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Growth and incidence of type 2 diabetes mellitus in North Kerala

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ABSTRACT

Diabetes is one of the major health problems in the developing countries. As the International Diabetes Federation (IDF) suggests that the number of adults living with diabetes worldwide was increasing from time to time. The study was conducted to assess the incidence of growth in the occurrence of type 2 diabetes (T2DM)) in North Kerala and also to develop a mathematical model to predict the growth of T2DM. The study was undertaken as a descriptive study in three multi-speciality hospitals in North Kerala. Details regarding the census of both in patients (IP) and out patients (OP) of T2DM were retrieved from the hospital records of past 10 years. These secondary data was subjected to regression analysis to predict the growth in the occurrence of both diabetes IP and OP till the year 2025. The findings of the study concluded that during the last 10 year diabetic OP percentage increased from 18.4% to 48.7%. There would be a substantial increase in the growth of diabetes would occur by the year 2025. Data also indicate that male T2DM patent has high chance of being affected by diabetes than female counterparts.

Key Words : Type 2 diabetes, Prediction, Inpatients, Outpatients, Mathematical model

INTRODUCTION

Diabetes is one of the major health and development challenges of the 21st century. It is an incurable, costly, increasing but largely preventable non-communicable disease that affects people of all ages. No country, rich or poor, is immune to the epidemic. Diabetes mellitus is considered as one of the major health problems in India. With high rates of prevalence and a steadily increasing demographic burden, diabetes has emerged as a major noncommunicable disease worldwide. The current prevalence of diabetes in India is 69.2 million and is expected to rise to 123.5 million (78.5% increase) by the year 2040, effectively rendering every fifth diabetic in the world to be an Indian (IDF, 2015).

The burden of ill health due to diabetes has also been increasing, primarily in developing world; in 2014 diabetes caused 1.5 million deaths worldwide and more than 80% of these deaths occurred in low- and middle-income countries (Cheema *et al*., 2014).

It is reported that nearly one million diabetic deaths every year in India .Kerala is the diabetes capital of India with a prevalence of diabetes as high as 20 per cent, more than double the national

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average of 8 per cent (Daivadanam *et al*., 2014). In a large multi-center study the prevalence of diabetes in Thiruvananthapuram was 17 per cent compared to 15 per cent in Hyderabad and New Delhi, 4 per cent in Nagpur and 3 per cent in Dibrugarh (Mohan *et al*., 2007).

Early detection of Pre diabetes and appropriate lifestyle modification can prevent the development of full-fledged Diabetes mellitus. Only very few published studies are available on the prevalence of Diabetes in the Kerala state, most of which indicate high prevalence. The increasing global burden of type II diabetes makes this a disease of considerable concern at the individual patient level and also at the public health level given the direct health costs and indirect costs of loss of work productivity.

Objectives :

- To assess the growth in the occurrence of T2DM patients in North Kerala regions
- To develop a mathematical model to predict the growth of T2DM.

METHODOLOGY

This is a completely hospital-based descriptive study mainly conducted in three leading multi-speciality hospitals in Calicut, Malappuram and Wayanad districts in North Kerala during the period from January 2007 to December 2016. T2DM patients both OP and IP visited the hospital for past 10 years were retrieved from hospital records and registers. The raw data were then subjected to statistical computations using the SPSS (Statistical Package for Social Sciences) version 21.0. The statistical methods adopted were Least Square Method (LSM) in regression analysis to predict growth of diabetes, One-way ANOVA to compare means of selected variables and simple correlation methods to investigate the dependence between multiple variables at the same time

RESULTS AND DISCUSSION

Results and discussion pertaining to the study is presented under the following heads. Fig. 1 represents the daily census of patients visited the hospital for the years from 2007 to 2016

