

# Economic Burden Due To Morbidity among Farmers and Non-Farmers with Type 2 Diabetes in Dambadeniya Area, Sri Lanka

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**Abstract:** This paper assesses the economic burden due to morbidity among Farmers and non-Farmers with Type2 Diabetes in Dambadeniya area through evaluating the cost factors mostly allied with equipments, laboratory tests, consultation, oral drugs as medicine and opportunity cost of the patient and companions. Data were collected by administering a questionnaire based face-to-face interviews with 80 selected diabetes patients at the base Hospital in Dambadeniya from May to August 2011. Both descriptive and inferential statistical techniques were used to analyze data. Total direct cost and indirect cost factors were calculated using specific formulas and cost factors were compared between groups using t- test statistics. Correlation of total cost factor s with age, presence of other illnesses duration of the disease and income were assessed using Pearson's correlation coefficient method. The study group comprised of 30 farmers and 50 non formers the costs of monthly cost of glucose meters, monthly most of oral drugs and monthly cost of OPD consultation are common and similar for both farmers and non-farmers. However, MAPE was the highest cost factor borne by farmers (72%) and non-farmers (74%). T-test values reveals that total direct cost shows significant difference between farmers and non-farmers ( $p < 0.006$ ) Total cost factor of patients significantly different among two groups farmers spend more than non-farmers ( $p < 0.05$ ). Results of correlation analysis reveal that total direct cost significantly correlates with age, and income in farmers and diabetic duration in non-farmers. In this study group diabetes was more common among non-farmers than farmers.

**Keywords:** Dambadeniya area, Direct cost, Economic Burden, Indirect Cost, Type 1 Diabetes, Type2 Diabetes.

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## I. INTRODUCTION

Diabetes is a chronic metabolic disorder that prevents the body from using energy from carbohydrate. This inefficiency of the body to utilize glucose may be partial or complete in a diabetic (Raheena, 1991). Mainly there are three types of diabetes, Type1, Type2 and Gestational diabetes. Type1 Diabetes Mellitus (T1DM) develops when there is a little or no insulin produce by pancreas. It is also known as insulin dependent diabetes mellitus. Type 2 Diabetes Mellitus (T2DM) develops when the body is unable to produce the insulin required by the body in the face of insulin resistance. In most cases this is linked with being overweight or obese. Lack of physical exercises and bad dietary habits mainly affect on Type2 diabetes. Gestational diabetes diagnosed with pregnant mothers. People become physically inactive due to diabetes that is called Morbidity.

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In Sri Lanka standardize prevalence of diabetes with people less than or at 20 years old are 10.3%. Urban population are 16.4%, rural population are 8.7%, and prevalence of pre-diabetes in urban and rural population are 11.5% (Katulanda *et al.* 2008).

Diabetes imposes a large economic burden on the national health care system. Expenditures on diabetes will account for 11.6% of the total health care expenditures in the world. About 80% of the countries will spend between 5% -13% of their total health care expenditure in diabetes.

Sri Lanka is a developing country that has an Agriculture based economy. The agriculture sector in Sri Lanka contributes 17.9% to the total Gross Domestic Production (GDP) and generates 32% of employment opportunities (Anon, 2012). It has found that 78.5% of the total population of Sri Lanka lives in rural areas. Almost 90% of this portion is considered poor in which most of them are farmers (Anon, 2012). Most findings have found that farmers typically earn comparatively diminutive income. Moreover it involves hard physical work in the field. These factors might be the rationale for the eventual decrement of farming communities.

Nevertheless farming as an occupation has supposed to be advantageous rather than modern livelihood, since it's prerequisite of physical activeness reassures the human health. Diabetes is one burdening health issue among white collar employees. Many findings have demonstrated that diabetes appears genetically as well as a result of physical inactiveness.

Since service sector which has been improved dramatically the society pushed into white collar jobs population would more susceptible to type 2 diabetes by far. Less care and awareness of the type 2 diabetes will lead to amplification of this issue. One harmful effect of diabetes is that People become physically inactive due to diabetes that is called morbidity. Patients thrive to overcome these issues by spending on possible recovery measures.

The objectives of this study are to estimate the economic burden due to morbidity among farmers and non-farmers with Type 2 diabetes and approximation of difference between their economic impacts.

