Economic Impact of Diabetes Care in Kannamanaickanur Village, Udumalpet Taluk, Tirupur District

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Abstract: Diabetes and its complications are a major cause of morbidity and mortality in India, and the prevalence of type 2 diabetes is on the rise. This calls for an assessment of the economic burden of the disease. The research design is exploratory and descriptive. The required information was collected using a structured questionnaire and interview method. The sampling criterion for this study was purposeful sampling. The study sample was composed of 60 diabetes patients from Kannamanaickanur Village and was conducted from January 2023 to March 2023. The prime objective of the study is to find out the Socio-economic profile of the diabetic, to estimate the direct cost, and indirect costs and to suggest the adoption of effective measures for the surveillance, prevention, and control of diabetes, to reduce the economic burden of diabetics. The data were entered in SPSS version 20.0 and percentage analysis was applied to interpret the Socio-economic and clinical profile of the diabetic patients. The Direct cost and indirect costs incurred by diabetic patients are estimated by descriptive statistical tools. The chi-squar.
e test is applied to find out the association between the clinical factors and the cost of treating Diabetes. ANOVA is used to analyze the relationship between the age and total cost. The factors influencing the cost of treating Diabetes and the economic burden of Diabetic patients in the Kannamanaickanur Village have been analyzed by multiple regression model. The high out-of-pocket expenditures and income loss due to diabetes are likely to have long-term consequences for households, particularly those with low income and no health insurance.

Keywords: Diabetes, Cost of illness, Economic Burden, Out-of-Pocket Expenditure.

1. INTRODUCTION

Diabetes is a widespread chronic disease that plays a significant role in the increased mortality rate and disability of the populace. It is the most common metabolic disease, presenting serious challenges for both individuals and governments, leading to various complications, diminished quality of life, and higher mortality rates. The global prevalence of diabetes was estimated to be 2.8 percent in 2000 and is projected to rise to 4.4 percent by 2030, with over three-quarters of people with diabetes residing in developing countries. According to the Diabetes Atlas published by the International Diabetes Federation (IDF), India had an estimated 65.1 million individuals with diabetes in 2014, expected to rise to almost 90 million by 2030. By 2030, the countries with the greatest number of diabetic individuals will be China, India, and the USA. It is projected that one in every five individuals with diabetes will be Indian. Consequently, due to these significant figures, the economic burden of diabetes in India ranks among the highest in the world.

Diabetes in India
India is currently grappling with a diabetes epidemic, with a nine percent adult prevalence rate and nearly 69 million people living with diabetes. This number is expected to rise to 101 million in the next 15 years. The International Diabetes Federation projects that the number of Indians with diabetes will increase to 123 million by 2040. Currently, five percent of the Indian population suffers from diabetes. According to a November 2017 report by the Indian Council for Medical Research, diabetes prevalence in India has increased by 64 percent over the past quarter century. Official WHO data shows that India tops the list of countries with the highest number of diabetics and is projected to rise to 79.4 million by 2030, compared to 31.7 million in the year 2000.

In India, the highest incidences of diabetes were found in South India, with rates of 13.5% in Chennai, 16.6% in Hyderabad, and 12.4% in Bangalore, followed by Eastern India (11.7% in Karnataka), Western India (9.3% in Mumbai), and Northern India (6.1% in Kashmir Valley, 11.6% in New Delhi). An estimated 7.8% of the population above 18 years of age has elevated blood glucose levels and is receiving treatment for diabetes, accounting for approximately 60 million people with diabetes out of a total population of over 1.3 billion. Nearly 900,000 annual deaths are directly or indirectly attributed to diabetes. According to the International Diabetes Federation (IDF), there are 463 million people with diabetes worldwide, with 88 million in the Southeast Asia region, out of which 77 million are in India, presenting a diabetes prevalence of 8.9%. The IDF also estimates that India has the second highest number of children with type 1 diabetes after the United States and contributes the largest proportion of incident cases of type 1 diabetes in children in the South East Asia (SEA) region. The World Health Organization reports that 2% of all deaths in India are due to diabetes.

