Risk of Hospitalisation among Patients with Type 2 Diabetes and its Determinants: A Logistic Regression Model

Subha P P[1] & Roy Scaria[2*]

[1]Assistant Professor, Research Department of Economics, Government College, Nattakom, Kottayam, Kerala, India.

[2]Assistant Professor, Department of Economics, T.M Jacob Memorial Government College, Manimalakunnu, Kerala, India (Research Guide, Research Department of Economics, Government College, Nattakom, Kottayam).

[*]Corresponding author email: royscariath@gmail.com

Abstract

Type 2 diabetes is a chronic metabolic disease, which occurs because of the ineffective use of the insulin produced in the body cells. The number of people with Type 2 diabetes is increasing in the worldwide, India and the state of Kerala. There are many factors responsible for the prevalence of the disease. The present study analyses the rate and risk of hospitalization among patients having Type 2 diabetes in Malappuram District, Kerala among the casual workers. The analytical tool of the study includes Percentages, Cross tabs, χ^2 Test and the Binary Logistic Regression Econometric Model. The study found that out of the 360 patients having Type 2 diabetes 32% (115 patients) has been hospitalized during the last one year period. Further, The Model result shows that place of residence, dietary type, obesity, family history of diabetes and complications are significant factors influencing the likelihood of hospitalization of Type 2 diabetes patients.

Keywords: *Type 2 diabetes, Hospitalization, Factors affecting hospitalization, obesity, diabetic history of family, Human Capital.*

1.1 Introduction

Diabetes, especially Type 2 becomes one of the major health problems of almost all countries of the world, both developed and developing. With each passing year, there is an increase in the number of people lives with this disease and people with the diabetic potency to enter into the disease. The mounting number of patients of any disease adversely affects humans being a productive resource for the society and the nation. "There are a number of factors that influence the development of Type 2 diabetes; it is obvious that the most influential are lifestyle behaviours which include consumption of processed foods, physical inactivity, and long sedentary periods" (Thiyagarajan & John, 2017). The recent estimates by the International Diabetes Federation, 2015 showed that "the number of adults affected by the disease in 2015 was 415 million which was projected to increase to 642 million by 2040. In addition to the 415 million adults, there are 318 million adults with impaired glucose tolerance, which puts them at high risk of developing the disease in the future" (International Diabetes Federation, 2015).

It is observed, "Long standing diabetes mellitus is associated with an increased prevalence of microvascular and macrovascular diseases" (Ramachandran, Snehalatha &Viswanathan, 2002). Heart disease and stroke (macrovascular complications) and blindness, kidney disease, nerve damage, and amputation (microvascular complications) are the important complications associated with diabetes. These complications lead to increased hospitalization and treatment cost, affecting the individual's capacity to do their job effectively and spike the economic burden of patients, family and the society.

It is observed that "good health the foundation on which to build- a life, a community, and an economy" (Hayden, 2014). Nowadays health is being considered as an important productive resource and expenditure for health care turns to be a vital area of investment because human capital is considered as a key factor for increasing productivity and economic progress. A

healthy life style and food habit reduce stress and improve the feeling of wellness, which in turn reduces absence from work due to sickness. "Activities that influence future real income by imbedding resources in people such as schooling, on- the job training, medical care, and consumption of vitamins and acquisition of information about the economic system as investment in human capital" (Becker, 1962, p. 9). Schultz remarked that direct expenditure on health is investment in human capital (Schultz, 1961, p. 1).

1.2 Statement of the Problem

Since Kerala has the highest proportion of elderly in India, the state has a highest prevalence of diabetes also. This is due to the drastic changes in the living standards and life styles of the people in the state. "Kerala is considered to be the diabetes capital of India, with 27% of adult males and 19 % of adult females being diabetic". (Health and Family Welfare Department, Government of Kerala, 2013). Moreover, several studies reported that the rate of hospitalisation was higher among patients with Type 2 diabetes. "People with Type 2 diabetes have 2-6 times higher hospital admission and also excessive length of hospital stay than that of people without Type 2 diabetes" (Comino, et.al., 2015). In the present study the risk of hospitalization among patients with Type 2 diabetes in Malappuram district and the socio economic factors influencing it, has been studied.

