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Opportunistic Screening for Raised Blood Sugar and Diagnosing Prediabetes and Diabetes among Patients Coming for Eye, ENT Consultation: A Descriptive Study

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ABSTRACT

INTRODUCTION: Diabetes is a pandemic of public health importance, and prediabetes has also emerged as a major public health concern. Unfortunately, one-third of individuals with diabetes are identified only after developing complications, and nearly three-fourths are unaware of their raised blood sugar status. Opportunistic screening at an earlier stage has good prognosis. The study aimed at an opportunistic screening of raised plasma glucose levels of outpatients and diagnosing prediabetes and diabetes among them. **MATERIALS AND METHODS:** This descriptive cross-sectional study was conducted among patients visiting an Eye ENT hospital in Bhaktapur, Nepal, between January to December 2019. Outpatients aged 40-79 years with unknown history of diabetes were invited for free hyperglycemia screening. Descriptive analysis was computed for patients participating in random plasma glucose (RPG) screening and patients coming for definitive tests for diabetes with elevated RPG levels. **RESULTS**: Amongst 6,913 outpatients, 14.9% had RPG levels of 140 mg/dL and higher. Among 159 patients with RPG levels 140 mg/dL and higher, 40.9% had prediabetes, and 32.7% had diabetes. **CONCLUSIONS**: Opportunistic screening in hospital OPD settings is feasible to identify people at risk of hyperglycemia. Timely detection of a silent killer - diabetes and prediabetes can be useful for early intervention and preventing complications.

Keywords: Diabetes, Hyperglycemia, Outpatients, Prediabetes.

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INTRODUCTION

Globally, diabetes ranks among the top 10 causes of mortality and is rising at an alarming rate[1, 2]. The pandemic has an estimated global prevalence of 10.5%, [3, 4] and an estimated prevalence of 8.5% in Nepal [5]. Mortality due to diabetes in Nepal is projected to increase from 8.68% in 2015 to 15.52% in 2040[6]. With increasing trends and complications even in developing countries, the global economic burden of diabetes is projected to reach US$2.2 trillion in 2030[7-11]. Lack of proper care, poor awareness, and unhealthy lifestyle will increase its future burden in Nepal [5, 12-14]. About one-third of diabetic patients are identified only after developing macro or microvascular complications, [15] and 73.5% of diabetic adults are unaware of their diabetic status [14]. Recently, prediabetes has been emerging as a major public health concern. The metabolic conditions in which peoples' glycaemic indicators are raised above baseline but below diabetes thresholds are in a state of prediabetes, a condition with a high risk of developing diabetes. For prediabetic individuals, lifestyle modification can lead to 40–70% relative risk reduction [16]. Cardiovascular and renal diseases have become highly prevalent in adults with prediabetes, [17, 18] along with other conditions related to diabetes like diabetic retinopathy, neuropathy, etc, [19].

Screening programs can help to reduce morbidity and mortality by preventing or delaying complications [15, 20]. In Nepal, diabetes screening coverage among 40-69 years old adults is 17.2% [14]. Population-based and community screening have not yielded the desired result and may not be cost-effective [21-24]. Hence, opportunistic screening among hospital outpatients could be one of the methods of identifying missed prediabetes and diabetes cases. This study aimed at screening raised plasma glucose levels of patients coming for Eye or ENT consultation with a view to diagnosing prediabetes and diabetes early.

MATERIALS AND METHODS

Study design and setting

This is a cross-sectional descriptive study. This study reviewed data from January to December 2019 among outpatients voluntarily participating in the screening of random plasma glucose (RPG) and same outpatients with raised RPG later coming for the diagnostic test of hyperglycemia at the Hospital for Children, Eye, ENT, and Rehabilitation Services (CHEERS) at Bhaktapur, Nepal. This non-profit hospital offers free screening for obesity, blood pressure, and blood sugar as value-added services from its Health Promotion Unit to all new patients aged 40 and above coming for OPD consultation [25, 26].