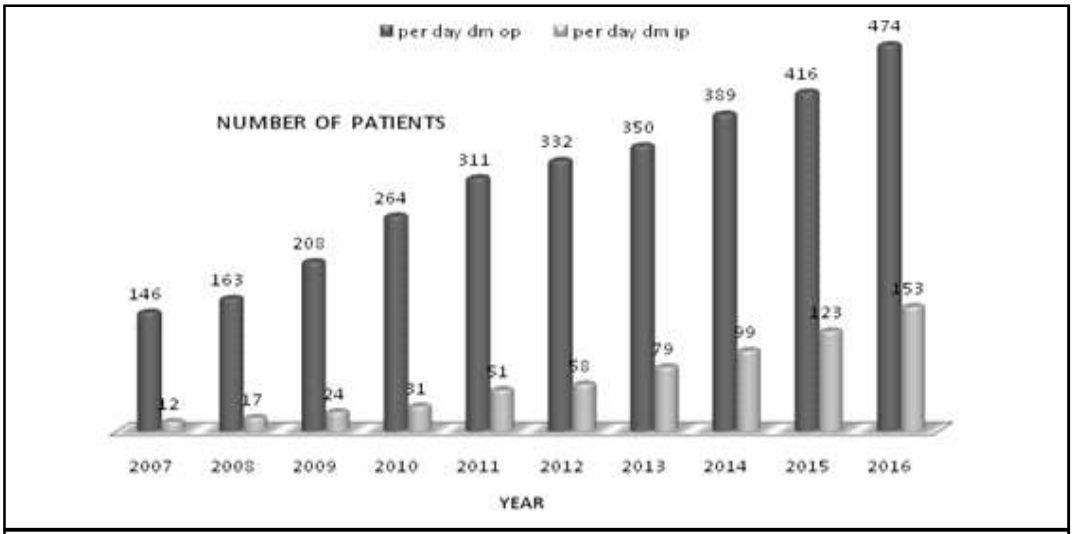

Fig. 1 : Daily census of OP and IP visited the hopsital

The data indicates that there is considerable increase in the number of OP and IP annually. Also the overall data high lights that within 10 year percentage of diabetic IP increased from 18.4% to 48.7%, when statistically tested both the observations prove statistical significance in this study.

Table 1 indicates that there is a considerable increase in the number of both male and female OP. A study conducted by Zaman *et al*. (2011) in KBN medical college report that the total percentage of new and old cases of diabetes mellitus was 19.78%, 16.06% in males and 22.04% in females .But in this study overall data high lights that in the case of OP, for all the years studied the number of males were greater than that of females.

Table 1 : Year wise census of OP based on gender

Year	Total	Male	%	Female	%
2007	45552	25776	56.59	19766	43.41
2008	50856	26895	52.88	23961	47.12
2009	64896	33258	51.25	31638	48.75
2010	82368	43892	53.29	38476	46.71
2011	97032	49501	51.02	47531	48.98
2012	103584	54260	52.38	49324	47.62
2013	109200	55632	50.95	53568	49.05
2014	121368	65893	54.29	55475	45.71
2015	129792	71256	54.90	58536	45.10
2016	147888	84376	57.05	63515	42.95
Total	952536	510739	53.62	441797	46.38

The secondary data from hospital records on diabetes patients as shown in Fig. 1 was subjected to regression analysis to predict the growth in the occurrence of diabetes IP and the details are presented in the Table 2

Table 2 : Prediction of the growth and occurrence of diabetes IP

r2	0.944	n	10
r	0.972	k	1
Std. error	11.98933	Dep. Var	In patient census

Anova table

Source	SS	df	MS	F	P-value
Regression	19504.148	1	19504.148		
Residual	1149.952	8	143.744	135.687	<0.001
Total	20654	9			

Regression output

Variables	Coefficents	Std. error	t (df=2)	P-value
Intercept	-30863.636	2655.145	-11.624	<0.001
t	15.376	1320	11.648	

It was observed from the regression analysis that the model is very much fit as there is 97.2 per cent reliability in the prediction. This implies that there is high dependence between year and number of IP. The Anova indicates high statistical significance in prediction using this model.