Diabetes in Tamil Nadu
The people of Tamil Nadu are facing a significant threat in the form of diabetes, with a prevalence rate of 15 to 18 percent in urban areas and 6 to 8 percent in rural areas. This alarming incidence is steadily increasing, and if this trend persists, Tamil Nadu will soon have the highest number of diabetes patients in the entire country. On World Diabetes Day, doctors in the city

expressed their concerns regarding this issue. While India already holds the unfortunate title of being the diabetes capital of the world, with over 72 million recorded cases in 2017, it is not far-fetched to predict that Tamil Nadu will eventually claim the title of India's diabetes capital. The government has implemented various active programs to combat diseases such as TB, dengue, and malaria, but there is a lack of initiatives targeting non-communicable diseases like diabetes. The government must expand its programs to reach even the smallest villages, providing diabetes screening and offering lifestyle and dietary advice to the people.

Scope of the Study

The combined clinical characteristics, development process, fatality rate, and economic impact of diabetes have positioned it as a significant health issue that demands considerable focus on both prevention and treatment. Despite its substantial impact on society, diabetes has not been a primary focus for governmental intervention. The increasing prevalence of diabetes and its associated complications necessitate immediate attention from healthcare providers and policymakers. The results of this research will underscore the importance of government intervention in addressing diabetes and other non-communicable diseases, ultimately averting countless deaths caused by these widespread and avoidable illnesses.

Statement of the Problem

India is presently facing a widespread outbreak of Diabetes Mellitus. As per the World Health Organization, India holds the unique distinction of having the largest number of Diabetic patients. The country is grappling with a significant healthcare burden due to the high prevalence of Diabetes. The incidence of Type 2 Diabetes has been steadily rising, starting from a mere 2.1 per cent in 1970 to 12.1 per cent in 2000. This increasing prevalence of diabetes presents a substantial clinical, economic, and societal challenge in India. The expenses related to diabetes care in urban areas have tripled from 1998 to 2015, primarily due to the rising costs of Diabetes medications, Laboratory tests, medical consultations, hospitalizations, surgical procedures, and management of complications. The cost of diabetes care is on the rise globally. There is limited data available from developing countries regarding the expenditure on diabetes care, with only a few studies conducted in India on this matter. Therefore, a study was initiated to analyze the economic impact of diabetic care in Kannamanaickanur Village, Udumalpet Taluk, Tirupur District.

Objective of the Study

1. To find out the Socio-economic profile of the diabetic Patients in Kannamanaickanur Village.
2. To estimate the direct cost, indirect cost, and intangible cost incurred by diabetic Patients in Kannamanaickanur Village.
3. To suggest efficient strategies for monitoring, preventing, and managing diabetes.

Hypothesis of the Study

1. There is no significant difference between the income level of diabetic patients and the nature of hospitals preferred for diabetes treatment.

2. There is no significant difference among Age groups in years and the number of complications of Diabetes.
3. There is no significant difference between the number of complications of Diabetes and the Total cost of treatment for Diabetes
4. There is no significant difference between the duration of Diabetes and the total cost of diabetes.

Need for the Study
Diabetes is no longer limited to the affluent or the wealthy. It is now becoming a concern even among the less privileged members of society. Research has indicated that individuals from lower socioeconomic backgrounds who have diabetes are more susceptible to complications due to limited access to quality healthcare. This is particularly alarming considering that a significant portion of the Indian population still lives below the poverty line. India holds the unfortunate title of being the "Diabetes Capital of the World," and this number is projected to reach approximately 90 million by the year 2030, according to various estimates. The combination of genetic predisposition and lifestyle changes associated with urbanization and globalization are contributing to the rapid increase of diabetes in India.

Limitations of the Study
The data for the present study was collected through the personal interview method, the possibility of data bias exists and hence the data collected would only be an approximation of facts. The study focuses on diabetic patients of Kannamanaickanur Village alone.

