

## The High Burden of In-Hospital Diabetes Mellitus at A Tertiary Care Hospital in Sri Lanka; A Case Control Study

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### Abstract

**Background:** Sri Lanka has a very high prevalence of diabetes with poorly organized diabetes care and limited resources for in-patient management. At present, 10.3% of the population is diabetic.

**Aim:** The aim of this study was to define the reasons for admission of diabetic patients to a tertiary care general medical unit, to calculate the point prevalence of diabetes related admissions, the mean duration of hospital stay and assess their in-hospital glycaemic control.

**Design:** A case-control study.

**Methods:** Data of 300 consecutive diabetic and non-diabetic admissions to the professorial medical unit at Teaching Hospital Peradeniya were studied between 30<sup>th</sup> May and 30<sup>th</sup> August 2011.

**Results:** The in-hospital point prevalence of diabetes was 40.4%. One quarter of diabetes related admissions were for control of hyperglycaemia. Twenty two percent were for acute coronary syndromes and another 16% for treatment of infections. Mean duration of hospital stay was 6.6 days for diabetic patients and 4.6 days for non-diabetic patients ( $P < 0.01$ ). The mean hospital stay of patients presenting with hyperglycaemia was 6 days. The mean fasting plasma glucose on admission and discharge in the diabetes group were 10.67 and 8.3 mmol/L respectively. Over 98% of diabetic patients had at least one in-hospital glucose value that exceeded 10 mmol/L.

**Conclusion:** A quarter of diabetes related admissions were for control of hyperglycaemia. Presence of diabetes mellitus significantly delayed the discharge of medical admissions. In-hospital glycaemic control of patients was generally poor. An effective diabetes outreach service needs to be initiated urgently to reduce diabetes related admissions.

**Keywords:** Type 2 Diabetes Mellitus; In-hospital diabetes prevalence; Duration of stay; In-hospital glucose values

### Background

Sri Lanka is a developing country with a population of 20 million and a heavy burden of diabetes. The current prevalence of diabetes is estimated to be 10.3% with a projected prevalence of 13.9% for the year 2025 [1]. The increase in prevalence is seen in both rural and urban areas [1,2].

In the face of this growing epidemic it is necessary to understand how diabetes utilizes health resources as a chronic non-communicable disease, and how it affects resources in an acute in-patient setting. For example, diabetes is a risk factor for coronary vascular disease, which often requires acute medical management.

Sri Lanka lacks a coordinated system of diabetes care and diabetic patients tend to present themselves to hospital out-patient departments or seek inpatient care for medical problems. The number of doctors and nurses per 100,000 population is 55 and 157.3 respectively in Sri Lanka [3]. The bed occupancy rate is 97% for secondary and tertiary care hospitals with specialist care and 28-33% for rural and community based hospitals [3]. Therefore the tertiary care institutions tend to be overcrowded and the turnover needs to be high to cater to the large patient volumes.

In the absence of organized, stratified care system for diabetes, minor issues like dose adjustments, minor wounds and infections which could have been successfully managed within a well organized

diabetes care system tend to get admitted to the already crowded state sector hospitals.

It is understood that people with both type 1 and 2 diabetes have a higher risk of morbidity and mortality. Similarly, both type 1 and 2 patients are more likely to be admitted to hospital, have re-admissions for emergencies and have a longer stay in hospital [4].

The importance of tight blood glucose control among outpatients with type 1 and 2 diabetes mellitus is well established [5,6]. Over the past years data has accumulated which re-enforced the need for strict in-hospital glycaemic control. There is compelling evidence that poorly controlled in-hospital diabetes leads to poor outcomes with increased morbidity and mortality as well as increased health care costs [7,8]. This in turn prompted the American College of Endocrinology (ACE) and the American Diabetes Association (ADA) to publish guidelines recommending tight glucose control for inpatients with diabetes [9].

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Sri Lanka has total island wide bed strength of 63961 beds [3] in the state sector hospitals, which caters to more than 90% of the population. The average number of days spent in hospital for any given admission at tertiary care hospitals in Sri Lanka is 3.7 days [3]. In 2010, Sri Lanka spent 16% of its health budget for treating diabetes and is the highest in the region [10]. In 2005, Premaratne et al. projected a rise of 36% in hospitalizations due to diabetes mellitus over the next 5 years [11]. The in-hospital prevalence of diabetes, the reasons for admission of diabetic patients and in-hospital glycaemic control has not been studied previously.

**Aim:** The aim of this study was to define the reasons for admission of diabetic patients to a tertiary care general medical unit, to calculate the point prevalence of diabetes related admissions, the mean duration of hospital stay and assess their in-hospital glycaemic control.