**II. METHODOLOGY*****Theoretical Framework:***

Dambadeniya is an area that accounts for a high production of paddy as well as the society comprise of both farmers and non-farmers. The non-farmer community consists of a diversity of professions considering the existence of many government, non-government institutes and private industries which covers non-farmer community. Thus, Dambadeniya is a balanced suitable area to locate of farmers and non-farmers for evaluating the economic burden of illness of Type 2 diabetes in Sri Lanka.

Health disorders evidently bring many costs to societies and patients with diabetes burden with a significant expenditure. This study evaluates the economic burden through estimating Direct and Indirect cost of Type 2 diabetes patients. Cost of glucose meters, cost of oral drugs, cost of OPD consultations, cost of diabetic related tests and household out of pocket expenses and cost incurred due to physical, sociological and psychological factors are considered as the components of Direct Cost. Average income loss due to working hour loss and income loss of accompanying person are considered as components of indirect costs.

***Cost Estimation Model:***

The cost factor of a patient can be divided in to two components; (1) Total Direct Costs (TDC) and (2) Total Indirect Costs (TIC) (3) Total Intangible Costs (TINC).

***Total Cost***

Total cost (TC) is the combination of all TDC, TIC and TINC formulated as below.

$$TC = TDC + TIC + TINC$$

***Intangible Cost:***

TINC refers to welfare losses due to the physical and psychological pain (Kirigia *et al.* 2009). Though TINC is an essential component that needs to be figured in all cost related explanations, it was omitted due to the unavailability of

qualified psychologist to quantifying and validating the TINC factor. Thus the formula of explaining the total expenditure of a patient is as below in the study.

$$TC = TDC + TIC$$

TDC represents the costs incurred as a result of a particular phenomenon, which is the cost of illness in case of this study. TDC of a diabetes patient includes cost of glucose meters, oral drugs, out patients' consultations, household out of pocket expenditures and cost of all tests related to the illness. The TDC can be illustrated as, discovered by Kirigia et.al, (2009).

$$TDC = MCM + MCD + MCO + MACT + MAPE$$

Where,

MCM = Monthly Cost of glucose meters /person.

MCD = Monthly Cost of Oral drugs/person.

MCO = Monthly Cost of OPD consultation /person.

MACT = Monthly Average Cost of diabetes related Tests/person.

MAPE = Monthly Average out of Pocket Expenditures borne by a person.

Monthly cost of glucose meters /person and annual cost of glucose meters (ACGM) can be calculated by

$$MCM = \frac{ACGM}{12} \div NDN$$

$$ACGM = \frac{(ACN+QGMN)}{A(0.03,5)}$$

Where,

CAN = Annual equivalent Cost of one Glucose meter.

QGM = Quantity of Glucose Meters needed.

A = Annuity factor (5, 0.03)

NDN = Number of patients.

The total cost of drugs particularly oral drugs (MCD) can be computed as follows.

$$MCD = NTY * P_M$$

Where,

NTY = Number of 500mg metformin tablets taken by a person/ month.

P<sub>M</sub> = Price of a 500mg "metformin" tablet.

$$MCO = \frac{NV}{NDN}$$

Where,

NV = Monthly total Cost for OPD consultation.

Monthly Average cost of diabetes related tests per person comprised of expenditure for Glycosylated hemoglobin test (HbA<sub>1c</sub>), Lipid profiling and Blood sugar tests. The calculation can be shown as

$$MACT = \frac{TCHBA+TCLP+TCBS}{NDN}$$

Where,

TCHBA = Total cost of Hb1Ac test / month.

TCLP = Total Cost of Lipid Profile / month.

CBS = Total cost of Blood sugar test.

NDN = Number of patients (number of farmers/ non farmers).

The additional expenditure incurred due to expenses of traveling, medicine and of partners accompanied in care accounts for monthly average out of pocket expenditures borne by a person is formulated as below.

$$MAPE = \frac{MTOoPE}{NDN}$$

MTOoPE = Cost of (transport + medicines + insulin)

**Total Indirect Cost (TIC):**

Total Indirect Costs represent the costs incurred indirectly to the total expenditure of illness. The production loss or income loss of patients and accompanying persons due to absenteeism of his/her employment is a major cost factor considered as indirect cost of illness. This can be calculated if the wage rate of a patient of his/her occupation and the time loss due to illness or consultation.