Participants and study procedures

Patients aged 40 – 79 years with no known history of diabetes and who had not had their blood sugar measured for the past six months were included in the study. Patients were screened for raised blood sugar levels on samples of venous blood. A group of public health and health promotion experts from CHEERS decided RPG levels of 140 mg/dL or higher as a cut-off value for the risk of developing hyperglycemia based on literature reviews with varying cut-off values [27, 28] for further diagnostic tests. Patients with RPG>140 mg/dL were advised to undergo definitive tests for diagnosis of diabetes at their regular health facility or to come to CHEERS. There were 10,788 patients fulfilling these inclusion criteria, and 6,913 participated voluntarily in the screening. Only 159 patients with RPG> 140mg/dL visited CHEERS for further diagnostic evaluation. The flow chart of the study participants' selection is presented in Figure 1. In this study, prediabetes was defined as fasting plasma glucose (FPG) between 100 to 125 mg/dL or postprandial glucose (PPG) between 140 to 199 mg/dL and diabetes as FPG ≥ 126 mg/dL or PPG ≥ 200 mg/dL [29].

Data management and statistical considerations

The records were imported into MS Excel 2016 and checked for completeness, legibility, and consistency. The descriptive analyses were done using IBM SPSS Statistics for Windows, Version 26.0.

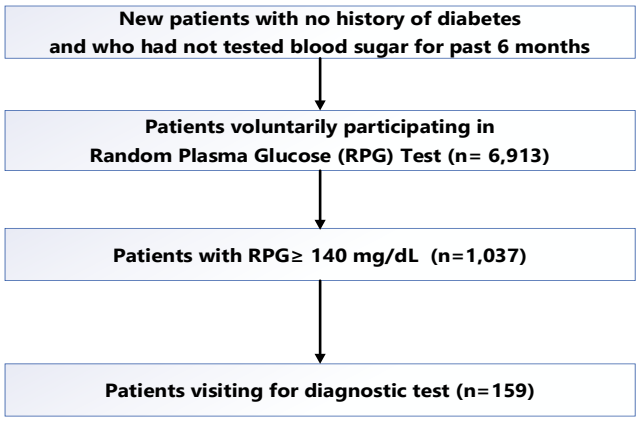

Figure 1| Flowchart of the study

Ethical considerations

This was a retrospective study, so record review permission was taken from the hospital, and the Ethical Review Board of Nepal Health Research Council (Ref. No.: 576, 2020).

RESULTS

Random Plasma Glucose

The mean (SD) age of 6,913 study participants was 52.28±10.10 years. Nearly three-fourths (73.7%) were aged between 40 and 59 years, and 55.5% were female. Among all, 14.9% had RPG levels of 140mg/dL and higher, as shown in Table 1.

Table 1| General characteristics of patients screened for random plasma glucose level (n=6,913)

Characteristics	Random Plasma Glucose Levels of study participants; n (%)		
	Total Sample	140 mg/dL and above	Less than 140 mg/dL
Gender			
Male	3,073 (44.5)	546 (17.8)	2,527 (82.2)
Female	3,840 (55.5)	486 (12.7)	3,354 (87.3)
Age-Group (years)			
40 – 59	5,098 (73.7)	736 (14.4)	4,362 (85.6)
60 – 79	1,815 (26.3)	296 (16.3)	1,519 (83.7)
Total	6,913	1,032 (14.9)	5,881 (85.1)

Fasting Plasma Glucose (FPG) and Postprandial Glucose (PPG)

Among 1,032 patients, 159 visited CHEERS for further diagnostic tests and consultations. The mean age of these patients was 52.21±10.22 years and more than half were men. The confirmatory diagnostic test revealed that four in ten (40.9%) had prediabetes, and just below one in three (32.7%) had diabetes, as depicted in Table 2.

Table 2| Diabetes status of patients with elevated random plasma glucose (n=159)

Characteristics	Plasma Glucose Levels			
	Total (%)*	≥ 126 mg/dL in FPG or ≥ 200 mg/dL in PPG (%)†	100 – 125 mg/dL in FPG or 140 – 199 mg/dL in PPG (%)†	< 100 mg/dL in FPG and < 140 mg/dL in PPG (%)†
Age-group				
40-59 years	118 (74.2)	41 (34.8)	45 (38.1)	32 (27.1)
60-79 years	41 (25.8)	11 (26.8)	20 (48.8)	10 (24.4)
Gender				
Male	83 (52.2)	30 (36.1)	36 (43.4)	17 (20.5)
Female	76 (47.8)	22 (28.9)	29 (38.2)	25 (32.9)
Total	159	52 (32.7)	65 (40.9)	42 (26.4)

*Column percentage,†: Row percentage, mg/dL: milligram per deciliter, FPG: Fasting Plasma Glucose, PPG: Postprandial Glucose.