Fig.2 describes time series analysis and prediction of growth in the occurrence of diabetes OP using secondary data. Hospital records census for in patients was available for 2007-2016. Adopting Least Square Method, the predication was done using the equation y= a+bx, Where, y = total number of OP. a and b = constant value x = the year we want to predict number of OP. While substituting the value Y = - 30863.636(15.376* year)

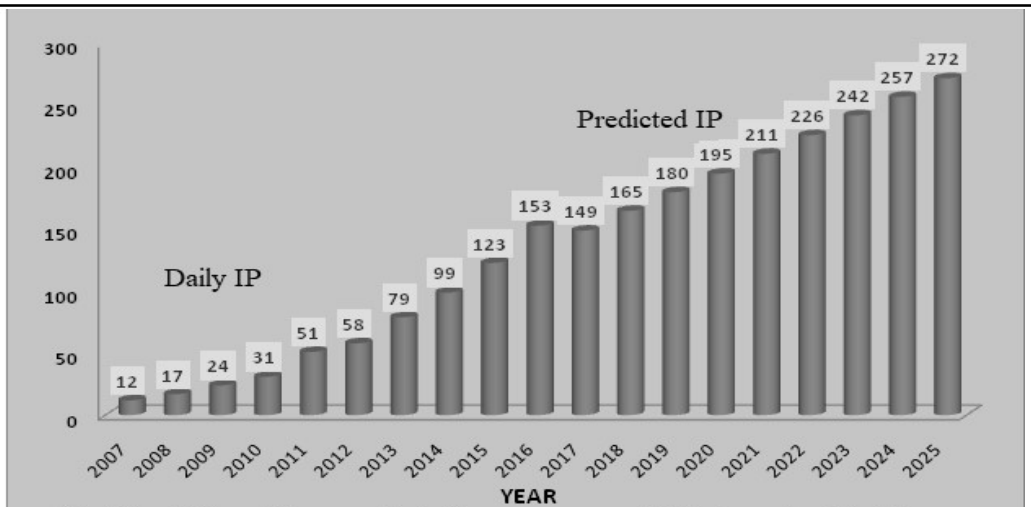

Fig. 2 : Prediction of the growth in the occurrence of diabetes using IP data

The secondary data on daily census of diabetic patients from hospital records as shown in Fig.1 was again subjected to regression analysis to predict the growth in the occurrence of diabetes OP, and the details are presented in Table 3.

Table 3 : Prediction of the growth in the occurrence of diabetes using OP data

r2	0.984	n	10
r	0.993	k	1
Std. error	13.81485	Dep. Var	In patient census

Anova table

Source	SS	df	MS	F	P-value
Regression	1905735.300	1	105735.3		
Residual	1526.800	8	190.85	554.023	<0.001
Total	107262.100	9			

Regression output

Variables	Coefficents	Std. error	t (df=2)	P-value
Intercept	-71706.400	3059.423	-23.438	<0.001
t	35.800	1.521	23.538	

Table 4 : Prediction of the growth in the occurrence of diabetes using secondary OP data

t	Day wise DM OP	Predicted	Residual	Growth % year wise	Growth % from 2007
2007	146	144	2		100
2008	163	180	-17	124.827	125
2009	208	216	-8	119.889	149.861
2010	264	252	12	116.589	174.722
2011	311	287	24	114.229	199.583
2012	332	323	9	112.457	224.444
2013	350	359	-9	111.077	249.306
2014	389	395	-6	109.972	274.167
2015	416	431	-15	109.068	299.028
2016	474	466	8	108.314	323.889
2017		502		107.676	348.75
2018		538		107.129	373.611
2019		574		106.654	398.472
2020		610		106.239	423.333
2021		645		105.873	448.194
2022		681		105.547	473.056
2023		717		105.255	497.917
2024		753		104.993	522.778
2025		789		104.756	547.639

Data indicates that when statistically tested 99.3 percentages reliability was observed for the regression model. The Anova also shows high statistical significance (<.001). The OP data prediction till 2025 was done using LSM as shown in the table. The prediction was done using the equation Y= a+bx while substituting the value Y= -71706.4+ (35.8 * year).

The trend analysis using this model shows that there is highly increasing trend in the number of diabetic outpatients. This type of prediction can be done for many years ahead. The prediction data shows that in 2025 there would be 5 times hike in the number of OP compared to 2007 (Table 4).

Conclusion :

The findings of the study concluded that there would be a substantial increase in the growth of diabetes would occur by the year 2025. Gender based growth analysis indicated that male has greater chance of being affected by diabetes than females in North Kerala.

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