Characteristics of government workers and association with diabetes and hypertension in the Cook Islands

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<http://dx.doi.org/10.5588/pha.13.0077>

Setting: Twenty government departments in Rarotonga, Cook Islands.

Objective: To determine the characteristics, presence of selected non-communicable disease (NCD) risk factors and prevalence of diabetes mellitus (DM) and hypertension among government workers who participated in 'wellness checks' in 2012.

Design: Cross-sectional study involving analysis of survey data.

Results: Of 598 employees, 70% were aged 25–54 years and 55% were female. Two thirds were obese (body mass index ≥ 30 kg/m²), and 76% had low levels of fruit and vegetable consumption. Of 50 (8.4%) participants diagnosed with DM (random blood glucose ≥ 11 mmol/l, fasting ≥ 7 mmol/l), 30 were self-reported and 20 were based on blood glucose. Of the 206 (34.4%) diagnosed with hypertension (systolic ≥ 140 and/or diastolic ≥ 90), 71 were self-reported and 135 were based on blood pressure measurements. Obesity was associated with hypertension (OR 2.79, 95%CI 1.4–5.4), but not with DM. No relationship was observed between fruit and vegetable consumption and presence or absence of DM or hypertension.

Conclusion: This study identified a high prevalence of obesity and hypertension among government employees in the Cook Islands, risk factors that are associated with NCDs such as DM and cardiovascular disease. 'Wellness checks' pave the way for interventions in workplace settings to prevent and better manage these diseases through early diagnosis, risk management, treatment and supportive public health policies.

Non-communicable diseases (NCDs) are a major public health problem in the Pacific.¹ At the 2011 Pacific Islands Forum, Pacific Island leaders declared the region to be in an 'NCD crisis', and highlighted the grave threat posed by NCDs not only to health but also to the social and economic development of the region.¹ There are 15000 Cook Islands Māori in the Cook Islands,² and 70000 in New Zealand. The Cook Islands is part of the Realm of New Zealand, and as citizens of New Zealand, Cook Islanders travel frequently between the Cook Islands and New Zealand (and onwards to Australia).

The World Health Organization's (WHO's) profile of the Western Pacific Regions, based on the STEPwise approach to NCD Risk Factor Surveillance surveys (STEPS) conducted in the region, identified the Cook Islands as having the third highest prevalence of NCD risk factors in the Pacific.³ Risk factors examined included physical inactivity, low fruit and vegetable

consumption, obesity and raised serum cholesterol. In the past 20 years, a number of health promotion initiatives in the Cook Islands have targeted NCD risk factors such as obesity, physical inactivity and healthy eating. Despite these efforts the prevalence of diabetes mellitus type 2 (DM) and hypertension is high and continues to rise (Figure).⁴

There is evidence to show that regular moderate physical activity and the consumption of five or more servings of fruit and vegetables a day are associated with a reduction in the risk of DM and hypertension.^{5,6} In light of this, in 2012 the Ministry of Health (MoH) launched a programme designed specifically for government workplaces and offered complimentary health assessments, or 'wellness checks', to all government employees on Rarotonga, the main island in the Cook Islands. The checks assessed the presence of NCD risk factors and the concurrent prevalence of DM and hypertension. Previous published reports such as those by Puaikura⁷ and the Tutakimoa Lifewise Project⁸ have analysed 'wellness checks' data to describe the prevalence of risk factors within the community. However, to date, none of the information on risk factors captured in the workplace has been formally published. This much-needed information will provide an important first step towards developing an evidence-based policy framework for evaluating and improving the effectiveness of workplace interventions to promote healthy lifestyles and reduce the risk of NCDs in the Cook Islands.

The aim of the present study was to determine the sociodemographic characteristics, the presence of selected NCD risk factors and the prevalence of DM and hypertension among all government workers on Rarotonga who took part in 'wellness checks' in 2012. Specific objectives were to determine among government

FIGURE Prevalence of diabetes and hypertension, Cook Islands, 2001–2011.

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KEY WORDS

Cook Islands; occupational health; diabetes mellitus; hypertension; risk assessment

Received 6 September 2013
Accepted 27 January 2014

PHA2014;4(2):S34–S38
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employees: 1) socio-demographic characteristics, selected NCD risk factors and prevalence of DM and hypertension, and 2) the association between sociodemographic characteristics and NCD risk factors with DM and hypertension.