1.3 Significance of the Study

Based on several studies, it is generally accepted that various demographic, socio-economic, life style factors increase the prevalence of Type 2 diabetes. This study helps to identify the risk factors of hospitalization among patients having the disease. Hospitalization is one of the important cost drivers of the Type 2 diabetes, the study will benefit the patients to make more aware about these factors and helps to modify the risk of hospitalization and related economic burden.

1.4 Methodology

The study mainly used primary data collected from a sample survey conducted in Malappuram district in Kerala where the diabetes prevalence has been high as 25.9% (Zachariach & Rajan, 2008) in the state with a structured questionnaire. The district is also particular in that the number of casual workers is the highest in the state. The samples, diabetic patients among casual workers, have been selected using a multi-stage random sampling technique. In the first stage, three *Taluks*, *Nilambur*, *Eranad* and *Perunthalmanna* have been selected at random out of six *Taluks* in the district. Secondly, two *Grama Panchayats* and one *Muncipality* from each *Taluk* have been selected randomly being the representative of rural and urban areas. Thirdly, two wards were selected at random from the selected *Grama Panchayats* and *Municipalities*. Finally, 25 sample units, the diabetic patients who engage with casual work, from the wards of *Municipalities* and 35 each from the wards of Grama Panchayats were selected at random. The rural urban proportion of the sample is kept akin to the proportion of rural and urban population in the district.

Hospitalisation and its determining demographic, socio economic, life style factors have been analysed using a Binary Logistic Regression model. Hospitalisation of the sample respondents, the dependent variable, is taken to be as a dichotomised dummy variable with value '1', if a patient is hospitalised and '0' otherwise.

1.5 Results and Discussion

The study considered various factors affecting the risk of hospitalization as demographic factors, socio-economic factors, life style factors and the health related factors. The demographic factors comprises of   age, gender and place of residence while, the socio-economic factors consists of religion and educational status of the patients. Besides, the life style factors take into account the alcohol use, tobacco use, regular exercise, dietary type and

obesity. In addition, information regarding the diabetic history of patient's family, presence of co-morbidities and the occurrence of complication among the sample patients has been collected. The profile of the sample respondents in respect of the stated independent variables is presented in Table 1.

Table 1

Socio Economic Profile of the Sample Respondents

Variables	No. of Type 2 Diabetic Patients(N=360)	Percentage
Age		
20-29	1	.3
30-39	25	6.9
40-49	77	21.4
50-59	179	49.7
More than 60	78	21.7
Gender		
Male	183	50.8
Female	177	49.2
Place of Residence		
Rural	134	37.2
Urban	226	62.8
Education		
Illiterate	56	15.6
Primary level	165	45.8
High school level	115	31.9
Higher secondary level	20	5.6
College level	4	1.1
Religion		
Hindus	84	23.3
Muslims	267	74.2
Christians	9	2.5
Tobacco use		
No	187	51.9
Yes	173	48.1
Alcohol use		
No	300	83.3
Yes	60	16.7
Regular Exercise		
No	279	77.5
Yes	81	22.5
Dietary Type		
Vegetarian	103	28.6
Non vegetarian	257	71.4
Obesity		

Not Obese	150	41.7
Obese	210	58.3
Family History of Diabetes		
No	140	38.9
Yes	220	61.1
Co morbidities		
BP	165	45.8
Cholesterol	36	10.0
Both of them	159	44.2
Complications		
No	198	53.3
Yes	162	46.7