Typically the indirect cost of a diabetes patient can be expressed as,

$$TIC = ILP + ILO$$

Where,

ILP = Average Income Loss due to working hours loss.

ILO = Income Loss of accompanying person.

**Collection of Data:**

The survey was conducted in two phases; (1) Pilot survey and (2) Clinical survey. The pilot survey was carried out with a smaller sample of randomly selected patients (n=15) from the clinic conducted by the base hospital in Dambadeniya, in order to validate the questionnaire. The real survey was conducted by carrying out a series of face-to-face interviews with 80 selected diabetes patients from the same clinic.

Systematic random sampling was used to select respondents where, one per five patients was selected as a respondent according to the arrival of the patient to the clinic. Patients with diabetes were interviewed to gather direct and indirect cost factors. Information allied with medical expenses and, time spent for medical costs were also collected.

**Analysis of Data:**

Both descriptive and inferential statistical techniques were used to analyze data. Cost components incurred in various aspects of patients were calculated separately in order to find out the magnitude of each component. Furthermore, relationship and the correlation between dependent variables and association between costs of expenditure in two parties were evaluated.

**III. RESULTS AND DISCUSSION**

**Background of the Respondents:**

The sample was categorized in to two major groups based on the occupation of patients; farmers (F) and non-farmers (NF) in order to compare different components of cost factors. The majority of diabetes patients were non-farmers (62.5%). Most of the farmers (46.0 %) and non-farmers (56%) were more than 50 years old (Table 1.) No patients were reported below age group of 20 in the studied clinic. The monthly income of most of the farmers (76.7 %) was below Rs. 10,000, while most of the non- farmers (48%) earned between Rs. 10,000-20,000 monthly. There were no farmers who were earning over Rs. 20,000 though a considerable number of non-farmers (30%) were earning over Rs. 20,000.

**TABLE 1: Socio-demographic characteristics of the respondents**

Variable	FR %	NF %
Head count	37.5	62.5
Age (years)		
≤ 20	0	0
21 – 30	3.34	10.0
31 – 40	10.0	18.0
41 – 50	40.0	16.0
51 – 60	26.7	32.0
> 60	19.9	24.0
Income (Rs.)		
≤ 10,000	76.7	22.0
10,000 – 15,000	20.0	24.0
15,000 – 20,000	3.3	24.0
20,000 – 25,000	0	10.0
> 25,000	0	20.0

Note: F – Farmers; NF – Non farmers

**Total Direct Costs Factors of Patients (TDC)**

The results of the analysis reveal that costs of MCM, MCD, and MCO are common and similar for both F and NF (Table 2). Among these three factors MCD costs Rs. 108 per person in one month. However, MAPE was the highest cost factor borne by F (72%) and NF (74%). Monthly Cost of OPD consultation and monthly cost of glucose meters per person was negligible when compared to total expenditure.

**TABLE 2: Direct Cost Factors of TDC**

TDC	Vocation	Cost(Rs.)	%
MACT	F	115.80	14.00
	NF	153.70	15.00
MAPE	F	587.00	72.00
	NF	734.00	74.00
MCD	F	108.00	14.00
	NF	108.00	11.00
MCM	F	0.52	0.00
	NF	0.52	0.00
MCO	F	1.79	0.00
	NF	1.79	0.00
TDC	F	813.11	100.00
	NF	998.00	100.00

Note: F – Farmers; NF – Non farmers

**Outcome of the t-test:**

T-test values in Table 3 reveals that DCF shows significant different between F and NF ( $p < 0.006$ ). Even though the amount is high for MAPE borne by a person is not significantly different among patients with diabetes in two groups. Thus MACT is the only cost factor out of five Direct Cost Factor varies among farmers and non-farmers. This implies that farmers spend more for laboratory tests than non- farmers. The reason for this could be that the over representation of the non-farmer community in the present sample.

**TABLE 3: T-test statistics of DCF**

TDC	T-value	Vocation	Mean
MACT	0.043*	F	115.80
		NF	153.70
MAPE	0.331	F	587.00
		NF	734.00
TDC	0.006*	F	813.11
		NF	998.00

Note: F-Farmers; NF -Non farmers; \*Significant at  $< 0.05$

**Total Indirect cost factors of the patients (TIC)**

Table 4 represents the ICF distribution among FR and NF. According to results the average income loss is significantly higher among NF than F ( $p < 0.05$ ). This may because FR earns less than NF and therefore hourly cost of working hours is less for F than NF.