2. RELATED WORK

In his study, Santhosh Kumar Yadav (2015) analyzed the diabetic healthcare expenses for individuals with diabetes, both with and without complications, which are incurred annually. The continuous rise in direct and indirect costs for the Indian population has led to a significant increase in future treatment expenses for diabetes in developing countries. This poses a substantial burden on economically disadvantaged diabetic patients belonging to lower income brackets.

Armando Arredondo and Gabriela Reyes (2013) in their study "Health Disparities from Economic Burden of Diabetes in Middle-Income Countries, Evidence from Mexico" explained the economic impact of Mexico revealed several consequences for healthcare systems, households, and individuals affected by Diabetes and its associated complications.

Loganathan, and John (2013) analyzed the economic burden of diabetes in Chennai. The study focuses on different income groups and age groups of diabetic patients. The survey was conducted in six Diabetic clinics in Chennai in 2011. The direct cost of diabetes was Rs. 23,818 in a year per patient. Of this, 95 percent of the cost was spent on Medicines. Middle-income and middle age groups spend more for Diabetics as compared to other groups. Patient's age, gender, and Education have no relationship with the medical costs.

Kapur (2007) studied the economic analysis of diabetes care. The Author analyzed the social and economic factors of diabetic patients and their impact on cost and health care. The study pointed out that delay in the identification of diabetics is also an important factor that influences the Cost. Various complications of diabetics and their severity determine the level of treatment and cost. Concerning annual direct cost, the diabetic Patients who are hospitalized spend more than two times as compared to the diabetic patients who are not hospitalized.

Ramachandran (2007) studied the socio-economic burden of Diabetes in India. The author mentioned that in developing societies Diabetes is a lifelong health problem and involves a high cost of medication. From the survey, he found that the cost of health care is shared by the family members. He found that there is no variation in the cost of health care between rich and poor people.

3. METHODOLOGY

The current study's methodology is detailed in this chapter, which includes the study's design, research setting, study population, sampling methods, and data collection and analysis procedures.

Selection of the Study Area
Kannamanaickanur village is located in Udumalaipettai Tehsil of Tirupur district in Tamil Nadu, India. It is located 66.9 km south of district headquarters in Tiruppur; 3.1 KM from Udumalaipettai; 485 km from the state capital Chennai Kannamanaickanur pin code is 642128 and the postal head office is Kannamanaickanur village according to census 2011 information the location code or village code of Kannamanaickanur village is 644840. Kannamanaickanur village is also a gram panchayat. The total geographical area of the village is 3143.49 hectares. There are about 3633 houses in Kannamanaickanur village. Kannamanaickanur has a total population of 12,375 people with 6164 males and 6211 females. The village male literacy rate is 81.26 Percent. And the female literacy rate is 66.79 Percent. The working population consisted of 83.19 Percent. There is a primary health centre and a government middle school. Udumalaipettai is the nearest statutory town of the Kannamanaickanur village which is 3.1 KM away from the village.

Selection of Samples
The study sample was composed of 60 diabetes patients from Kannamanaickanur Village. This study was conducted from January 2023 to March 2023.

Methods of Data Collection
A structured questionnaire was used to collect the data. The questionnaire deals with social economic aspects, information relating to duration of disease, place of treatment and complications relating to disease, the direct cost of Diabetes, indirect and the economic burden faced by the patients because of diabetic cost.

Data Analysis

The data were entered in SPSS version 20.0 and percentage analysis is applied in order to interpret the Socio-economic and clinical profile of the diabetic patients. The Direct cost, Indirect cost and Intangible cost incurred by Diabetic patients in the estimated by Descriptive statistical tool. Chi-square test is applied in order to find out the association between the clinical factors and cost of treating Diabetes. ANOVA is used to analyse the relationship between the age and total cost. The factors influencing the cost of treating Diabetes and the Economic burden of Diabetic patients in the Kannamanaickanur Village have been analysed by multiple regression model.

Multiple Regression Analysis

In this model the dependent variable is Total Direct and Indirect Cost of Treating Diabetes and independent variables are, Nature of the hospital preferred to go for a treatment, Frequency of visiting the hospital in a year, Duration of diabetes and Number of complications of Diabetes.