Note. From Primary Data collected from Malappuram District, Kerala

1.6 The Proportion of Hospitalization among Type 2 Diabetes Patients among Casual workers

Figure 1 and 2 show the proportion of patients hospitalised during the last one year (prior to the survey) and frequency of hospitalisation respectively. The number of patients hospitalised was 115, 32 per cent of the total. Further, 96 patients (84%) hospitalised only once, 13 patients (11%) twice and 6 patients (5%) thrice.
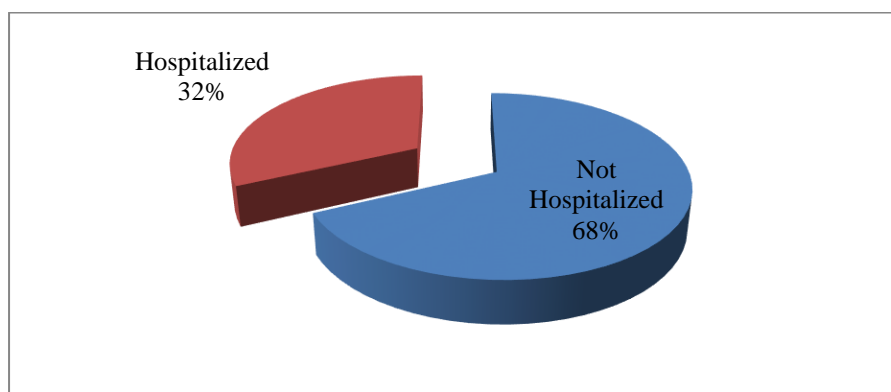

Figure1. Proportion of hospitalization among patients having Type 2 diabetes among casual workers.
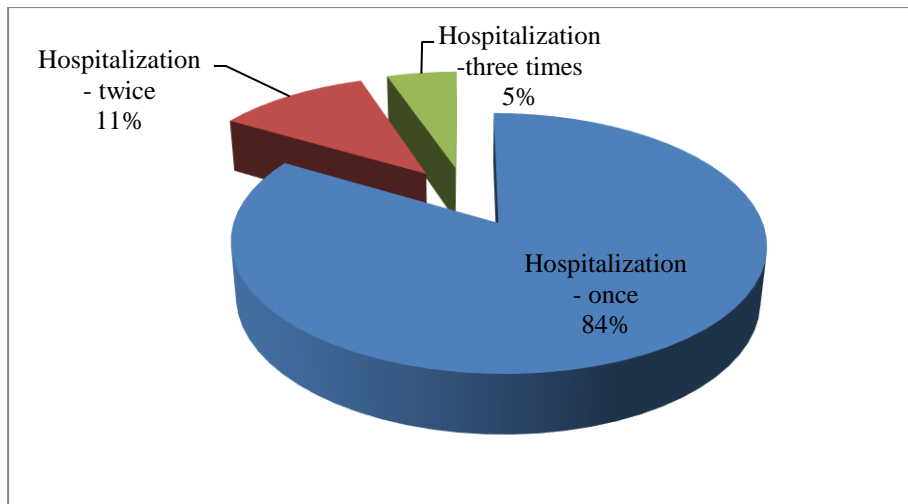
Source: Primary Data collected from Malappuram District

Figure2. Frequency of Hospitalization

Source: Primary Data collected from Malappuram District

1.7 Hospitalization and Diabetes Related Complications

World Health Organization 2016 reported, "diabetes if not well controlled, may cause blindness, kidney failure, lower limb amputation and several other complications". These complications require long-term treatment, which is considered as the prime cause for hospitalization among Type 2 diabetic patients. Furthermore, these complications increase the hospitalization cots and thereby "account for 60 per cent of diabetes related health care costs (direct cost) and almost 80-90 per cent of indirect costs" (Kapur, 2007). Another study reported that "The three most common reasons for hospitalizations in patients with diabetes were diseases of the cardiovascular system (53.6%), diseases of the respiratory system (22.8%), and diabetes as a principal diagnosis (6.3%)"(Al-Adsani & Abdulla, 2015, p. 65). Hence, the present study analyse the association of hospitalization and complication of diabetes. The association between hospitalisation and diabetic complications of patients has been checked using cross tabs as illustrated in table 2.

Table 2

Hospitalization and Diabetes Related Complications

Type 2 Diabetes Patients Hospitalised		Patient have diabetic complications			χ^2 Test Results
		No	Yes	Total	
Not Hospitalized	No. of Patients	176	69	245	
	% of Patients have diabetic complications	91.7%	41.1%	68.1%	$\chi^2 (1)$ **= 05.504** **p<.001** **Cramer's V=.541, p<.001**
Hospitalized	No. of Patients	16	99	115	
	% of Patients have diabetic complications	8.3%	58.9%	31.9%	
Total	No. of Patients	192	168	360	
	% of Patients have diabetic complications	100.0%	100.0%	100.0%	

