Prevalence of self-reported diabetes, hypertension and heart disease in individuals seeking State funding in Trinidad and Tobago, West Indies

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Abstract *Objective:* Diabetes, hypertension and heart disease inflict a heavy health burden on the Caribbean Republic of Trinidad and Tobago. This study assessed the prevalence of self- reported diabetes, hypertension and heart disease in lower socioeconomically placed individuals accessing welfare grants.

Method: Data collected between July 2008 and June 2009 were analyzed from 14,793 responses. The survey sought information on education, average monthly income, health, housing, and household facilities.

Results: Self-reported disease prevalence was 19.5% (95% CI: 18.9–20.2) for diabetes mellitus; 30.2% (95% CI: 29.5–30.9) for hypertension; and 8.2% (95% CI: 7.7–8.6) for cardiac disease. Diabetes and cardiac disease had equivalent gender frequency; hypertension was more prevalent in women ($p < .001$). Disease prevalence was highest in Indo-Trinidadians, married and divorced subjects, non-Christians and increased with age. Those with primary education alone were at greatest risk.

Conclusion: Trinidad and Tobago have a high prevalence of hypertension, diabetes and heart disease. Hypertension showed gender specificity in women. Prevalence was highest in Indo-Trinidadians, increased with age, and primary education

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1. Introduction

Chronic non-communicable diseases (CNCDs) are viewed to be the leading causes of global death and disability in the not so far off 2030 and are predicted to cause three quarters of all deaths [1]. Cardiovascular disorders, chronic obstructive pulmonary disease, asthma, diabetes, obesity, some cancers and disabling mental illness are included under the umbrella of this acronym. CNCDs have dominated the global health burden in recent years, and poorer countries seem to have provided the model for this observation. Evidence clearly points to CNCDs as disproportionately affecting the poor [2]. In low- and middle-income countries, chronic disease is the current cause for an estimate of more than 80% of deaths [1,3]. Countries economically not on par with the developed nations bear the biggest brunt of these diseases, and Caribbean territories with less than enviable economies are significantly saddled with this health encumbrance. In 1990 non-communicable diseases surpassed maternal, peri-natal, communicable, and nutritional disorders in the Caribbean [4]. More than a decade later the health scenario suggests these diseases are still the leading causes of morbidity. The Caribbean has the highest prevalence of CNCDs in the region of the Americas [5]. In the twin-island republic of Trinidad and Tobago, the mortality rates from diabetes and cardiovascular disease are higher than in North America (United States and Canada) [5].

The epidemiologic transition to CNCDs has been well documented in Trinidad and Tobago [6,7]. The first survey of a stratified random sample of the entire population of Trinidad screened 24,069 persons in the 1960s and reported that 1.89% of the sample satisfied the criteria for diabetes [8], which was one of the highest reported prevalence for this disease in the region. In a second study conducted between 1977 and 1985 of 2491 persons in an urban setting, the incidence rates of hypertension in men were 37 per 1000 person-years and 29.5 per 1000 person-years in women. The incidence of diabetes (per 1000 person-years) in Indians was 23.5/1000 and was significantly higher than in Africans [9]. However, following these two early population-based epidemiologic studies, more recent data on the epidemic have been based on self-reporting of the CNCDs. Thus, the 2005 Survey of Living Conditions reports that 10.4% of the poorest and 17.6% in the richest of 2086 community dwelling respondents had self-reported diabetes. In this survey no information was provided for hypertension [10]. These data provide an insight into the evolution of the diabetes epidemic in Trinidad and Tobago. The death rate from diabetes in the country is ten times higher than in the United States of America, and the age-adjusted, gender-specific mortality rates from heart disease and all cardiovascular diseases rank among the highest in the Caribbean [11].

