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# The prevalence of diabetes complications and associated risk factors in Pacific Islands countries

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## ABSTRACT

**Aim:** To determine the prevalence of diabetes complications and associated risk factors among people with type 2 diabetes in three Pacific Island countries, Nauru, Solomon Islands and Vanuatu.

**Methods:** This cross-sectional study was carried out on a sample of 459 people with diabetes. Subjects were screened for complications using a standardised protocol which gathered information on demographics, physical and biochemical parameters.

**Results:** Of the 459 subjects, 47% were female, mean age was 54 years and mean duration of diabetes was eight years. The prevalence of diabetes complications was significantly higher in Nauru compared with the Solomon Islands and Vanuatu – microalbuminuria 71%, 36% and 51% respectively ( $P < 0.001$ ), retinopathy 69%, 40% and 42% respectively ( $P < 0.001$ ), and abnormal foot sensation 30%, 23% and 19% respectively ( $P = 0.036$ ). The prevalences of hypertension, overweight/obesity and poor glycaemic control were high. The percentages of subjects achieving recommended clinical targets were low. Microalbuminuria was significantly associated with duration of diabetes, hypertension and glycaemic control. Diabetic retinopathy was significantly associated with duration of diabetes whereas abnormal foot sensation was significantly associated with duration of diabetes and glycaemic control.

**Conclusions:** This study found a high prevalence of diabetes complications and associated risk factors, which indicate the need to improve diabetes care and strengthen preventive efforts to reduce complications.

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## 1. Introduction

The magnitude of the global health burden of diabetes [1,2] and its negative implications for human development and

achievement of global development goals [3,4] is well documented. The vast majority of this burden is due to complications of diabetes and accounts for substantial costs [5,6].

Many studies from a range of countries have reported the prevalence of complications and related risk factors among

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people with diabetes. Diabetes complications can be prevented through proven cost effective interventions [7,8]. Multi-risk factor interventions which include lifestyle changes and pharmacological therapy have been shown to reduce the risk of diabetes complications by up to 50% [9,10].

The risk of microvascular complications is reduced by intensive glycaemic control [11] and tight blood pressure control [12]. Regular risk factor assessment in the primary care setting minimises hospitalisation due to diabetes complications [13], and improvements in systems of diabetes care, screening and treatment programmes for diabetes improve diabetes clinical outcomes [14,15].

Pacific Island countries (PICs) have a limited capacity to deliver effective diabetes prevention and care [16,17] and the proportion of people with diabetes who practice self care is low [18]. Despite anecdotal reports of high rates of diabetes complications in PICs, a formal literature search yielded no recent peer-reviewed literature on the prevalence of diabetes complications in these countries. Consequently, as part of a larger capacity building project, we aimed to (i) determine the prevalence of diabetes complications and associated risk factors in people with diabetes in three PICs: Nauru, the Solomon Islands and Vanuatu, and (ii) assess the control of risk factors against recommended clinical targets.

## 2. Subjects, materials and methods

This cross-sectional study was carried out on a convenience sample of 459 people with known diabetes (100 from Nauru, 160 from the Solomon Islands, and 199 from Vanuatu) to determine the prevalence of diabetes complications and associated risk factors. Subjects attending the diabetes clinics in each country during a one week period, which co-incided with a visit by an Australian diabetes team, were screened using a standardised protocol. Data were collected on age, gender, age at diagnosis, duration of diabetes and diabetes treatment. Physical assessment included measurement of weight and height and calculation of BMI with overweight defined as a BMI  $\geq 25$  and obese as a BMI  $\geq 30$ . The Omron digital automatic blood pressure monitor was used to measure resting blood pressure. Blood pressure was measured three times and mean was used in the analysis. Hypertension was defined as a systolic blood pressure  $\geq 140$  mmHg and/or diastolic blood pressure  $\geq 90$  mmHg or taking blood pressure lowering medications. Visual acuity was assessed and fundus examination through dilated pupils was performed by an experienced optometrist. Foot sensation was assessed using a 10 g monofilament by trained foot care nurses and loss of the ability to detect this pressure (abnormal foot sensation) at one or more anatomic sites on the plantar surface of the foot was defined as neuropathy. Biochemical assessment included measurement of HbA1c using a DCA Analyser; urinary albumin/creatinine ratio (ACR) using a DCA Analyser and microalbuminuria was defined as an ACR  $> 2.5$  mg/mmol for men or  $> 3.5$  mg/mmol for women; blood lipids (total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides) were measured by Cholestech LDX analyser.

The clinical targets agreed for the overarching diabetes project in the three PICs and specifically for this study were:

- (i) HbA1c  $< 7.0\%$  (53 mmol/mol)
- (ii) Blood pressure  $< 130/85$  mmHg
- (iii) Total cholesterol  $< 5.0$  mmol/L  
HDL cholesterol  $> 1.0$  mmol/L  
LDL cholesterol  $< 2.5$  mmol/L  
Triglycerides  $< 2.0$  mmol/L

The data were compiled and analysed using IBM SPSS statistical package version 21. Country data are reported as means  $\pm$  SEM and percentages, and compared using one way ANOVA test and logistic regression model adjusted for age, sex and duration of diabetes. Associations between diabetes related complications and risk factors for complications were assessed using logistic regression model adjusted for country. Statistical significance was defined as  $P < 0.05$ .

This research was approved by the Human Research Ethics Committee, the University of Sydney and the Research Ethics Committees of the Nauru, Solomon Islands and Vanuatu.

## 3. Results

Table 1 shows the demographic details of the 459 people (mean age 54 years, mean age at diagnosis 46 years, and mean duration of diabetes eight years) screened for complications and associated risk factors by country. Overall there were 244 (53%) males (mean age 53.9 years) and 215 (47%) females (mean age 54.1 years). Subjects in Nauru were younger than those in the Solomon Islands and Vanuatu but had the longest duration of diabetes. The percentage treated with diet alone in Nauru, Solomon Islands and Vanuatu was 41%, 13% and 11% respectively, oral anti-diabetic agents 49%, 82% and 83% respectively, and insulin 10%, 5% and 6% respectively.

Risk factors for diabetes complications were common but the risk factor profile differed between the PICs. Nauru had the highest mean BMI, HbA1c, ACR and LDL cholesterol while Vanuatu had the highest mean blood pressure and triglycerides. The percentage of people in Nauru, Solomon Islands and Vanuatu achieving targets were 50%, 31% and 15% respectively for blood pressure, 20%, 17% and 28% respectively for HbA1c, 47%, 55% and 49% respectively for total cholesterol, 29%, 29%, and 11% respectively for HDL cholesterol, 16%, 24% and 42% respectively for LDL cholesterol, and 54%, 50%, 45% respectively for triglycerides.

Diabetes complications were common and the prevalence also varied in the three PICs. The prevalence of microalbuminuria in Nauru, Solomon Island and Vanuatu was 71%, 36% and 51% respectively, retinopathy 69%, 40% and 42% respectively, and abnormal foot sensation 30%, 23% and 19% respectively (Table 2).

The association between diabetes complications and risk factors for complications was assessed using logistic regression models. Microalbuminuria was significantly associated with longer duration of diabetes, hypertension and poorer glycaemic control, abnormal foot sensation with longer duration of diabetes and poor glycaemic control and diabetic retinopathy with longer duration of diabetes. Although higher rates of retinopathy were found in people with poor glycaemic control and hypertension, the association was not statistically significant.

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