DISCUSSION

This study showed that 14.9% of patients had their RPG level at 140mg/dL or higher. In routine clinical practice, an opportunistic screening study in the USA showed that 3% had RPG levels at 130 mg/dL or higher[27], whereas 54.5% had RPG levels at 110 mg/dL (6.1 mmol/L) or higher among patients visiting medicine OPD in Puducherry, India[28]. All these studies had different age-group study participants, reference levels, RPG investigation methods, and different study lengths. Despite these differences, all these studies show that screening for raised blood sugar levels is desirable for all patients regardless of their complaints in institutional settings. In our study, the confirmatory diagnostic test among patients with RPG levels 140 mg/dL and higher revealed that 32.7% had diabetes. These RPG levels and higher provide good differentiation, signaling the need for further diagnostic testing at regular intervals. However, the importance of the opportunistic screening of diabetes is highlighted by the fact that the undiagnosed cases of diabetes are higher in developing countries,[30] the asymptomatic phase may last for years,[24] and can lead to macro-and micro-vascular complications, including neuropathy, nephropathy, retinopathy, coronary artery disease, stroke, and peripheral vascular disease,[31-33] and premature mortality,[7] which can cause substantial economic loss for both the patient and added burden to the health system[8].

In this study, the confirmatory diagnostic test among patients with RPG levels 140 mg/dL and higher revealed that 40.9% had prediabetes. However, a community-based survey showed that 4.32% had prediabetes in a semi-urban town of Kathmandu, Nepal[34]. Even though the study in a semi-urban town was conducted a year before our study, our study's higher prevalence of prediabetes is due to the selection of individuals with RPG levels who had 140 mg/dL or higher. Studies have shown that elevated plasma glucose levels in prediabetes sufficiently increase the risk of cardiovascular disease,[18] increases the risk of developing diabetes, and 5-10% progress towards diabetes annually[16]. Also, a cohort study showed that people with diabetes had higher RPG levels at baseline than those who did not have diabetes after a five-year follow-up [35]. Observational studies have shown a close association between prediabetes and early forms of nephropathy, chronic kidney disease, small fiber neuropathy, diabetic retinopathy, and increased risk of macrovascular disease [16].

Moreover, early recognition of those at high risk for diabetes can permit preventive management in high-risk individuals before disease onset. Therefore, screening at the point of contact, followed by standard diagnostic testing, like the ones we have done, effectively detects prediabetes. Lifestyle changes such as a healthier diet and increased physical activity can help prevent diabetes and associated morbidities among people with prediabetes. If this opportunistic screening and counseling had not been done, these cases would have been left undetected or detected only after developing symptoms and/or complications of diabetes, given the paucity of symptoms in the early stages of diabetes. Screening and earlier detection for undiagnosed prediabetes and diabetes are recommended to help prevent prediabetes and diabetes from getting worse and minimize their impact on other health conditions [24]. As more than four in five (84%) of the population are availing health services (outpatient services) in Nepal, [36]

opportunistic screening in health facility settings with laboratory services could complement the community screening and detect a majority of people with currently undiagnosed diabetes as envisioned in a package of essential non-communicable disease intervention at the primary health service setting in Nepal [37]. However, the development of a diabetes risk prediction tool for the Nepali population is similar to the Finnish Diabetes Risk Score [38], the Indian Diabetes Risk Score, [39] the German Diabetes Risk Score [40], and American Diabetes Association Risk Score [41] could be useful in limited-resource settings like Nepal. The present study was conducted in a tertiary level Eye and ENT hospital and is a single-center study in a semi-urban location, so it cannot be generalized.

CONCLUSIONS

Opportunistic screening in hospital OPD settings is feasible to identify people at risk of hyperglycemia. However, developing a diabetes risk prediction tool and screening selected ones could be helpful in limited-resource settings like Nepal.

ADDITIONAL INFORMATION AND DECLARATIONS

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Data Availability: All data generated or analyzed during this study are included in this publication.

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