METHODS

Study design

This was a cross-sectional study involving analysis of data obtained from 'wellness checks' offered by the Cook Islands MoH to government employees in Rarotonga.

Setting General

The Cook Islands consist of 15 islands in the South Pacific with approximately 15000 inhabitants of mainly Polynesian descent. Rarotonga, the main island, is the country's main administration centre. In 2011, 10572 people, approximately 70% of the total resident population of the Cook Islands, resided on Rarotonga.² Of these, 7703 (73%) are employed, with 1345 (17%) working in the government sector. The majority (95%) of the government employees in the country are of Cook Islands descent.² The official employment age in the Cook Islands is 16–65 years.

Wellness checks

In January 2012, all 30 government departments on Rarotonga were invited by letter to participate in the 'wellness checks' programme. Twenty of the departments accepted the invitation. The checks were conducted by staff from the MoH's Health Promotion Unit between January and June 2012. A self-administered questionnaire was developed by the Cook Islands MoH on age, sex, levels of physical activity, fruit and vegetable consumption and history of DM and hypertension. Anthropometric measurements of height and weight were obtained using standardised methods and tools to calculate body mass index (BMI), capillary blood samples were taken to assess random and fasting blood glucose and total cholesterol, and systolic and diastolic blood pressure (BP) was measured in the sitting position using the left arm and the appropriate sized cuff. A single resting BP measurement was taken, unless it was raised, in which case a second reading was taken. MoH staff were trained to distribute the questionnaires and gather anthropometric and other study data.

Information was recorded onto the MoH Community Health Assessment Form, and the data were entered into the electronic patient information system (Medtech, Auckland, New Zealand). Participants who screened positive for raised blood glucose or blood pressure were referred to the general health care system for diagnosis, treatment and care.

Participants

Study participants were government employees from 20 government departments on Rarotonga who were present at work on the day of the MoH 'wellness check' visit and who accepted the invitation to undergo a health assessment.

Data variables, operational definitions and data collection

Data variables included age; sex; BMI; reported history of DM or hypertension; number of days each week and number of servings per day of fruit and vegetables consumed; intensity, number of days per week and time in minutes of physical activity (intensity of physical activity was classified subjectively as light, moderate or vigorous); random and fasting blood glucose; and blood pressure, measured in the sitting position. Operational definitions were as follows: high level of fruit and vegetable consumption = five servings of fruit and vegetables/day 7 days/week; any number of servings of fruit and vegetables less than this was defined as low level of consumption; low level of physical activity = engaging in <150 min of moderate physical activity per week, defined as leisure time activities, gardening and housework, and excluding activity done as part of paid employment; obesity = BMI ≥ 30 kg/m²; hypertension = history of hypertension or resting sitting systolic pressure ≥ 140 mmHg and/or diastolic pressure ≥ 90 mmHg.⁷ For the purpose of this study, DM was classified as a history of DM, random blood glucose ≥ 11.1 mmol/l or fasting blood glucose ≥ 7.0 mmol/l.⁷

Analysis and statistics

Data from Medtech were exported to an Excel spreadsheet (Microsoft, Redmond, WA, USA) and from there to EpiData version 3.1 (EpiData Association, Odense, Denmark) for analysis. Summary statistics were used to describe the prevalence of characteristics, NCD risk factors, DM and hypertension. Unadjusted odds ratios (ORs) with 95% confidence intervals (CIs) were calculated to explore associations between risk factors and DM and hypertension. Levels of significance were set at 5% ($P < 0.05$).

Ethics

Ethical approval for this research was obtained from the Ethics Advisory Group of the International Union against Tuberculosis and Lung Disease (EAG: 103/12) and the Cook Islands MoH Research Committee.

