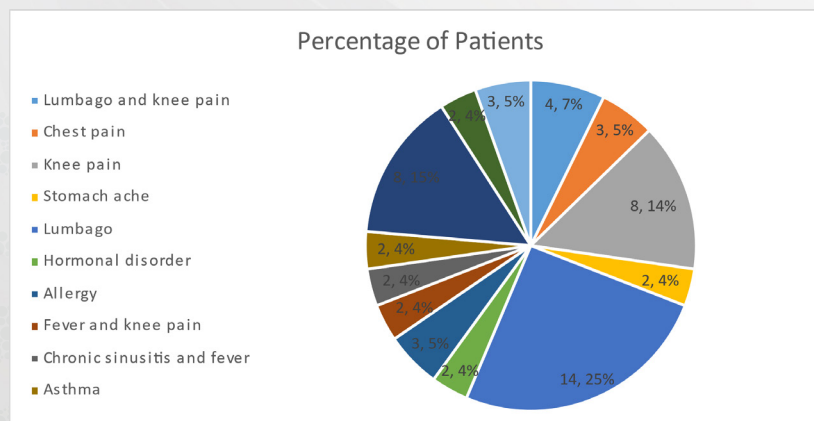


Figure 2: Number of patients for each disease

more in-depth study of each disease which. Figure 1 shows the number of patients with diseases. These illnesses, from lumbago and knee pain to vein diseases and high blood pressure, are shown by the numbers in a very clear way. Let's get into the specifics and look at how important each condition is by looking at the number of patients and the share of people who have it. Figure 2 shows the percentage of patients for each disease like Lumbago and knee pain, which affect four people and make up (7%) of the cases, stand out as a major worry. This double problem makes me wonder what the connection is between knee pain and lower back pain. Analyzing the links between these two parts of the body may find similar risk factors or underlying reasons. The fact that chest pain was mentioned in three cases (5%) makes us worry right away about possible heart problems. Due to how serious chest pain is, it is very important to figure out where it comes from and take action right away. Eight cases (15%) of knee pain make it stand out as a common problem. The high number shows that it has a big effect on the population, which makes us look more closely at possible reasons, which can be anything from lifestyle choices to underlying health problems. Two people (4% of the population) have stomachaches, which may not seem like a big deal, but they can really mess up your daily life. The need to find the root reasons and create individual treatment plans becomes obvious. Lumbago, reported in 14 cases (25%), claims the highest number, showing its substantial frequency. Unraveling the complexities of lumbago and adapting treatment methods to individual cases is important, given its large representation in the dataset. Hormonal disease, affecting two people (4%), raises questions about the range of symptoms within this group. Understanding the individual chemical changes and their effects on general well-being is important for focused treatments. Allergy, involving three people (5%), shows the value of spotting and controlling allergic reactions. Exploring external factors and applying individual allergy control strategies becomes important. Fever and knee pain, described in two cases each (4%), present a unique mix that requires a complex understanding. Investigating possible infectious or inflammatory reasons for this pairing is important for effective treatment. Chronic sinusitis and fever, also reported in two cases (4%), spur a study of chronic inflammatory diseases and suitable treatment methods. Identifying similar causes between these two conditions may lead to overall treatment methods. Asthma, affecting two people (4%), stresses the importance of lung health. Exploring preventive measures and lifestyle changes suited to asthma control is important for improving general well-being. Venous disease, with eight confirmed cases (15%), shows the value of knowing circulation system health. Exploring causes adding to vein diseases and implementing preventive steps is important for lowering their frequency. Pain, described in two cases, causes questions about the nature and origin of pain. While the term is general, a thorough study of the recorded cases can provide insights into the particular difficulties people face. Blood pressure, reported in three cases, shows the value of tracking and controlling cardiovascular health. Understanding the reasons adding to blood pressure changes and having individual strategies is important. Analyzing the number spread of illnesses further refines our understanding of their relative effect. Lumbago leads with 25%, followed by knee pain and vein disease at 15% each. These numbers serve as a guide for healthcare plans and resource sharing, ensuring a focused method to handle common diseases. In studying the links between diseases, it becomes clear that some conditions may share similar risk factors or adding elements. Investigating these links can guide broader methods of healthcare, given the linked nature of different health issues. The effect of living decisions on disease frequency is obvious, and it is important to look into particular areas. Sedentary lives may add to knee pain, while food habits could influence stomach aches. Identifying these links allows for focused protective steps and lifestyle changes. Identifying similar causes among widespread diseases is a key step in building complete healthcare plans. Whether genetic predispositions or external effects, knowing these similarities allows more effective protection and control methods. The consequences for healthcare are important, considering the frequency of certain diseases. Allocating resources based on frequency makes the best use of medical facilities and staff, handling the most important health issues within the community. The value of early diagnosis and prevention cannot be stressed. Regular tests and information programs can greatly impact disease results, lowering the load on healthcare systems and improving general community health. Tailoring healthcare tactics for specific diseases provides a more targeted and efficient approach. Customized treatment plans based on the unique features of each disease can improve patient results and increase total healthcare effectiveness. Overcoming difficulties in handling high-prevalence diseases takes novel methods. Research and development focused on these common diseases can lead to breakthroughs in treatment methods and, eventually, better patient care. Integrating inclusive methods into healthcare is crucial for handling the complex nature of common diseases. Considering not only the physical but also the mental and emotional parts of well-being lead to more complete and lasting answers. The social effect of common diseases goes beyond individual health. Communities may face economic pressures and greater requests for healthcare facilities. Strategies for community understanding and support play a key role in reducing these wider effects. Sharing personal stories humanizes numbers, giving a better understanding of the difficulties people face. These tales offer a glimpse into the daily battles and