Note. From Primary Data collected from Malappuram District, Kerala

It can be found from the Table 2 that hospitalization is more among patients having Type 2 diabetes complications than that of those having no complications. The Table further indicates that, 58.9 % (99 patients) of patients with complication have had hospitalization during the last one year (prior to the survey), while only 8.3% (16 patients) of patients without complication have had hospitalisation. A Chi-square test was performed to test whether there is a statistically significant association between hospitalization and complication of Type 2 diabetes. The test result shows that there is a statistically significant association between hospitalization and complication, χ^2 (1) =105.504, p< .001. However, the relationship is found to be moderate, Cramer's V=.541, p<.001.

1.8 Factors Affecting Hospitalization among Type 2 Diabetes Patients

"Type 2 diabetes is the commonest form of diabetes constituting 90% of the diabetic population" (World Health Organization, 2016). It is a lifelong disease, which requires

continuous care management from the beginning. Many factors are responsible for the prevalence of the disease. The Global diabetes report, 2016 says, "the risk of type 2 diabetes is determined by interplay of genetic and metabolic factors. Ethnicity, family history of diabetes, and previous gestational diabetes combine with older age, overweight and obesity, unhealthy diet, physical inactivity and smoking to increase risk". Diabetes leads to many life threatening complications such as amputation, retinopathy, cardiovascular disease, nephropathy, neuropathy and peripheral vascular disease. The complications and many risk factors together lead to increased hospitalization among the patients.

Running Binary Regression, the model summary obtained is illustrated in Table 3.

Table 3

Binary Logistic Regression showing Factors Affecting Hospitalization among Type 2 Diabetes Patients having Type 2 Diabetes. Dependent Variable- Hospitalization of Type 2 diabetes

Predictors	Coefficient	Std. Error	z	p-value	Odds Ratio
const	−4.61068	1.61652	−2.852	0.0043***	
Age	0.0182772	0.0265024	0.6896	0.4904	1.0184
Female (RC)					
Male	0.158141	0.347386	0.4552	0.6489	1.1713
Urban(RC)					
Rural	−0.768081	0.326431	−2.353	0.0186**	0.4639
Illiterate(RC)					
Primary Level	0.225309	0.419924	0.5365	0.5916	1.2527
High School Level	−0.0139626	0.544320	−0.02565	0.9795	0.9861
Higher Secondary Level	0.990845	0.918384	1.079	0.2806	2.6935
College Level	−0.720418	1.09878	−0.6557	0.5120	0.4865
Hindus (RC)					
Muslims	0.847397	0.498673	1.699	0.0893	2.3336
Christians	0.267701	0.954199	0.2806	0.7791	1.3070
Tobacco use (No) (RC)					
Tobacco use (Yes)	0.632008	0.355634	1.777	0.0755	1.8814
Alcohol use (No) (RC)					
Alcohol use (Yes	−0.384044	0.542580	−0.7078	0.4791	0.6811
Exercise(No) (RC)					
Exercise(Yes)	−0.293494	0.384844	−0.7626	0.4457	0.7457

Vegetarian Non Vegetarian(RC)	−1.00331	0.392208	−2.558	0.0105**	0.3667
Not Obese(RC) Obese	1.33715	0.374522	3.570	0.0004***	3.8082
Family history(RC) Family history	0.680972	0.329261	2.068	0.0386**	1.9758
Diabetic Duration	0.0228842	0.0314632	0.7273	0.4670	1.0231
Complications(No) (RC) Complications(Yes)	2.26044	0.381176	5.930	<0.0001***	9.5873
BP(RC) Cholesterol	−0.0743598	0.523095	−0.1422	0.8870	0.9283
Both of them	0.324762	0.329376	0.9860	0.3241	1.3837

Note. From Primary Data collected from Malappuram District, Kerala

The regression result shows that place of residence, dietary type, obesity, family history of diabetes and complications are significant factors influencing the likelihood of hospitalization of Type 2 diabetes patients. Place of residence is a significant factor affecting hospitalization of the disease (Odds Ratio=0.4639, p=0.0186), which shows that the hospitalization of diabetes patients is 0.4639 times higher among respondents residing in rural areas than urban areas. Dietary type is also significantly affecting hospitalization of Type 2 diabetics (Odds Ratio=0.3667, p=0.0105), the odds ratio implies that that hospitalization of Type 2 diabetes patients is 0.3667 times higher among patients having non vegetarian dietary type than those having vegetarian diet. The next important factor affecting the hospitalization of patients is obesity (Odds Ratio=3.8082, p=0.0004) indicating that the hospitalization of Type 2 diabetes is 3.8082 times higher among individuals having obesity than those of having no obesity.