Dependent Variable: Total Direct and Indirect Cost of Treating Diabetes (Y)
Independent Variable
1. Nature of the hospital Preferred to go for a treatment(X_1)
2. Frequency of visiting the hospital in a year (X_2)
3. Duration of Diabetes (X_3)
4. Number of complications of Diabetes (X_4)

Hence the Multiple regressions Model is

TCTD (Y) = α + α_1 Nature of the hospital preferred to go for a treatment + α_2 Frequency of Visiting the Hospital in a year + α_3 Duration of Diabetes + α_4 Number of complications of Diabetes + U
Where

1. **TCTD** = Total cost of treating Diabetes in a year αs are parameters to be estimated
2. **U** = Error term

Data Analysis and Interpretation
Social and Economic profile of the Diabetic Patients

Characteristics	Categories	Frequency	Percent
Age	Below 20	1	1.7
	21 - 40	7	11.7
	41 - 60	35	58.3
	Above 60	17	28.4
Gender	Male	32	53.3
	Female	28	46.7
Marital status	Married	56	93.3
	Unmarried	1	1.7
	Widow	3	5.0

Number of Children	0	16	26.7
	1 - 2	37	61.7
	3 - 4	4	6.7
	Above 4	3	5.0
Educational Status	Illiterate	19	31.7
	School level	27	45.0
	Graduate	12	20.0
	Post graduate	1	1.7
	Professional	1	1.7
Occupational Status	Government employee	5	8.3
	Private employee	7	11.7
	Entrepreneurs	3	5.0
	Professionals	4	6.7
	House Wife	20	33.3
	Student	5	8.3
	Agricultural labors	16	26.7
Type of Family	Joint family	4	6.7
	Nuclear Family	56	93.3
Income Details	Below 25000	35	58.3
	25001 - 50000	21	35.0
	50001 - 100000	3	5.0
	Above 100000	1	1.7

Mean and Standard Deviation of Direct Cost for Regular Visit

S. No	Direct Cost for Regular Visit	No. of Patients	Mean	SD
1.	Doctor consultation	46	435.87	269.085
2.	Specialist Fees	9	922.22	423.609
3.	Laboratory charges, ECG	17	222.94	230.347
4.	Medicines	59	631.18	379.566
5.	Total Direct cost for Regular visit	53	1315.66	727.619

Mean and Standard Deviation of Opinion of Diabetic patients

Opinion of Diabetic patients	Mean	SD
Cost of Treatment is high	1.95	1.241
Cost of medicines and test charges are high	1.85	1.055
Cost is high when diabetic complications are more	1.92	1.225
Burden increases due to increase cost of treatment	2.08	1.1211
Indebted due to high cost of treatment	3.32	.948
Cost is in par with Treatment	2.55	1.307
Diabetic is in control after treatment	1.32	.911
Treatment is good in Private and Specialty hospitals	1.48	1.081
Satisfied with the Treatment given	1.43	1.031

Chi-square Test for Association between number of Complications of Diabetes and the Total Cost of Treatment for Diabetes

Null hypothesis: There is no significant difference among number of complications of Diabetes and the Total cost of treatment for Diabetes.

Chi-square test for association between number of complications of Diabetes and the Total cost of treatment for Diabetes

Number of Complications of Diabetics	Total cost for Diabetes	Total cost for Diabetes	Total cost for Diabetes	Total cost for Diabetes	Total	Chi square value	P value
	Below 1000	1000 - 2000	2000 - 3000	Above 3000			
0	1 (50%) [3.1%]	0 (0%) [0%]	1 (50%) [12.5%]	0 (0%) [0%]	2 (100.0%) [3.3%]	115.557	0.716
1	2 (40%) [6.3%]	2 (40%) [11.8%]	0 (0%) [0%]	1 (20%) [33.3%]	5 (100.0%) [8.3%]		
2	7 (53.9%) [21.9%]	5 (38.5%) [29.5%]	1 (7.7%) [12.5%]	0 (0%) [0%]	13 (100.0%) [21.7%]		
>= 3	22 (55%) [68.8%]	10 (25%) [58.9%]	6 (15%) [75%]	2 (5%) [66.7%]	40 (100.0%) [66.7]		
Total	32 (53.3%) [100.0%]	17 (28.3%) [100.0%]	8 (13.3%) [100.0%]	3 (5%) [100.0%]	60 (100.0%) [100.0%]		
Note: 1. The value within ( ) refers to Row Percentage. 2. The value within [ ] refers to Column Percentage.							