RESULTS

Characteristics, selected risk factors, diabetes and hypertension among government workers

The median age of the 598 government employees who participated in the study was 40 years. Their characteristics and prevalence of DM and hypertension are shown in Table 1. About 70% of the participants were aged 25–54 years and over half were female. Levels of physical activity were recorded in only one third of the participants ($n = 203$). Among these, 88% ($n = 179$) had low levels of physical activity. Two thirds were obese (BMI ≥ 30 kg/m²). Just over 75% of the participants had low levels of fruit and vegetable consumption. Fifty (8.4%) participants were diagnosed with DM, 30 based on self-reported history and 20 on blood glucose measurements; 206 (34.4%) were diagnosed with hypertension, 71 based on self-reported history and 135 on blood pressure measurements.

ACKNOWLEDGEMENTS

This research was supported through an operational research course that was jointly developed by the Centre for Operational Research, International Union Against Tuberculosis and Lung Disease (The Union), Paris, France, and the Médecins Sans Frontières, Brussels-Luxembourg, and run in the South Pacific by The Union and the Public Health Division of the Secretariat of the Pacific Community, Nouméa, New Caledonia. Additional support for running the course was provided by the School of Population Health, The University of Auckland, Auckland, New Zealand; the College of Medicine, Nursing and Health Sciences, Fiji National University, Suva, Fiji; the Division of TB Elimination, Centers for Disease Control and Prevention, Atlanta, GA, USA; Regional Public Health, Hutt Valley District Health Board, Lower Hutt, New Zealand; the National TB Programme, Fiji Ministry of Health, Suva, Fiji; the Sydney Emerging Infections and Biosecurity Institute, The University of Sydney, Sydney, NSW, Australia; and the Dunedin School of Medicine, The University of Otago, Dunedin, New Zealand. The authors also thank the Cook Islands Ministry of Health for supporting the study and approving the use of survey data, N Tangi for assistance with data collection and entry and the participants who took part in the 'wellness checks'. Funding for the course was provided by the Global Fund to Fight AIDS, TB and Malaria, Geneva, Switzerland, the World Diabetes Foundation, Gentofte, Denmark, and the Australian Agency for International Development, Canberra, ACT, Australia. Conflict of interest: none declared.

TABLE 1 Characteristics of government workers on Rarotonga, Cook Islands

Variable	Total n (%)
All government workers	598
Age, years	
15–24	85 (14.2)
25–34	137 (22.9)
35–44	158 (26.4)
45–54	125 (20.9)
55–64	76 (12.7)
≥65	17 (2.8)
Sex	
Male	272 (45.5)
Female	326 (54.5)
Physical activity*	
High	24 (4.0)
Low	179 (29.9)
Not recorded	395 (66.1)
Body mass index, kg/m ²	
Normal (18.5–24.9)	64 (10.7)
Overweight (25–29.9)	123 (20.6)
Obese (≥30)	396 (66.2)
Not recorded	15 (2.5)
Fruit and vegetable consumption†	
High	144 (24.1)
Low	454 (75.9)
History of diabetes mellitus‡	30 (5.0)
History of hypertension‡	71 (11.9)
Diabetes mellitus based on blood testing§	20 (3.3)
Hypertension based on blood pressure measurement¶	135 (22.6)

*Low: ≤150 min moderate physical activity/week; high: ≥150 min moderate physical activity/week.

†Low: ≤5 servings of fruit and vegetables/day; high: ≥5 servings of fruit and vegetables/day.

‡Self-reported history of diabetes mellitus or hypertension

§Random blood glucose ≥11.1 mmol/l or fasting blood glucose ≥7.0 mmol/l.

¶Resting sitting systolic pressure ≥140 mmHg and/or diastolic pressure ≥90 mmHg. CI = confidence interval.

Association between characteristics and NCD risk factors with diabetes and hypertension

Characteristics and NCD risk factors in participants with and without DM are shown in Table 2. Those with DM were more likely to be older, have higher levels of physical activity and a BMI ≥30 kg/m² (obese) than those not meeting the criteria for DM. There were no differences in sex or levels of fruit and vegetable consumption between the two groups. No relationship between BMI and fruit and vegetable consumption and presence or absence of DM (Table 3) was observed. Physical activity was not analysed in relation to DM due to large amounts of missing data.

