

Diabetes

Chairpersons: C Powell, M Tulloch-Reid

O – 62

Health inequities in diabetes, its risk factors and adverse outcomes in populations living in the Caribbean: A systematic review

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Objectives: Following the World Health Organization Commission on the Social Determinants of Health, Caribbean countries committed to identifying and reducing health inequities (Rio Political Declaration 2011). We undertook a systematic review to determine what is known about the social distribution of diabetes mellitus (DM), its risk factors and major complications in the Caribbean. This paper describes findings on the distribution by ethnicity, education, occupation and income.

Design and Methods: We searched MEDLINE, EMBASE and the Virtual Health Library for Caribbean studies published between 2007 and 2013 that described the distribution by ethnicity, income, education and occupation of known risk factors for Type 2 DM, prevalence of DM, DM control or complications. Only quantitative studies were included; each was assessed for risk of bias.

Results: Out of 2796 unique records, 81 articles required full text review and 29 articles met the inclusion criteria. Few studies examined DM, its risk factors or complications by education ($n = 4$), income ($n = 2$) or occupation ($n = 1$). None described significant relationships but all had a high-risk of bias. Statistically significant findings were described from Barbados, Cuba and Trinidad on the distribution of diabetes by ethnicity: higher in blacks than whites and in South Asians in Trinidad compared to other groups (OR 1.87; 95% CI 1.14, 3.05).

Conclusion: Published data in the Caribbean on the social distribution of diabetes, its risk factors and complications were very limited and of overall low quality. Work to better identify health inequities in the Caribbean is required if governments are to meet their commitment to addressing them.

O – 63

The importance of gender as a social determinant of diabetes in the Caribbean: A systematic review and meta-analysis

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Objectives: We undertook a systematic review to determine the social distribution of diabetes mellitus (DM), its risk factors and major complications in the Caribbean. This paper describes our findings on the distribution by gender.

Design and Methods: We searched MEDLINE, EMBASE and the Virtual Health Library for Caribbean studies published between 2007 and 2013 that described the distribution by gender of known risk factors for Type 2 DM, prevalence of DM, and DM control or complications. Only quantitative studies ($n > 50$) were included; each was assessed for risk of bias. Meta-analyses were performed, where appropriate, on studies with a low or medium risk of bias, using random effects models.

Results: We found 50 articles from 27 studies, yielding 118 relationships between gender and the outcomes. Women were more likely to have DM, obesity, be less physically active but less likely to smoke. In meta-analyses of good quality population-based studies, odds ratios for women vs men for DM, obesity and smoking were 1.65 (95% CI 1.43, 1.91), 3.10 (2.43, 3.94) and 0.24 (0.17, 0.34), respectively. Three studies found men more likely to have better glycaemic control but only one achieved statistical significance.

Conclusion: Female gender is a determinant of DM prevalence in the Caribbean. In the vast majority of world regions, women are at a similar or lower risk of Type 2 diabetes than men, even when obesity is higher in women. Caribbean female excess of diabetes may be due to a much greater excess of risk factors in women, especially obesity and physical inactivity.

O – 64

An evaluation of psychological well-being and secular trends in the occurrence of Type 2 diabetes 1993–2014 in outpatients in a community

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Objective: To evaluate psychological well-being and secular trends among outpatient diabetics in community-dwelling Trinidadian patients.

Methods and Design: We used a cross-sectional study design. The population consisted of all adult patients (> 18 years) with Type 2 diabetes mellitus (T2DM), receiving care at the main primary healthcare facility serving that community. The communities came from the North Central Regional Health Authority (RHA) and the Eastern RHA. The World Health Organization (WHO-5) Well-being Index was used to determine quality of life and psychological well-being. Scores ranged from 0 (worst) to 100 (best).