Family history of diabetes also have significant influence on the likelihood of the hospitalization of Type 2 diabetics (Odds Ratio=1.9758, p=0.0386) indicating that individuals having family history of diabetes causes 1.9758 times hospitalization as compared to patients having no family history of diabetes. The most important factor that determines hospitalization among patients having Type 2 diabetes is the complication. Type 2 diabetes

complications have significant influence on the likelihood of the hospitalization (Odds Ratio=9.5873, p=<0.0001) indicating that individuals having complications causes 9.5873 times hospitalization as compared to patients having no complications. The Table again shows that age, gender, education, religion, alcohol consumption, tobacco use, regular exercise, diabetic duration and co morbidities have no influence on the hospitalization of Type 2 diabetes patients.

1.9 Conclusion

As far as Type 2 diabetes patients are concerned, frequent hospitalisation augment the treatment cost and other costs, indirect and intangible, which can have a significant impact on the quality life of patients and their families. Casual workers being the downtrodden low earning section of the society, heavy treatment costs will impair their income consumption pattern and hence the overall quality of life.   Hence, frequent hospitalisation needs to be avoided and it   requires reducing the severity or complications of the disease through appropriate care, timely diagnosis and risk management plans with regard to food habit, doing regular exercises and judicious optimum intake of medicines.

One cannot modify the diabetic history of family, however, possible to modify the present state, which would be the history in the future. As diabetes is a lifelong disease once affected, minimising the risk of hospitalisation and related cost of treatment has long term positive economic effects on the individual, the society and the nation. The frequency of hospitalization and the length of stay in hospital need to be reduced so that all types of catastrophic costs associated with the disease can be minimised. It is to be emphasised contextually that people should be better aware of the disease and risk management of hospitalization.

References

Al-Adsani, A. M., & Abdulla, K. A. (2015). Reasons for hospitalizations in adults with diabetes in Kuwait. *International Journal of Diabetes Mellitus*, 65-69.

Becker, G. S. (1962). Investment in human capital: A theoretical analysis. *The Journal of Political Economy, 70*, 9-49.

Comino, E. J., Harris, M. F., Islam, M. F., Tran, D. T., Jalaludin, B., Jorm, L., . . . Haas, M. (2015). Impcat of diabetes on hospital admission and length of stay among a general population aged 45 year or more: A record linkage study. *BMC Health Service Research*, 1-13.

Hayden, J. (2014, December 09). *World Economic Forum*. Retrieved from weforum.org/agenda/2014/12/why-good-health-is-the-first-wealth/.

Health and Family Welfare Department, Government of Kerala. (2013). *Health policy Kerala-2013*.

International Diabetes Federation. (2015). *IDF Diabetes atlas seventh edition.* Brussels, Belgium: International Diabetes Federation.

Kapur, A. (2007). Economic analysis of diabetes care. *Indian Journal of Medical Research*, 473-482.

Ramachandran, A., Snehalatha, C., & Viswanathan, V. (2002, December 25). The burden of type2 diabetes and its complications- the Indian scenario. *Current Science, 83*(12), 1471-1476.

Schultz, T. W. (1961, March). Investment in human capital. *The Americn Economic Review, 51*, 1-17.

Thiyagarajan, S., & John, S. (2017). Does diabetes blight work productivity:Across sectional investigation on selected type 2 diabetes participants. *Journal of Social Health and Diabetes*, 43-46.

World Health Organization. (2016). *Global Report on Diabetes.* Geneva, Switzerland: World Health Organization.

Zachariah, K. C., & Rajan, S. I. (2008, September). Costs of basic services in Kerala, 2007 education, health, childbirth and finance (loans). Centre for Development Studies, Trivandrum.