Characteristics and NCD risk factors in participants with and without hypertension are shown in Table 4. Those with hypertension were more likely to be older and have a BMI ≥30 kg/m² (obese) than those who did not have hypertension. There were no differences by sex, physical activity or levels of fruit and vegetable consumption between the two groups. No relationship between fruit and vegetable consumption and presence or absence of hypertension was observed; however, obesity defined as BMI ≥30 kg/m² was associated with hypertension (Table 5). Physical activity was again not analysed in relation to hypertension, due to large amounts of missing data.

TABLE 2 Characteristics of government workers in relation to presence or absence of diabetes, Rarotonga, Cook Islands

Variable	Diabetes mellitus*		P value†
	Yes n (%)	No n (%)	
Total (n = 598)	50 (8.4)	548 (91.6)	
Age, years (n = 598)			<0.01
15–24	2 (4)	83 (15.1)	
25–34	4 (8)	133 (24.3)	
35–44	11 (22)	147 (26.8)	
45–54	16 (32)	109 (19.9)	
≥55	17 (34)	76 (13.8)	
Sex (n = 598)			0.50
Male	25 (50)	247 (45.1)	
Female	25 (50)	301 (54.9)	
Physical activity (n = 203)‡			0.02
High	4 (33.3)	20 (10.5)	
Low	8 (66.7)	171 (89.5)	
Body mass index, kg/m ² (n = 583)			≤0.01
Normal (18.5–24.9)	0 (0)	64 (11.7)	
Overweight (25–29.9)	5 (10)	118 (21.5)	
Obese (≥30)	43 (86.4)	353 (64.4)	
Fruit and vegetable consumption (n = 598)§			1.00
High	12 (24)	132 (24.1)	
Low	38 (76)	416 (75.9)	

*Fasting blood glucose ≥7.0 mmol/l or random blood glucose ≥11.1 mmol/l.

†Based on χ^2 test.

‡Low: ≤150 min moderate physical activity/week; high: ≥150 min moderate physical activity/week.

§Low: ≤5 servings of fruit and vegetables/day; high: ≥5 servings of fruit and vegetables/day.

TABLE 3 Relationship between presence of selected known risk factors and diabetes in government workers, Rarotonga, Cook Islands

Variable	Diabetes mellitus* OR (95%CI)	P value
Body mass index, kg/m ²		
Normal (18.5–24.9)	1.0	
Overweight (25–29.9)	5.99 (0.33–110.1)	0.35
Obese (≥30)	15.87 (0.97–261.13)	0.18
Fruit and vegetable consumption†		
High	1.0	
Low	1.0 (0.51–1.98)	0.1

*Fasting blood glucose ≥7.0 mmol/l or random blood glucose ≥11.1 mmol/l.

†Low: ≤5 servings of fruit and vegetables/day; high: ≥5 servings of fruit and vegetables/day.

OR = odds ratio; CI = confidence interval.

DISCUSSION

This is the first published study to explore the prevalence of selected risk factors and their association with DM and hypertension among government workers in the Cook Islands using data obtained from the MoH's standardised 'wellness check'. The key findings were that in this working age population, there were low levels of physical activity (where it was reported), low levels of fruit and vegetable consumption and a high prevalence of obesity. The prevalence of DM was 8%, and just over one third of the government workers had hypertension. There was a significant association between obesity and hypertension.

TABLE 4 Characteristics of government workers in relation to presence or absence of hypertension, Rarotonga, Cook Islands

Variable	Hypertension*		P value†
	Yes n (%)	No n (%)	
Total (n = 598)	206 (34.4)	392 (65.6)	
Age, years (n = 598)			<0.01
15–24	12 (5.8)	73 (18.6)	
25–34	35 (17.0)	102 (26.0)	
35–44	59 (28.6)	99 (25.3)	
45–54	56 (27.2)	69 (17.6)	
≥55	44 (21.3)	49 (12.5)	
Sex (n = 598)			
Male	103 (50.0)	169 (43.1)	0.11
Female	103 (50.0)	223 (56.9)	
Physical activity (n = 203)‡			0.58
High	9 (10.9)	15 (13.6)	
Low	57 (89.1)	122 (86.4)	
Body mass index, kg/m ² (n = 583)			
Normal (18.5–24.9)	12 (5.8)	52 (13.3)	0.01
Overweight (25–29.9)	36 (17.5)	87 (22.2)	
Obese (≥30)	155 (75.2)	241 (61.5)	
Fruit and vegetable consumption (n = 598)§			0.90
High	49 (23.8)	95 (24.2)	
Low	157 (76.2)	297 (75.8)	

*Blood pressure ≥140 mmHg and/or ≥90 mmHg.