Results: The sample comprised 301 participants. The mean age was 60.78 years (SD ± 11.5) with an interquartile range of 51–70 years with no significant age difference between males and females (73.8 versus 75.1; $p = 0.235$). Females outnumbered males, F:M 1.5:1. Sample participants consisted of 42% Africans and 33.2% Southeast Asians. Of the participants, 66% were found to be overweight or obese. One-half of the participants scored < 50, indicating they were not content with their quality of life, with 1.7% likely to be depressed. There was an increase in patients between the 1990s and 2004–14 and the occurrence of cases in younger age groups. For the first time in 2004–09, there were patients aged 29–30 years and there were patients aged 19–28 years in 2010–14.

Conclusion: We provide evidence that in the community, T2DM is increasingly occurring and shifting toward younger age groups and there is significant dissatisfaction in the quality of their lives.

O – 65

Evaluating the risk of obstructive sleep apnoea in Type 2 diabetic patients, and its associations

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Objectives: To assess the prevalence of high risk of obstructive sleep apnoea (OSA) in Type 2 diabetics. To identify risk associations of OSA with obesity, sleep quality, daytime sleepiness and acanthosis nigricans.

Design and Methods: A cross-sectional study was done in the diabetic wards of health facilities governed by three regional health authorities in Trinidad. Obstructive sleep apnoea risk was assessed by the snoring, tiredness, observed apnoea, high blood pressure (STOP) – body mass index, age, neck circumference and gender (BANG) questionnaire. Sleep quality and daytime sleepiness were also assessed by the Pittsburgh Sleep Quality Index and Epworth Sleepiness Scale, respectively. Bioimpedance analysis was also done using a stadiometer and standard bioimpedance scale.

Results: A total of 281 diabetic patients and 147 non-diabetic patients were interviewed throughout Trinidad. Females made up the majority of the sample, 67% of the diabetics and 66% of the non-diabetics. The prevalence of OSA was found to be 73.2% in Type 2 diabetics. Non-diabetics had an OSA prevalence of 39.5%. Results from a binary regression showed that having diabetes increased the probability of “high risk of OSA” by 93.1%.

Conclusion: The prevalence of high risk of OSA in Trinidad was high in Type 2 diabetic patients, and has strong correlations with obesity and acanthosis nigricans.

O – 66

High prevalence of diabetes mellitus in a cohort of Trinidadian patients with chronic obstructive pulmonary disease

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Objective: To define the prevalence of diabetes mellitus (DM) in a cohort of Trinidadian chronic obstructive pulmonary disease (COPD) patients, and investigate its relationship to lung function, quality of life and depression.

Design and Methods: Anthropometric and spirometric data were obtained from 108 COPD (91 males) patients from Trinidad chest clinics, who also had glycated haemoglobin (HbA_{1c}) test results. Questionnaires on quality of life, St George’s Respiratory Questionnaire (SGRQ) and COPD Assessment Test (CAT) and depression (Center for Epidemiologic Studies Depression Scale (CES-D and CESD-R) were administered and an interview conducted.

Results: Mean (SD) age was 67.4 (11.0) years and median (interquartile range; IQR) HbA_{1c} was 6.1 (5.7, 6.7)%. Glycated haemoglobin values were obtained for 105 patients, of whom 40% had diabetes and 40% pre-diabetes. Diabetics had a greater ($p = 0.001$) median (IQR) body mass index 27.3 (24.1, 30.4) than non-diabetics 24.2 (21.2, 27.2). Patients with at least one chest infection/exacerbation in the past year had increasing CAT and SGRQ total ($p < 0.001$) and CES-D and CESD-R ($p \leq 0.013$) scores. Total scores for CAT and SGRQ were negatively related to lung function and Global Initiative for Chronic Obstructive Lung Disease (GOLD) stages ($p < 0.001$). All lung function parameters, except forced expiratory volume/forced vital capacity (FEV₁/FVC), decreased with increasing CES-D and CESD-R scores ($p < 0.05$). Chronic obstructive pulmonary disease Assessment Test and SGRQ correlated well with CES-D and CESD-R scores ($p < 0.001$). Intravenous corticosteroid use was positively associated with HbA_{1c} ($p = 0.043$). Dosage of inhaled corticosteroids was associated with lower FEV₁ ($p = 0.034$) and higher SGRQ and CAT ($p \leq 0.048$). Forced percentual vital capacity predicted was negatively related to HbA_{1c} ($p = 0.033$).