## Methods

300 consecutive patients were studied at the Professorial medical unit, Teaching Hospital Peradeniya, between the 30<sup>th</sup> of May and 30<sup>th</sup> August 2011. One hundred and fifty diabetic patients and 150 age, sex and matched controls admitted consecutively were enrolled in the study. Inclusion criteria for cases included age more than 18 years, diagnosis of diabetes mellitus for more than 3 months and having regular scheduled follow up by a physician. Patients admitted with diabetic ketoacidosis or hyperosmolar non-ketotic states, those transferred out to intensive care units, patients with gestational diabetes and those on palliative care were not included. The control group comprised 150 age and sex matched persons admitted to the same medical unit with no prior diagnosis of diabetes. Patient baseline characteristics, anthropometric measurements and patient's blood glucose values during the hospital stay were recorded. All patients had Fasting Blood Glucose (FBS) performed on the morning following admission after an overnight fast of 10 hours. Those who were admitted late in the day, and not having enough time for an overnight fast had the blood glucose measurement performed the following day. Admitting glucose value was defined as fasting blood glucose (FBS). A discharge glucose value was defined as FBS performed during the last day of hospital stay. Random Blood glucose (RBS) values were calculated in the diabetic group in the following manner. Patients had at least 3 blood glucose samples performed on them during a single day. The mean of all of the 3 values was taken as the daily mean RBS. The daily means were summed up and divided by the number of days in hospital to arrive at the mean RBS of each patients hospital stay. HbA1C was not routinely performed in the state sector due to the high cost and if required needed to be performed at private laboratories.

Authors used a pre-printed format to collect information on patient demographics, data on the index admission and in case of diabetic individuals, diabetes related information. The cause for admission was extracted from the case notes as recorded by the admitting physician at the out patients department. In instances where there was a discrepancy between the cause for admission and the final diagnosis made during hospital stay, the final diagnosis was recorded as the cause for admission. The point prevalence of in-hospital diabetes was

calculated on 3 days, 7 days apart during the study period and the mean in-hospital point prevalence was calculated. Ethical clearance for the study was obtained from the Ethics Review Committee of the Faculty of Medicine, University of Peradeniya, Sri Lanka. Informed written consent was obtained from the participants and was formally recorded.

## Data analysis

The data analysis was conducted using the Statistical Package for the Social Sciences (SPSS, version 20) for Windows. A p value of 0.05 was used to determine any statistically significant difference.

## Results

There were 150 patients enrolled in the diabetic group, with a mean age of 60.1 (median: 60, SD 11.96) years. There were 63 males and 87 females with a mean age of 57.11 (SD 11.06) and 62.3 (SD 12.06) years respectively. The mean age of the non-diabetic patients was 60.7 (median: 59.5, SD 12.1) years.

The diabetes group-included patients who were recently diagnosed as well those who have had diabetes for over 40 years (range: 6 months 40 years). The mean duration of diabetes was 7.62 years (SD 7.99). The presence of diabetes related complications were 71.2%. At least one macro-vascular complication was present in 82% of patients and microvascular complications in 70%. The baseline characteristics of the diabetic and non-diabetic populations are tabulated in Table 1.

The diabetic and non-diabetic patients' mean duration of stay in hospital was 6.61 (SD 5.74) and 4.65 (SD 3.69) days respectively and the difference was statistically significant ( $P < 0.01$ ). The commonest reason for admission to hospital in the diabetic group was for optimization of blood glucose control (25.3%) followed by acute coronary events (22.7%) and infections (16%). Three patients (2%) were admitted with symptomatic hypoglycaemia. In the non-diabetic group, the commonest cause for admission was infections (54.7%), followed by acute coronary syndromes in 11.3%.

Table 2 depicts the mean duration of in-hospital stay and plasma glucose values by disease category

Of the patients admitted with acute coronary syndromes, patients with diabetes spent on average one day longer than non-diabetic individuals (5.2 vs. 4.2 days). Of the patients admitted with infections, diabetic patients mean duration of stay was 2.3 days longer than non-diabetic individuals (7 vs. 4.7). Patients admitted for optimization of blood glucose had a mean duration of stay of 6 days in hospital.

The overall mean admitting fasting plasma glucose values of the diabetic and non-diabetic groups was 10.67 mmol/L and 5.5 mmol/L respectively. The discharge Fasting plasma glucose in the diabetic group was 8.3 mmol/l. The improvement in glucose values was statistically significant ( $P < 0.01$ ). Ninety eight percent of patients in the diabetes group had at least one blood glucose value that exceeded 10 mmol/L. The proportion of patients with any fasting blood glucose value that exceeded 10 mmol/L during hospital stay was 56%.