†Based on χ^2 test.

‡Low: ≤150 min moderate physical activity/week; high: ≥150 min moderate physical activity/week.

§Low: ≤5 servings of fruit and vegetables/day; high: ≥5 servings of fruit and vegetables/day.

The strengths of the study were that a large sample of government workers was assessed using a standardised wellness check assessment tool. The study was also conducted and reported according to STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines.⁸ The study also had a number of limitations. We have no information about the government departments who did not take part or the reasons for non-participation. Similarly, as we had no information on the number of people who did not accept the invitation to participate in the wellness checks, we are uncertain about the representativeness of the participant sample. In addition, given that only 17% of the workforce in the Cook Islands is employed in the government sector, these findings are unlikely to be representative of the Cook Islands' entire working population. We did not capture information on participant ethnicity. However, the predominance of Cook Islanders in the Government sector suggests that the study would have been underpowered to explore any differences by ethnicity. The questionnaire was self-administered, and was not checked for completeness at the recruitment locations. A large number of respondents failed to answer the full set of questions on physical activity, rendering information on the composite physical activity variable incomplete for two thirds of participants. One of the definitions of DM used for the study was based on random blood glucose, without information on DM symptoms: this is not in line with World Health Organization guidelines,⁹ and it is possible that we over-classified participants using this methodology. No adjustment was made for potential confounders such as tobacco, alcohol, salt intake and other poten-

TABLE 5 Relationship between the presence of selected known risk factors and hypertension in government workers, Rarotonga, Cook Islands

Variable	Hypertension* OR (95%CI)	P value
Body mass index, kg/m ²		
Normal (18.5–24.9)	1.0	
Overweight (25–29.9)	1.79 (0.86–3.75)	0.12
Obese (≥30)	2.79 (1.44–5.39)	<0.01
Fruit and vegetable consumption†		
High	1.0	
Low	1.02 (0.69–1.52)	

*Blood pressure ≥140 mmHg and/or ≥90 mmHg.

†Low: ≤5 servings of fruit and vegetables/day; high: ≥5 servings of fruit and vegetables/day.

OR = odds ratio; CI = confidence interval.

tially relevant exposures in these analyses; the ORs may therefore have under- or over-estimated the effect of the known risk factors on the disease outcomes of interest. The demographic analyses in this study were limited to participant information contained in their Medtech record. These data do not contain information on workplace setting or the nature of the work. This information would have allowed additional analyses exploring the presence of any relationship between workplace and work patterns and the NCD risk factors examined.

Despite these limitations, the findings of the study have significant implications for policy and practice. First, 40% of participants with DM and 65% of those with hypertension were identified as a result of active blood testing or blood pressure measurements. It is well established that half of individuals with DM globally are undiagnosed,¹⁰ and the same holds true for hypertension.^{11,12} Active screening in the workplace therefore seems a worthwhile activity, provided that it is linked to referral for diagnosis and care. Stroke and cardiovascular disease are the leading causes of mortality in the Cook Islands,⁴ and early diagnosis and treatment of DM and hypertension may prevent premature deaths and reduce risk factor prevalence. The findings also provide further evidence of the benefits of opportunistic screening through a primary health care approach.

Second, lifestyle behaviours such as low fruit and vegetable intake and low physical activity are recognised risk factors for NCDs.^{6,13} Findings from the most recent Cook Islands STEPs survey of the general population identified similar rates of low fruit and vegetable consumption (82%) and obesity (61%), but lower rates of low physical activity level (75%) than in the present study.¹⁴ Some of the differences in levels of physical activity between the two studies may be due in part to measurement error and missing data, but may also reflect a more sedentary lifestyle among government employees. 'Wellness checks' in the workplace, such as those carried out in this research, not only provide the opportunity to monitor and screen for known risk factors and negative health outcomes, they also provide an avenue to strengthen existing healthy lifestyle interventions in the workplace. However, such activities need to be supported by healthy public policy if long-term gains are to be made at the population level.^{5,15,16} Third, obesity was clearly linked to hypertension in our study, and efforts to reduce obesity in the workplace setting need to be strengthened.