achievements of those touched by different health issues. Behind each number is a unique journey, stressing the need for caring healthcare practices. Humanizing the numbers promotes empathy and understanding, encouraging a more helpful and inclusive approach to healthcare. The role of technology in disease control is ever evolving. Innovations such as telemedicine and smart devices add to improved usability and tracking, improving the overall level of healthcare service. Continuous improvements in healthcare technology, from tests to personalized treatments, add to better patient results. Embracing and merging these technological developments is important for staying at the top of healthcare greatness. Examining new trends in disease frequency offers useful insights into changing health issues. Anticipating these trends allows strategic healthcare planning, ensuring that resources are directed where they are most needed. Predicting the future healthcare environment includes considering changing tools, moving demographics, and social changes. Proactive methods can help handle future healthcare needs, ensuring that systems stay flexible and strong. In conclusion, the patchwork of disease frequency is complicated and diverse. By studying the offered information, we gain a better understanding of the obstacles and possibilities within the healthcare scene. Utilizing this information for the benefit of individual health, group well-being, and the development of healthcare methods is crucial. Regular tracking, early action, and a balanced approach are key factors in handling common illnesses and creating a healthy society.

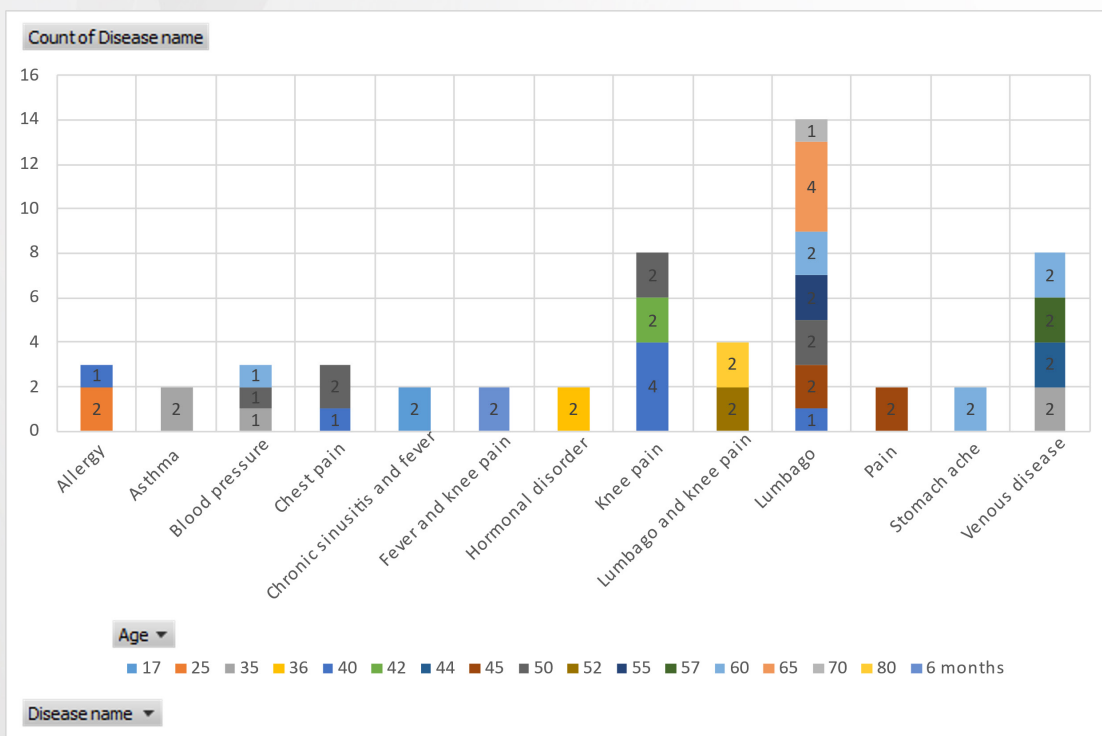


Figure 3: Number of patients for each disease

Within the information provided, a varied array of health problems appears, each linked to specific age groups indicated by different colors in figure 3. This combination of data forms a detailed picture, giving useful insights into the frequency of ailments across different groups. Allergies, a common health worry, seem to appear mainly around the age of 25, obvious by the recurrent orange marking. This constant trend suggests a heightened tendency to allergic responses during this specific time of life. Additionally, the information shows another clump of allergy cases at the age of 40, marked in blue. The return of allergies in distinct age groups causes reflection on the persistency and development of allergic traits throughout an individual's lifespan. Asthma cases, identified by a faint grey marking, are particularly common around the age of 35. This cluster of breathing problems in this specific age group raises questions about the possible factors adding to such frequency. The color-coded picture helps in visually identifying these trends, adding a layer of clarity to the understanding of health problems. Blood pressure issues, illustrated by different shades of blue and grey, appear to be more common in people over the age of 50. The increasingly darker shades indicate older age groups, showing a possible link between advanced age and an increased chance of blood pressure-related problems. Instances of chest pain, a complaint with multiple sources, are recorded in people aged 40, marked in blue, and those aged 50, marked in dark grey. The difference in age groups causes discussion on the various reasons

adding to chest pain within these demographics. Chronic congestion and fever are noted in people around the age of 17, marked in a light shade of blue. This specific age group frequency may be linked to external factors, lifestyle, or hormonal changes typical of teens. Fever and knee pain, a disease noted in babies of 6 months, marked in water blue, suggests a unique population. Understanding the nature of health problems in babies is important for early help and proper medical care. Hormonal diseases seem to affect people around the age of 36, marked in yellow. The regularity in this age group suggests a possible link between hormonal changes and this specific stage of life. Knee pain, a common disease across the dataset, is mentioned in different age groups. The color-coded marks, such as blue, dark