The given statistical results are related to a Pearson chi-square test conducted to evaluate the relationship between diabetic complications and the total cost involved. The chi-square test assesses whether there is a significant association between two categorical variables. The Pearson chi-square value obtained in this test is 115.557. The degrees of freedom (d.f) are 125. The p-value is 0.716. Since the p-value is greater than the significance level of 0.05, we fail to reject the null hypothesis that there is no significant association between diabetic complications and the total cost involved. In other words, we cannot conclude that the two variables are related. Therefore, based on these results, we cannot establish a significant relationship between diabetic complications and the total cost involved. It is important to note that this conclusion is based on the assumption that the data satisfies the assumptions of the chi-square test, such as the independence of observations and an adequate sample size in each category.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.560[a]	.314	.264	1113.631
a. Predictors: (Constant), Duration of Diabetes, Diabetic Complications of the Respondent, Number of Visit to the Hospital in a Year, Nature of the Hospital to go for a Treatment.				

Anova

Model		Sum of Squares	Df	Mean Square	F	Sig.
	Regression	31169386.765	4	7792346.691	6.283	.000[b]
	Residual	68209617.819	55	1240174.869		
	Total	99379004.583	59			
a. Dependent Variable: Total direct cost and indirect cost						
b. Predictors: (Constant), Duration of Diabetes, Diabetic Complications of the Respondent, Number of Visit to the Hospital in a Year, Nature of the Hospital to go for a Treatment.						

Coefficients

Model	Un-standardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	2155.752	765.321		2.817	.007
Nature of the Hospital Preferred to go for a Treatment	-540.615	129.405	-.484	-4.178	.000
Number of Visiting the Hospital in a Year	478.532	259.323	.211	1.845	.070
Diabetic of Complications of Respondent	199.804	114.241	.197	1.749	.086
Duration of Diabetes	.288	117.303	.000	.002	.998

a. Dependent Variable: Total direct cost and indirect cost

The nature and importance of various descriptive variables influence the total direct and indirect cost of treating diabetes revealing that the duration of Diabetes, Diabetic Complications of the respondent, and Number of Visiting the Hospital in a Year are positively significant at a 5 percent level. The nature of the Hospital Preferred to go for treatment of the sample respondents is statistically significant and has a negative impact. However, out of four variables, only two variables i.e., Duration of Diabetes and Diabetic Complications of

Respondents in the model influenced the total direct and indirect cost of treating diabetes value significantly. Duration of Diabetes and Diabetic complications of respondents is the major determinant of the total direct and indirect cost of treating diabetes

4. RESULT AND DISCUSSION

The majority (86.7) percent of Diabetic patients belong to the age group 41 to 60 and above 60 categories. Both males and females are almost equally affected by Diabetes. The majority (93.3) percent of persons are affected by Type 2 Diabetes. 51.7 get diabetes as hereditary. 21.7 percent get it because of obesity. 1.7gets because of physical inactivity and sedentary living. 5.0 percent is due to urbanization and 15.0 percent is due to stress. 96.7 percent of diabetic patients have hypertension complications. 15.0 percent have Dyslipidemia, 83.3 patients suffer from depression, 11.7 percent are affected by cardiovascular problems, 30.0 have retinopathy complications, 13.3 percent have neuropathy, 10.0 percent suffer from nephropathy, 70.0 percent suffer from a foot problem and 16.7 percent has other problems. 10.0 percent underwent surgery due to diabetes complications. Mostly it is Eye surgery.