**TABLE 4: T-test statistics of ICF**

TIC	T-value	Vocation	Mean
ILP	0.045*	F	281.00
		NF	438.00
ILO	0.213	F	5.00
		NF	58.00
TIC	0.026*	F	286.00
		NF	504.00

Note: F-Farmers; NF -Non farmers; \*Significant at  $< 0.05$

### Total Cost Factor of Patients (TC)

According to results given in the Table 5 for TC which is the combination of both TDC and TIC revealed that the expenditure is significantly different among two groups (NF spend more than F  $p < 0.05$ ).

**TABLE 5: T-test statistics of TCF**

TC	T-value	Vocation	Mean
TC	0.034*	F	1100.00
		NF	1502.00

Note: F-Farmers; NF -Non farmers; \*Significant at  $< 0.05$

### The Total Economic Burden in Dambadeniya Area:

A total of 600 patients with diabetes were reported to the clinic during the study period. After considering the direct and indirect cost incurred per person of F and NF communities of registered patients in the clinic, the average loss per month is Rs. 247500 and Rs. 563250.00 respectively (Table 6).

**TABLE 6: Total economic burden**

Vocation	TC per person per month (Rs.)	Number of persons registered in the clinic	Total Economic burden (Rs.)
F	1100.00	225	247500.00
NF	1502.00	375	563250.00

Note: F – Farmers; NF – Non farmers

According to the above results it can be concluded that, economic burden of non-farmer community is significantly higher than the farmer community. It reveals that physical exercises gaining from farming activities are significantly contributed to reduce the diabetes occurrence.

### Correlation between TC and Other Factors:

TC shows significant correlation with age (AGE) and presence of other illnesses (PRI) among F. Other variables such as duration of the disease (DD), income (INC) and number of working hours (NWH) did not show significant correlation to the TC (Table 7).

All factors showed positive relationship with the total expenditure except the NWH. The results reveal that farmers age, presence of other illnesses have been significantly correlated with the total cost. Thus aging farmers with other illnesses may prone to higher economic burden.

**TABLE 7: Correlation between TC and Socio demographic factors of farmers**

Variable	PCC	P-value
AGE	0.413	0.023*
NWH	-0.322	0.082
INC	0.107	0.574
DD	0.218	0.247
PRI	0.546	0.002*

Note: PCC – Pearson Correlation Coefficient; \*Significant at 0.05 level

The factors; INC, ILT and PRI account for a significant correlation with the total cost the non-farmers spend against diabetes (Table 8). In both farmers and non-farmers showed a negative correlation between working hours (NWH) with the TC. The results reveal that the INC, ILT and PRI have been significantly correlated with the total cost of non-farmers. Thus non-farmers who earn higher income and whom being a diabetes patient for a long time diagnosed with other illnesses might be prone to higher economic burden.

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**TABLE 8: Correlation between TCF and socio demographic factors of non-farmers**

Variable	PCC	P-value
AGE	0.167	0.278
NWH	-0.209	0.172
INC	0.299	0.049*
ILT	0.359	0.017*
PRI	0.073	0.040*

*Note: PCC – Pearson Correlation Coefficient; \*Significant at 0.05 level*

#### IV. CONCLUSIONS

This paper assesses the economic burden due to morbidity among Farmers and non-farmers with Type2 diabetes in Dambadeniya area through evaluating the different types of cost factors.

Total cost incurred by one farmer for diabetes related activities was Rs.1100.00 per month and total loss is Rs.247500.00 per month for the farmers who were registered in the clinic of base hospital in Dambdeniya. In similar way, total loss for the non-farmer community was Rs. 563250.00 per month.

The results of the T-tests reveal that cost of laboratory tests is the only cost among five Direct Cost factors that varies among Farmers and non-farmers.

Prevalence of diabetes among non-farmers (62.5%) was higher than farmers (37.5%) and also economic burden of non-farmer community is significantly higher than the farmer community according to the clinical survey. One of the main reasons of reduction of diabetics among the farmers would be the high physical exercises through farming activities. Arranging efficient awareness programs on such type chronic disease for both farmer and non-farmer communities would be advantageous in reducing the economic burden and related problems.

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