In conclusion, this study involving government workers in Rarotonga, Cook Islands, has identified a high prevalence of se-

lected risk factors that are associated with obesity, hypertension and DM. This opens the way for interventions in workplace settings to prevent and better manage the NCD epidemic through early diagnosis, risk management and treatment. Future studies should explore the prevalence of smoking and alcohol use in this population and their contribution to DM and hypertension in government employees in the Cook Islands.

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Contexte : Vingt ministères à Rarotonga, Iles Cook.

Objectifs : Déterminer les caractéristiques, la présence de facteurs de risque de plusieurs maladies non transmissibles et la prévalence du diabète (DM) et de l'hypertension chez des fonctionnaires qui ont participé aux « bilans de bien-être » en 2012.

Schéma : Etude transversale par analyse des données d'enquête.

Résultats : Sur 598 employés, 70% avaient de 25 à 54 ans et 55% étaient des femmes. Deux tiers étaient obèses (IMC >30 kg/m²) et 76% consommaient peu de fruits et légumes. Cinquante participants avaient un DM (8,4%), 20 déclarés par eux-mêmes et 30 découverts grâce à leur glycémie (test de glycémie au hasard ≥11 mmol/l ; à jeun ≥7 mmol/l) ; 206 (34,4%) avaient une hypertension (systolique ≥140 et/ou diastolique ≥90), 71 connus

et 135 en fonction de la mesure de leur pression artérielle. L'obésité était associée à l'hypertension (OR 2.79 ; IC95% 1,4–5,4) mais pas au DM. Il n'y avait pas de relation entre la consommation de fruits et légumes et la présence de DM ou d'hypertension.

Conclusion : Cette étude a mis en évidence une prévalence élevée d'obésité et d'hypertension parmi les employés des ministères des îles Cook, associés à des maladies non transmissibles comme le DM et l'hypertension. Les « bilans de bien-être » ouvrent la voie à des interventions sur les lieux de travail afin de prévenir et de mieux prendre en charge ces maladies grâce à un diagnostic et un traitement précoces, une gestion des risques et des politiques de santé publique favorables.

Marco de referencia: Veinte dependencias gubernamentales de Rarotonga, en las Islas Cook.

Objetivos: Determinar las características sociodemográficas, la presencia de factores de riesgo de padecer algunas enfermedades no transmisibles y la prevalencia de diabetes (DM) e hipertensión arterial en los funcionarios que participaron en los 'controles de la persona sana' propuestos en el 2012.

Métodos: Se llevó a cabo un estudio transversal en el cual se analizaron los datos de la encuesta.

Resultados: Participaron en la encuesta 598 empleados, el 70% tenía entre 25 años y 54 años de edad y el 55% era de sexo femenino. Dos tercios de los funcionarios eran obesos (índice de masa corporal ≥30 kg/m²) y el 76% consumía pocas de frutas y verduras. Cincuenta participantes presentaron diagnóstico de DM (8,4%) (glucosa sanguínea al azar ≥11 mmol/l, en ayunas ≥7 mmol/l), en 30 casos

por autnotificación y en 20 con base en la glucemia; hubo 206 personas con diagnóstico de hipertensión (34,4%) (sistólica ≥140 and/or diastólica ≥90), de los cuales 71 autnotificados y 135 con base en mediciones de la tensión arterial. La obesidad se asoció con la hipertensión (OR 2,79; IC95% de 1,4 a 5,4), pero no con la DM. No se observó ninguna correlación entre el consumo de frutas y verduras y la presencia o ausencia de DM o hipertensión.

Conclusión: Se puso en evidencia una alta prevalencia de la obesidad y hipertensión en los funcionarios de las Islas Cook, la cual se asoció con la presencia de enfermedades no transmisibles como la DM o la hipertensión. Los 'controles de la persona sana' sientan las bases de intervenciones en los lugares de trabajo, destinadas a prevenir y tratar mejor estas enfermedades mediante el diagnóstico temprano, la gestión de los riesgos, el tratamiento y la formulación de políticas de salud pública.