Although population-based epidemiologic surveys are the gold standard, information derived from self-reporting of diabetes in a Taiwanese population has been found to be accurate in determining disease prevalence [12]. Further, in a USA study of 2037 persons self-reporting of diabetes when compared with a review of their medical records revealed a specificity of >90% but with lower (66%) sensitivity [13]. The self reported prevalence of diabetes, hypertension and heart disease in a large population of individuals from the lower socioeconomic group who applied for State-sponsored welfare grants was studied. The determined prevalence rates of these conditions, particularly diabetes and hypertension — the two most common chronic non-communicable diseases in Trinidad and Tobago — will contribute to the health care system planning over the next decade.

2. Materials and methods

2.1. Ethical permission

This is a retrospective database study. Data from patients were anonymized and permission was obtained from the Ministry of the People and Social Development for analysis of these data. It was not deemed necessary to obtain ethical permission from an Institutional Review Board as these data were entered on a database of the above-mentioned Ministry and were taken with the informed consent of respondents and were anonymously analyzed.

2.2. Population

Respondents came from a short-term financial assistance program which is offered to economically vulnerable persons and families within Trini-

dad and Tobago. Eligibility for this program is determined using a Means Test Score applied by the Ministry of the People and Social Development.

2.3. Data collection

Data were collected from persons who accessed the program from its inception in August 2006 to January 31, 2008. The exercise targeted 21,790 recipients of the program. A database of recipients was provided in May 2008 by the government agency responsible for the implementation of the program. Data were formally collected during the period July 2008 to June 2009. Correspondence was sent by the Ministry of the People and Social Development to all persons listed on a database that were accessing this program via mailings and advertisements inviting them to attend an interview session at specific centers across Trinidad and Tobago on a specific date, time and venue. For the purpose of administering the interview, Trinidad and Tobago was divided into five zones (East, Northeast, South, Central and Tobago) and 23 centers manned by supervisors and interviewers were set up within these zones. The invitation letters to recipients indicated the specific documents required to be provided at the interview. A household interview was subsequently conducted with each respondent who attended the initial interview. When respondents did not attend the first interview, attempts to obtain the data were made by house visits. A field verification exercise was conducted after the interview to verify living conditions.

2.3.1. Instrument of collection
Data were collected via interviewer administered application forms, using information provided by recipients. A 32-page manual was developed and utilized in the training of interviewers before the start of the exercise. The main instrument of data collection was a 27-page application form developed and prepared in consultation with a governmental agency and consisted of sections on characteristics of household members, levels of educational attainment, average monthly income, health/disease status, housing, and household facilities. The following demographic data were all subject-defined: ethnicity, income level, educational attainment, religious affiliation, marital status and residence.

3. Results

3.1. Description of population

Though attempts were made to interview all relevant recipients (21,790), only 15,649 persons were interviewed. Data were incomplete for 856 participants; the remaining 14,793 interview responses were utilized for this paper. The final demographic configuration of recipients was: 86% females and 14% males with the mean age being 46.4 years (SD = 12.9).

3.2. Age and ethnicity

On a more detailed examination of age, 13% of recipients were between 17 and 30 years, 22% between 31 and 40 years, 26% between 41 and 50 years, 23% between 51 and 60 years, 14% between 61 and 70 years and 2% were over 71 year old; 65% of recipients were 41 years and over, 49% of respondents were of East Indian origin, 35% were of African origins, 15% were of mixed origin, and 1% belonged to other ethnic groups. The marital status showed that 29% of recipients were married, 29% were single, 14% were in a 'common law' relationship, 13% were widowed, 9% were separated, 4% were divorced and for 1% no information was given.

3.3. Religious affiliation

The distribution of religious backgrounds of recipients is as follows: 28% Hindu, 17% Pentecostal, 16% Roman Catholics, 11% Baptist, 6% Anglicans, 5% Islam, 5% Seven Day Adventists (SDAs), 3% Presbyterian, 1% Jehovah Witness, 1% Methodist, less than 1% Moravian, 6% other and in 1% none. The other religious groups included Assembly Church of God, Bahai, Ethiopian Orthodox, Open Bible, Rastafarian and Spiritual Baptist.