Diabetic patients with Acute Coronary Syndromes (ACS) had

	Diabetic admissions					Non-diabetic admissions			
	No	(%)	Mean age(years)	SD	Duration of Diabetes(years)	No	(%)	Mean age(years)	SD
Male	63	41.6	57	11	7.6	64	42.6	56	13
Female	87	58.3	62	12	7.7	86	57.3	63	11
	150		60.1	11.9	7.6	150		59.5	12.1

**Table 1:** Age, gender and the duration of diabetes mellitus.

Reason for admission	Diabetic admissions					Non-diabetic admissions				
	Number	(%)	Mean duration of stay (days)	SD	Admission FBS (mmol/L)	Discharge FBS (mmol/L)	Number	(%)	Mean duration of stay (Days)	SD
ACS	34	22.66	5.17	2.13	8.45	9.59	17	11.3	4.18	1.42
Diabetes	38	25.33	6.05	4.40	15.96	9.37	-	-	-	-
Infections	24	16	7.04	5.36	11.43	8.67	82	54.7	4.76	3.88
Hypoglycemia	3	2	3.66	2.88	5.6	6.64	-	-	-	-
Other	51	34	7.96	7.94	12.37	8.10	51	34.0	4.71	3.95

**Table 2:** Mean duration of in-hospital stay and plasma glucose values by disease category.

a mean FBS and RBS of 8.45 (SD 4.33) and 12.31 (SD 6.67) mmol/l respectively at the time of admission. Diabetic patients with infections had a mean FBS and RBS of 11.43 (SD 5.57) and 15.76 (SD 7.24) mmol/l on admission. Patients admitted for optimization of blood glucose had a mean FBS of 15.96 (SD 11.17) and RBS of 17.28 (SD 9.0) mmol/l at admission. The mean fasting plasma glucose of the diabetes group on discharge was 8.3 (SD 4.5) mmol/l. All groups showed significant decrease in plasma glucose value on discharge compared to the values at admission.

The mean in-hospital point prevalence for diabetes was 40.4%.

## Discussion

The prevalence of diabetes in Sri Lanka has increased significantly over the last 2 decades from 2.5% to 10.3% [1,2]. However, very little work has been done to characterize the impact of diabetes on the existing health infrastructure and health expenditure. Premaratne et al. in 2005, projected an exponential rise in hospitalization due to non-communicable diseases over the next 5 years with the highest rise of 36% for diabetes mellitus [11].

The current study found the mean age of diabetic admissions to be 60.1 years (SD 11.9). Diabetes related admissions are generally of an older age group compared to non-diabetic admissions. A Brazilian survey found more than 2/3rds of the in-patient diabetic population to be older than 60 years [12]. Bach et al. found a similar trend in Australia with 93% of diabetic related admissions being over 40 years of age [13].

The overall prevalence of complications in our study was high (71.2%). However, there may have been an under reporting of micro-vascular complications as routine screening is not currently available and asymptomatic micro-vascular disease may have gone undetected in this study. Bach et al. found a similar complication rate of 82% among diabetic admissions in Melbourne Australia [13].

Sri Lanka has a total bed capacity of 69361 beds in state sector institutions as recorded at the end of 2008 [4]. The point prevalence of in-hospital diabetes in our study was 40.4%. In a UK survey of 206 centres, patients with diabetes accounted for 5.8%–25.8% of inpatients with a median of about 15% [13]. A study of over 2 million Japanese inpatients found an inpatient prevalence of 11.4% [14]. Compared to figures from the developed world, our figures indicate very high use of acute hospital beds for diabetes related issues. The community prevalence of diabetes in the UK and Japan was 6.6% and 7.6% respectively [13,14]. The overall community prevalence of diabetes in Sri Lanka is 10.3% according to national figures. About 1/3<sup>rd</sup> of diabetic patients in the community are undiagnosed [1]. Even after making allowances for this, presence of diabetes carries at least a three-fold rise in the risk of hospitalization in Sri Lanka. The most probable reason for this high point prevalence is the absence of out of hospital diabetes care. This is exemplified by over one quarter of diabetes related admissions being for optimization of glucose control. Empowering of patients on diabetes management, delegation of care to general practitioners

and community based hospitals and training nurses in the diabetes management [15] may help to reduce the overcrowding observed at tertiary care institutions in this study.