The mean and standard deviation of direct cost and indirect cost for regular visits. The data includes the direct cost and indirect costs of Diabetic patients. On average the patients spend Rs.435.87 for doctor consultations Rs.922.22 for specialist charges, Rs.222.94 for laboratory charges ECG, etc., and Rs.631.18 for medicines. The total mean cost for the patient for their regular visit is Rs.1315.66 per month. The results of the ANOVA revealed that there is no significant difference between the income level of diabetic patients and the nature of hospitals preferred for diabetes treatment. The chi-square value of 49,953 for 36 df and P value of 0.061 ($P>0.05$); shows that there is no significant relationship between the age of the respondents and the incidence of diabetic complications. The chi-square value of 115.557 for 125 df and P value of 0.716($P>0.05$); shows that there is no significant association between the diabetic complications and the total cost involved. The chi-square value of 152.895 for 156 df and the P value of 0.555($P>0.05$); shows that there is no significant relationship between the duration of diabetes and the total cost involved. Regression Analysis revealed that the duration of Diabetes and its complications of respondent is the major determinants of the total direct and indirect cost of treating diabetes.

5. CONCLUSION

Diabetes is prevalent, persistent, and expensive. The prevalence of diabetes is reaching alarming levels and continues to rise. Every seven seconds, a person loses their life to diabetes, resulting in four million deaths worldwide annually. Diabetes, similar to other chronic illnesses, not only creates a significant economic strain on society but also places a heavy financial burden on individuals, patients, and their families. Due to the increased need for medical services, individuals with diabetes often face higher overall medical costs and out-of-pocket expenses compared to those without the condition.

The expenses associated with managing diabetes are on the rise. Diabetic individuals incurred notably higher costs for their care, including expenses for medications, insulin, hospital admissions, laboratory services, dietary needs, transportation, and longer hospital stays.

Despite the presence of government healthcare facilities providing free services, they struggle to cater to the needs of all patients. Health insurance coverage remains limited in popularity. The substantial expenses associated with treating diabetes across various socio-economic patient demographics will place a significant strain on both individuals and government resources. In light of the escalating diabetes burden, it is imperative to adopt a health system-strengthening strategy that includes standardized care practices, nationally recognized management protocols, and regulatory guidelines. A robust and extensive healthcare infrastructure is crucial for fostering a population of healthy individuals who can actively contribute to social and economic progress. While the Government of India has introduced commendable initiatives at the national level, it is essential to implement these measures at the grassroots level to prevent the emergence of a diabetes pandemic in India.

Suggestions to Control Diabetes
Regular blood tests are essential to monitor health and can be prevented by avoiding a sedentary lifestyle and making healthier choices. Being overweight or obese is a risk factor for diabetes, making daily exercise crucial for prevention. Adequate sleep of 7-8 hours per day is necessary to maintain high energy levels and reduce cravings for unhealthy foods. Stress is a leading cause of many diseases, including diabetes, as stress hormones can directly impact blood glucose levels. Therefore, managing stress is vital for a happier and healthier life.

Policy Recommendations
The economic burden of diabetic people increases because they are approaching only private hospitals for treatment where they have to spend more. Even low- and middle-income people do not approach government hospitals because of their poor quality of treatment, poor infrastructure, and shortage of manpower. The government hospital should be renovated with modern infrastructure and advanced medical technology. The quality of treatment should be improved. The government should take measures to supply the medicines for the diabetic people at subsidized rates. Introduction of cost reduction and cost-effective strategies for diabetes care should be implemented. Research should be encouraged on the basic, clinical, and social aspects of diabetes. The primary data study shows that only 2.4 percent of diabetic people have a Mediclaim policy. Many people were not aware of the insurance policy and some are of the view that it does not cover the entire diabetic expenses. Hence awareness should be created among people about the importance of insurance policies and the government should revise the existing insurance policies to suit the needs of diabetic patients. The policy should cover all the expenses of diabetic patients.

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