3.4. Education and Income

The vast majority of recipients (63%) had only a primary education, 34% had a secondary education, less than 1% were in a tertiary education at university or taking distance learning programs, less than 1% were enrolled in an adult literacy program and 2% had no education. The mean monthly income of recipients was TT$ 430.36. The mean monthly income and monthly expenditure of each household were TT $1,715.34 and TT$ 1,050.38 respectively, so that the net income was TT$ 664.98 (income and expenditure are based upon means test criteria).(1US$ = 6.44 TT$).

3.5. Geographic location

Respondents came from the following regional areas as determined by the regional offices: 7.7% from Port of Spain, 14.3% from San Juan, 12.3% from Sangre Grande, 9.3% from Chaguanas, 9.6%

from Couva, 7.7% from San Fernando, 15.7% from Princes Town, 11.6% from Penal, 5.2% from Point Fortin and 6.6% were from Tobago.

3.6. Marital status

Table 1 shows that single and married subjects within the studied group were approximately equal in prevalence. Only 3.7% were divorced.

3.7. Medical illness in the population interviewed

Diabetes mellitus was reported by 19.5% (95% CI: 18.9—20.2), hypertension by 30.2% (95% CI: 29.5—30.9) and cardiac disease was reported by 8.2% (95% CI 7.7—8.6) of the studied group. Both diabetes and cardiac disease were approximately equally prevalent among males and females, but hyperten-

Table 1 The composition of individuals seeking State-funded, short-term public financial assistance in Trinidad and Tobago (2008).

	Self-reported (N)	Self-reported (%)
Gender		
Male	1990	14.1
Female	12139	85.8
Ethnicity		
Afro-Trinidadian	4989	35.5
Indo-Trinidadian	6978	49.6
Mixed	2099	14.9
Marital status		
Single	4165	29.9
Married	4110	29.5
Separated	1267	9.1
Divorced	515	3.7
Common Law	1987	14.2
Widowed	1902	13.6
Religion		
Hinduism	3956	30.1
Islam	646	4.9
Roman Catholic	2197	16.7
SDA	709	5.4
Other christian groups	5616	42.8
Age		
17—30	1835	13.0
31—40	3108	22.0
41—50	3610	25.5
51—60	3312	23.4
61—70	2002	14.2
71+	267	1.9
Education		
Primary	9 213	65.5
Secondary	4 735	33.7
University	110	.8
Diabetes mellitus		
Yes	2 758	19.7
No	11 273	80.3
Hypertension		
Yes	4 272	30.4
No	9 764	69.6
Cardiac disease		
Yes	1 156	8.3
No	12 820	91.7

Table 2 Prevalence of NIDDM, HTN and Cardiac Disease in individuals seeking financial assistance in a State-funded, short-term support program (2008).

	Diabetes mellitus				Hypertension				Cardiac Disease			
	Self-reported	Yes			Self-reported	Yes			Self-reported	Yes		
	(%)	N	χ^2	p-value	(%)	N	χ^2	p-value	(%)	N	χ^2	p-value
Gender												
Male	18.6[a]	367	1.60	.21	22.0	434	76.92	.000	10.7	211	18.27	.000
Female	19.8	2389			31.8	3832			7.9	944		
Ethnicity												
Afro-Trinidadian	13.0	644	435.03	.000	25.5	1266	173.33	.000	4.4	219	264.24	.000
Indo-Trinidadian	26.7	1850			35.6	2470			12.1	835		
mixed	12.1	251			25.0	52			4.8	99		
Marital status												
Single	14.9	614	423.29	.000	25.1	1036	546.13	.000	5.6	233	236.18	.000
Married	21.0	858			30.5	1249			8.7	353		
Separated	19.8	249			30.5	383			8.1	102		
Divorced	21.1	108			33.9	173			10.2	52		
Common law	12.0	237			20.9	412			4.8	94		
Widowed	35.1	663			51.7	977			16.4	308		
Religion												
Hinduism	27.0	1060	218.48	.000	36.3	1428	117.19	.000	13.3	519	199.26	.000
Islam	23.4	150			33.0	211			10.5	67		
Roman Catholic	14.9	326			25.1	546			5.3	114		
SDA	12.2	86			23.2	163			3.7	26		
Other Christian Groups	17.0	951			29.3	1633			6.5	362		
Age												
17–30	2.9	53	1326.13	.000	7.5	136	1794.90	.000	1.0	18	699.61	.000
31–40	7.7	239			15.0	462			2.2	69		
41–50	16.9	605			26.2	940			6.1	218		
51–60	32.4	1064			46.8	1537			13.7	446		
61–70	36.7	729			54.0	1072			18.2	360		
71+	25.6	68			46.2	123			16.5	44		
Education												
Primary	24.8	2267	438.34	.000	36.9	3379	521.38	.000	10.8	980	210.78	.000
Secondary	10.0	472			18.3	859			3.6	170		
University	7.3	8			15.5	17			2.8	3		