grey, and little green, provide a visual picture of the spread. Analyzing the age spread of knee pain can guide healthcare tactics suited to specific groups. Lumbago and knee pain, a mix of back and knee problems, are found in people aged 52 and 80, marked in brown and yellow, respectively. The variation in age shows that this condition may appear differently in people of different age groups. Pain, a general term for pain, is mentioned regularly in people aged 45, marked in red. The similarity in age group raises questions about common causes leading to pain in this category. Stomachache, noted in people aged 60, marked in little blue, shows a frequency of stomach problems in this specific age group. Venous disease, a condition affecting the venous system, appears to be more common in people aged 35, 44, 57, and 60, marked in shades of little grey, green blue, green, and little blue, respectively. This varied age distribution emphasizes the complex nature of venous illnesses. In reviewing the big sum, certain findings stand out. For instance, the repeat of certain conditions like lumbago and knee pain (55 occurrences) and knee pain (55 occurrences) shows a high frequency of these health issues within the sample. In conclusion, these specific data points provide a refined view of the frequency of various health problems across different age groups. The color-coded marks offer a visually appealing way to spot patterns and trends within the information. This analytical method, focusing solely on the data given, throws light on the range of health problems and their population patterns. Understanding these trends is crucial for fitting healthcare measures to specific age groups and meeting the unique needs of people at different times of life.

CONCLUSIONS

Bangladesh's rural areas have a high prevalence of NCD risk factors. It is necessary to investigate more closely other risk factors in both clinical and public health settings if a risk factor such as blood pressure, hormone disorders, or chest discomfort is identified. According to our research, Bangladesh may soon witness a dramatic rise in NCDs. If national inactivity persists, this will therefore result in a greater demand on the health care system and a decrease in production as a result of deaths and impairments that occur during prime working years. Some future directions are listed below for this study.

1. Predictive Modeling: Creating models based on a variety of risk variables that can predict the onset and course of NCDs. Healthcare practitioners can detect individuals who are more susceptible to health risks and take proactive actions by utilizing past data and sophisticated predictive algorithms.

2. Personalized medical: Combining quantitative analysis with personalized medical techniques to customize interventions and therapies based on each patient's distinct genetic composition, lifestyle choices, and illness risk profile. This may result in more focused and efficient treatments for NCD management and prevention.

3. Real-time Monitoring Systems: Creating real-time monitoring systems that track important health indicators and give prompt feedback to patients and healthcare professionals by utilizing graphical visualization approaches. These programs could provide people the confidence to manage their health proactively and delay the development of NCDs.

4. Multi-modal Data Integration: Investigating methods for combining data from several sources, including wearable technology, genetic profiles, electronic health records, and environmental variables. Through the use of graphical visualization tools to combine multiple data types, researchers may obtain a more thorough knowledge of the intricate interplay between many factors that contribute to noncommunicable diseases (NCDs).

Like other research, this research also has some limitations. Only the age factor was considered in this study. The result would be more accurate if the gender factor was present while processing the result. Hence the outcome can contribute to the medical sectors for many purposes for improvement in public health sectors.

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