Conclusion: The prevalence of DM in the COPD patients was 40%; however, no significant correlations of DM to outcome measures were observed. Patients with worse quality of life due to poor lung function were more depressed.

O – 67

The impact of self-monitoring of blood glucose on metabolic control in patients with Type 2 diabetes: A developing country perspective

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Objectives: The role of self-monitoring of blood glucose (SMBG) in patients with Type 2 diabetes mellitus (T2DM) remains inconclusive. As part of the approach to improve glycaemic control in patients with T2DM in Trinidad, the Ministry of Health distributed free glucometers and strips. The aim of this study was to evaluate the impact of SMBG on glycaemic control and to determine patients' behaviours and responses.

Design and Methods: A large outpatient diabetes clinic was selected for the study where eligible clients were included using a systematic sampling technique. A structured pretested questionnaire was administered to all participants to collect all data including the use of a glucometer. Glycated haemoglobin was measured to assess

glycaemic control. All data were stored, verified and analysed with SPSS version 16.

Results: Of the 214 participants recruited, 85 (40%) were currently using SMBG. Using HbA_{1c} of ≤ 7 as an indicator of adequate glycaemic control of T2DM, there was a significant difference ($p = 0.002$) between the two groups in reaching this goal. Only 12 (14%) participants in the SMBG group had adequate control, whereas, among the non-SMBG group, 42 (32.6%) were well controlled. Self-monitoring of blood glucose users felt using the glucometer helped them to achieve their blood sugar targets and were interested in continuing to use it. Most patients tested themselves (78.8%), however, only 26.2% ever recorded the results.

Conclusion: The study showed no direct benefits of self-monitoring of blood glucose in attaining optimal glycaemic control in patients with T2DM.

O – 68

Footwear choice and the prevalence of peripheral neuropathy in a population-based sample of people with diabetes in Barbados

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Objective: To determine footwear choice and peripheral neuropathy prevalence in a population-based sample of people with diabetes in Barbados.

Design and Methods: A representative sample of the adult population (≥ 25 years) was selected by multistage sampling. People with a previous diagnosis of diabetes or a single fasting blood glucose ≥ 7 mmol/L or glycated haemoglobin (HbA_{1c}) $\geq 6.5\%$ completed a questionnaire. Examination for neuropathy included 10 g monofilament testing at four plantar sites per foot, 128 Hz tuning fork and vibration perception threshold (VPT) biothesiometer testing at the hallux.

Results: Of 237 participants (71.8% response rate, 33% male, mean age 63.2 years, range 29.6–95.7 years, mean HbA_{1c} 7.2%), 50.8% had a previous diagnosis of diabetes, two had amputations and four had foot ulcers. More men (67%) compared to women (29.7%) never wore footwear in the house ($p < 0.001$), but 42.7% of the women vs 18.2% men wore slippers (open back shoes) when attending the assessment centre. Most (57.7%) had symptoms of neuropathy by the United Kingdom (UK) symptom score, but only 7.6% by the slipping slipper sign. With 10 g monofilament testing at eight sites, 23.6% (95% CI 18.2, 29), 17.2%, 12.0% and 9.8% had a loss of sensation at ≥ 1 , 2, 3 and 4 sites, respectively. Nearly ten per cent (9.3%; 95% CI 5.6, 13) had a VPT of ≥ 25 V, and 12.7% (95% CI

8.4, 17) did not detect the vibration of a tuning fork for at least one foot.