[a] Column percent.

Table 3 Percent difference for age and sex for diseases (NIDDM, HTN and Cardiac Disease) in individuals seeking financial assistance in a State-funded, short-term support program (2008).

Age	Diabetes			Heart			Hypertension		
	Male	Female	Difference (%)	Male	Female	Difference (%)	Male	Female	Difference (%)
17—30	(4)[a] 2%[b],b	(49) % 3%	1	0	(18) 1%	1	(5) 3%	(131) 8%	5
31—40	(23) 7%	(216) 8%	1	(9) 3%	(6) 2%	1	(30) 9%	(431) 16%	7
41—50	(70) 13%	(534) 18%	5	(40) 7%	(177) 6%	1	(87) 16%	(851) 28%	12
51—60	(141) 27%	(922) 33%	5	(75) 15%	(371) 14%	1	(149) 29%	(1387) 50%	21
61—70	(117) 33%	(612) 38%	5	(74) 21%	(286) 18%	3	(136) 38%	(935) 57%	19
71 & over	(12) 19%	(56) 28%	11	(12) 19%	(32) 16%	3	(26) 42%	(96) 48%	6

[a] Raw numbers in parentheses.
[b] Column percent.

Table 4 Comparison of prevalence of NIDDM, HTN and Cardiac Disease in Widowed Gender Groups seeking financial assistance in a State-funded, short-term support program (2008).

	Diabetes Mellitus				Hypertension				Cardiac disease			
	Self-reported Yes				Self-Reported Yes				Self-Reported Yes			
	(%)	N	χ^2	p-value	(%)	N	χ^2	p-value	(%)	N	χ^2	p-value
Gender												
Male	32		.063	.448	31.6	30	15.72	.000	15.8	15	.013	.524
Female		631			52.4	947			16.2	293		

[a]Column percent.

sion had a significantly higher prevalence in females (Table 2).

The gender-specific prevalence of hypertension (HTN) was studied in more detail to allow comparison with a recently conducted PAHO/WHO National STEPS Survey (2011) in Trinidad and Tobago.[1] Table 3 shows that HTN was more prevalent in individuals seeking financial assistance compared with the National Survey. There appears to be a much greater prevalence of HTN in females, by about 8%, in this study compared with the national survey. The prevalence of HTN though higher in males nationally was less in this study compared with females. This may be a result of the disproportionate higher percentage of females accessing this State-funded program.

All three illnesses were more prevalent among the Indo-Trinidadians in this study. They were also more prevalent in married and divorced subjects, and in non-Christians. Prevalence rates for all three ailments increased with age with a peak prevalence in the 51 to 60-year-old subjects with 46.8% of this group with hypertension. Finally, subjects with a primary education only were also at greatest risk for all three diseases.

Table 4 shows the difference in distribution of the diseases, with age and gender. All diseases have an increasing prevalence up to 70 years of age, but fall off thereafter, perhaps indicating a survivor effect. The proportion with heart disease is less than those of diabetes and HTN in all age groups, illustrating the lag between cardiac diseases and diabetes or HTN.