Our study demonstrated that patients with diabetes had a mean duration of stay of 6.61 days against 4.65 days for age and sex matched non-diabetic patients. The difference was statistically highly significant ( $P < 0.01$ ). In a recent study performed in the UK, the length of stay for patients with diabetes was 2.8 days longer than for those without, irrespective of age, socioeconomic status, admission type or case complexity [16]. Similarly an Australian study found that diabetic patients admitted to general medical wards stayed one day longer than normoglycaemic patients without diabetes [17]. Another study performed by Moreira and colleagues in Brazil found a mean duration of stay of 14.6 days with a median of 10 for diabetic patients [12]. Compared to a national mean of 3.7 days spent in a tertiary care hospital for any cause, both diabetic and non-diabetic patients our study spent more time in hospital. The 2 additional days spent in hospital in the diabetic group compares well with findings of other studies [16,17].

In the diabetic group, the longest duration of stay was recorded for diabetic patients with infections (7 days), followed by those admitted for optimization of glucose control (6 days) and acute coronary syndromes (5.2 days). A significant proportion of diabetic patients (25.5%) were admitted for optimization of blood glucose control. This is in contrast to a recent study in Melbourne Australia, where, the number of diabetic admissions directly related to optimization of glucose control was only 4 out of 404 (1%) [13]. This probably indicates the effectiveness of the Australian health care system in managing glycaemic related issue of diabetic patients out of hospital. This indicates that about 10% of acute beds could have been freed for other acute patients if an effective diabetes care system was in place in Sri Lanka. These findings clearly have a bearing on the Sri Lankan health expenditure.

The non-diabetic admissions recorded the longest duration of stay for infections (4.7 days) followed by acute coronary syndromes (4.2 days). Therefore the presence of diabetes seem to significantly prolong the in-hospital stay of patients within a disease category. The longer duration of stay for patients with diabetes probably reflects the higher mean age of the diabetic patients, significantly elevated plasma glucose values at admission, the higher prevalence of co-morbidities and complications, and the poor healing capacity of such patients. This study did not explore reasons for delayed discharge for patients with diabetes and this issue should be addressed in future studies.

Sri Lanka has limited health resources and the number of beds available for acute care is limited. As a quarter of diabetic admissions were for the optimization of blood glucose control, an urgent study should be made to see if these patients could have been managed, as out patients if a robust and reliable diabetes care network was available. Mahto et al. demonstrated a reduction of 35% in diabetes related admissions following the initiation of a Diabetes Outreach Service (DOS) in the United Kingdom [18].

In patient blood glucose values exceeding 200 mg/dl (11 mmol/l) at any time has been shown to adversely affect the outcomes of acute coronary syndromes, congestive cardiac failure, and strokes. Higher plasma glucose also increase the mortality from these diseases and prolong hospital stay [19]. Our study, which was performed outside a critical care setting, found that 98% of patients had at least one glucose value that exceeded 10 mmol/L and 56% of patients had FBS exceeding 10 mmol/L. The highest mean FBS of 15.9 mmol/L was seen in patients admitted for optimization glucose control followed by 11.4 mmol/L in those with infections and 8.45 mmol/L in those with acute coronary syndromes. The fasting plasma glucose levels on discharge, however was considerably lower, with a mean value of 8.3 mmol/l in the diabetic group indicating the initiation or fortification of blood glucose management during hospital stay. Moreira et al. found similar values with 89.2% of in-patients in Brazil having at least one blood glucose value that exceeded 10 mmol/L with 54% of patients having FBS that exceeded 10 mmol/L. The target of maintaining all glucose value < 10 mmol/L recommended in the ADA/AACE hospital diabetes management guidelines was generally not achieved [7]. Strict adherence to current guidelines on in-patient blood glucose management should be made, as there is compelling evidence of poorer outcomes with increased mortality and morbidity with less stringent glycaemic control.

### Strengths and limitations

The major strength in this study was the provision of data on in-hospital management of diabetes when no previous data was available. Inclusion of a single site, limited generalizability across other categories of hospitals and absence of HbA1C, which would have reflected the long-term glycaemic status of those requiring hospitalization, are recognized as limitations.

### Conclusion

This study highlights that diabetes significantly prolongs the hospital stay of patients, one quarter of all diabetes related admissions are for optimization of glucose control and the in-hospital glucose control of all diabetes related admissions are sub-optimal. The reasons for delayed discharges needs to be addressed in future studies. In hospital glucose control should be improved and a mechanism for dealing with poor glucose control in the community needs to be found urgently to avoid over crowding of hospitals and promote better utilization of medical beds in hospitals.

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