Conclusions: Objectively detected neuropathy ranged from 9.3% to 23.6%, depending on the method, with foot complications risk being exacerbated by footwear choice.

O – 69

Albumin/creatinine ratio as an indicator of diabetic foot in a Barbados population

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Objective: High levels of circulating glucose affect the vasculature in diabetes, leading to complications such as retinopathy, nephropathy and diabetic foot. In diabetic nephropathy, the elevated glucose levels also serve to alter the physiology of the glomerulus resulting in elevated albumin excretion. In this case-control study, we examined the albumin/creatinine ratio in persons with self-reported Type 2 diabetes, with and without non-healing foot wounds (failure to heal < 30 days).

Design and Methods: Fasting EDTA blood (2 mL) samples and urine samples (15 mL) were obtained from 90 persons self-reported as living with diabetes. Cases were described as persons with non-healing foot wounds and controls as persons with no current foot wounds or history of non-healing foot wounds. Glycated haemoglobin levels and albumin/creatinine ratios were assessed using a Bayer DCA2000+ Analyser. Fasting glucose levels were determined using a Roche Reflotron+ Analyser. Results were compiled and analysis performed using Stata SE 12.1 (Stata Corporation).

Results: Mean HbA_{1c} in cases was 9.1% (\pm 2.1 SD) and in controls was 8.3% (\pm 1.9 SD) [p = 0.05]. Mean fasting glucose in cases was 142.19 mg/dL (\pm 50.76 SD) and in controls 134.57 mg/dL (\pm 60.10 SD) [p = 0.52]. Mean albumin/creatinine ratio in cases was 210.23 mg/g (\pm 275.44 SD) and in controls 42.62 mg/g (\pm 103.49 SD) [p < 0.001].

Conclusions: In this diabetic case control study, albumin/creatinine ratio was markedly higher in persons with diabetes and non-healing foot wounds. This may be a marker of interest as an early indicator of the diabetic foot.

O – 70

Association of genetic variants in the HNF4A and HNF1B genes with early onset Type 2 diabetes mellitus in the Indo- and Afro-Trinidadian populations

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Objective: To determine if variation in *HNF4A*, *HNF1B* and *PAX4* genes is associated with increased risk of early onset Type 2 diabetes mellitus (T2DM) in Indo- and Afro-Trinidadians.

Design and Methods: The promoter, exons and flanking intronic regions of the *HNF4A*, *HNF1B* and *PAX4* genes were sequenced in 167 T2DM and 61 non-diabetic subjects of South Asian Indian ancestry and 66 T2DM and 59 non-diabetic subjects of African ancestry. Differences in single nucleotide polymorphism (SNP) allele and haplotype frequency between T2DM patients and non-diabetic subjects were calculated and pairwise linkage disequilibrium was also assessed for regions within these genes.

Results: Three variants identified in intron 4 of the *HNF4A* gene demonstrated association with early onset T2DM in the Indo-Trinidadian population: rs11574739, p = 0.0032, OR 2.99 (95% CI 1.44, 6.22); rs3212194, p = 0.02, OR 2.57 (95% CI 1.17, 5.65) and rs321219, p = 0.0083, OR 2.72 (95% CI 1.29, 5.71). In the *HNF1B* gene, an intron 7 SNP, rs2269842, was associated with early onset T2DM in both the Indo- and Afro-Trinidadian groups, p = 0.012, OR 0.42 (95% CI 0.20, 0.87) and p = 0.012, OR 0.44 (95% CI 0.23, 0.86), respectively. Both findings are previously unreported. No association was demonstrated with variants typed within the *PAX4* gene.

Conclusions: Variants in the *HNF4A* and *HNF1B* genes may contribute to increased risk of early onset T2DM in Indo-Trinidadians. *HNF1B* variants may similarly influence diabetes susceptibility in Afro-Trinidadians. However, further studies are required to fully elucidate the contribution of such variants to the prevalence of diabetes in the Trinidadian population.