As many as 95% of the widowed persons were females; assessing the relationship between gender and diseases for widowed persons, a significant relation emerged for hypertension and females. There was no significant difference across gender widowed groups for diabetes or cardiac diseases (Table 5). Assessing the relationship between Hin-

Table 5 Comparison of prevalence of NIDDM, HTN and Cardiac Disease in Hindus and Seven Day Adventists (SDA) seeking financial assistance in a State-funded, short-term support program (2008).

	Diabetes mellitus				Hypertension				Cardiac disease			
	Self-Reported Yes				Self-reported Yes				Self-reported Yes			
	(%)	N	χ^2	p-value	(%)	N	χ^2	p-value	(%)	N	χ^2	p-value
Religion												
Hindu	26.8*	1060	69.78	.000	36.1	1428	45.96	.000	13.1	519	52.06	.000
SDA	12.1	86			23.0	163			3.7	26		

*Column percent.

dus and SDAs, a significant difference for all diseases emerged with an identifiable higher prevalence in Hindus.

4. Discussion

Successful management of CNCDs is dependent on social and environmental influences beyond the scope of the health care system. The increase in chronic diseases in developing countries is consequent to the increasing prevalence of risk factors, such as increased alcohol consumption, smoking, obesity, physical inactivity and low fruit and vegetable intake. Poverty is closely linked with social determinants of chronic disease, such as poor education [14], ethnicity [15], age, poor diet and tobacco use [16]. In this report, a higher prevalence of hypertension in females was found compared with the PAHO/WHO National STEPS Survey. Subjects in this study who had received a primary education only were at greatest risk for all three diseases compared with other degrees of education. An education enables people to rise beyond the limitations of poverty and is capable of curbing the rising prevalence rates of CNCDs. In a nationally represented cohort from the United States, education and income were important determinants in diabetes-related mortality [17]. In another study from India, educated parents made decisions which positively affected the health of their children [18].

More Trinidadians of East Indian ethnicity suffered from all three conditions in this cohort. In the United States the disproportionate sufferers of heart disease, cerebrovascular disease, and type 2 diabetes, which were ranked in 2000 as first, third, and sixth, respectively, among the leading causes of death and disability were racial and ethnic communities comprising the African Americans, Hispanic-Latino Americans, Native Americans and Alaska Natives, and Asian Americans and Pacific Islanders [19] From Jamaica, another Caribbean nation, hypertensive heart disease was predominant in Afro-Caribbean populations, and ischemic heart disease and acute myocardial infarction though highly prevalent appeared to have been missed and not recognized [20]. It appears that people of Indian heritage are more susceptible to these three disease entities of the metabolic syndrome.

The World Health Organization estimates that chronic disease accounts for 60% of deaths worldwide and has given precedence globally to the prevention and treatment of chronic diseases [21]. Among hypertension, heart disease and diabetes, hypertension has been cited as the most frequently reported condition [22]. This observation has implications for health and longevity in Trinidad, if this research is to be guided by data showing hypertension, like diabetes, has a rising prevalence [23] and is an alert to its etiological health burden for cerebrovascular accidents, which were the second leading cause of death a decade ago [4].

All three conditions showed a peak prevalence in subjects aged 51—60 years and 46.8% of these had hypertension. One study from Sweden showed that the prevalence of co-morbidity in older persons ranges from 55% to 98% [22]. Co-morbid chronic disease conditions are common in elderly patients and are significantly associated with higher mortality, particularly in patients between the ages of 65 and 89 years. Co-morbid diabetes, hypertension and cardiac disease were found to be the most prevalent in subjects between the ages of 61 and 70 years. Authors of a study from three European countries in men with chronic disease between 65 and 84 years reported co-morbidity was relatively common and could explain a large proportion of excess in all-cause mortality in 10 years of follow-up [24]. The age dependency of multi-morbidity in individuals studied illustrated a significant rising prevalence in both women and men from 18.5% to 44.0% and 28.6% to 58.0%, respectively [25]. Over the age of 51, women demonstrated a higher

prevalence of cardiovascular/metabolic disease than did men. In cross-sectional studies, older age, female gender, and low socioeconomic status were associated with multi-morbidity [22]. The higher prevalence of chronic conditions in women in this study established a gender difference which is strengthened by the findings of Marengoni et al. [22]. However, other studies found gender differences that were either smaller [26] or larger in men [27].

One interesting observation was that 35.1%, 51.7% and 16.4% of diabetics, hypertensive and heart disease patients respectively were widowed. These categories represented the highest marital status proportion for all three diseases and may have important policy implications. It is well recognized that widowhood is associated with poverty [28]. A household loses much of its earning potential or pensions with the death of the male breadwinner, or the long-term caring for a chronically disabled male wage earner. The well-documented longer life expectancy of women taken together with men marrying younger women in general, means that women often may live their later years without their life partner and thereby get a reduced income.

The association between poverty and chronic disease is interesting and has been described. Poverty contributes to CNCDs, and CNCDs contribute to poverty. The poor are more likely to smoke, have high levels of alcohol intake, have diets high in unsaturated fats, have low fruit and vegetable intake and enjoy a more sedentary lifestyle [29], all of which are risk factors for the development of non-communicable diseases. Where the literature is not as clear is in the status of widowhood and poverty and the relationship with the development of CNCDs. One could speculate if it is widows that suffer from chronic disease and are subjected to relative poverty as a result of the loss of their partner, or does losing a life partner lead to poverty which in turn results in chronic metabolic disease? This dilemma is worthy of exploration.

The burden of cardiovascular disease, specifically hypertension, diabetes and dyslipidemia in the Caribbean, portrays that which is reported in sub-Saharan African countries [30] considering both regions experience changing lifestyles with advancing urbanization. Wellbeing in both regions is influenced by a lack of infrastructural healthcare support, rapid urbanization, inadequate finances and insufficient and inefficient government programs that focus on disease prevention.

The recognized drivers of the health threat viz. diet, obesity, lack of exercise and smoking collectively fuel cardiovascular disease. Gender specific-

ity is emergent; for example obesity is a major risk factor in women, but smoking continues to predominate as a cardinal risk factor in men. The impact of low socioeconomic influences on obese women and male smokers put them at increased risk for developing or experiencing poor outcomes of metabolic and cardiovascular disease. These findings highlight the need to explore the nature and magnitude of CNCDs and identify a pressing need for interventions which prevent these illnesses in Trinidad and Tobago.

This study has prompted further work with the Government of Trinidad and Tobago to mount surveillance studies to detect cases of diabetes, hypertension and the metabolic syndrome in families of patients being treated at primary health centers. This research agenda also aims to explore prospectively in schoolchildren and adolescents the prevalence of obesity and pre-diabetes.

Notwithstanding data collection in 2008—2009 and the results under publication in 2012—2013 may limit the representation of current data, we believe the situation in this twin island republic of 1.3 million people has not significantly changed. Factors which contributed to the delay are the extensive population strength of 21,790 respondents in 23 centers that were screened across the country. Data collection by interview was entered manually on forms and later transcribed into an electronic database, and cross-checked with manual records to ensure an error-free file.

5. Conclusion

Hypertension, type 2 diabetes and cardiac disease are highly prevalent in individuals seeking State-funding in Trinidad and Tobago, and Indo-Trinidadians are the most affected ethnic group among these individuals. The peak prevalence of these conditions is between 51 and 60 years, particularly for hypertension. Hypertension is significantly more prevalent in females, while diabetes and cardiac disease are not gender specific. Low socioeconomic status and lower standards of education favor these conditions. Preventive measures to contain, and elucidate surveillance systems to detect these diseases are needed to form necessary features of the country's research agenda.

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