International Journal of Nursing
Peer Reviewed | Open Access | Free Online Journal | www.ijnonline.com
Published Biannually | ISSN: 2279-0195.

ORIGINAL ARTICLE

Gender differences in population-based prevalence of cardiovascular and cerebrovascular diseases in Chile: are men being under-diagnosed?

Dressler C*[a], Cabieses B[ab]

Dressler C

a Department of Health Sciences, University of York, York, United Kingdom
b Faculty of Medicine, Universidad del Desarrollo Clinica Alemana, Santiago, Chile

ABSTRACT

Background: Cardiovascular diseases (CVD) are the biggest killer worldwide. Chile has a long standing CVD preventive system, but no gender-focused study has been conducted so far. The purpose of this study was to analyse the existence of gender differences in the prevalence of CVD in Chile. This was a secondary analysis of the cross-sectional Chilean Health Survey 2009- 2010, including 5277 adult participants.

Methods: The relationship between CVDs and gender, crude and adjusted by potential confounders, were estimated by weighted Poisson regressions.

Results: Crude overall prevalence of self-reported hypertension was 28.13% and it was significantly lower in men (10.92%) than women (17.20%). Half of the population were overweight/obese (39.20%/22.92%) and alcohol consumption in the past month was high (58.42%). Around 40.19% currently smoke. Gender was significantly associated with hypertensions (PR 1.58, 95% CI [1.23-2.03]) as well as having public healthcare insurance (PR1.45, 95% CI [1.01-2.10]).

Conclusion: The results suggest that men reported hypertension less often than women, but comparisons with objective measures suggested they were under-diagnosed. These discrepancies need further consideration in preventive programmes and gender-focused policies in Chile. Nurses and other health professionals are key in creating, implementing and evaluating novel recruitment strategies for men.

Keywords: *Chile/epidemiology; Hypertension; Health Surveys; Cerebrovascular Disorders.*

***Corresponding Author**
ARRC 2nd Floor Postgraduate Offices, Department of Health Sciences, University of York, Heslington, York, YO10 5DD, United Kingdom Tel: +44 1904 321915; Fax: +44 1904 321388,
e-mail:dressler.corinna@gmail.com

Introduction

Chile is a middle-income country with an intermediate level of development that has experienced deep economic and demographic changes (Arteaga, Astorga, et al., 2002). Over the last century, a significant improvement in the health status of the population in Chile has been seen (Albala & Vio, 1995; Infante A., 2000). However, significant differences have been reported in the health status of Chilean subpopulations. As a response to the complex situation in Chile and its healthcare system (Box 1), the country decided to take advantage of the knowledge developed across the world on health inequalities (Jadue & Marin, 2005) and instigated a healthcare reform in 2005 (Atena, 1991; Infante, De la Matta, & Lopez-Acuna, 2000) .

Box 1: Chilean healthcare system

The Chilean healthcare system was created in 1952 and was a publicly integrated system until the dictatorship period (1973-1989). During the 1980s, the military government took a series of measures to stimulate growth in the membership of the private healthcare system. Since then, the Chilean healthcare system has been a mixed system characterized by segmentation. The public and private sectors coexist with poor interaction and dialogue between them. The private system covers about 25% of the population and the public sector covers around 60% of the population. The public system is broadly divided into 100% free of charge, available to those living in poverty by a means-tested approach, and the public with co-payment that varies in the proportion to be paid according roughly to the household earning. The rest of the population is either part of the Army healthcare system (around 4%) or have no healthcare coverage at all (around 10%) (Arteaga, Astorga, & Pinto, 2002; Arteaga, Thollaug, Nogueira, & Darras, 2002; Oyarzo, 2000)

Cardiovascular diseases (CVD) are the biggest killer worldwide. Death rates are estimated to reach 23.6 million by 2030 with middle and low income countries accounting for 80% of CVD death worldwide (World Health Organization, 2010). In Chile CVD showed an upward trend in the 1980s, but a decrease in hypertensives and CVD mortality in younger age groups has since been observed (Albala & Yanez, 1997; Cruz-Coke, 1985; Pramparo, 2002). Chile has, in fact, had a long standing CVD preventive system (Cruz-Coke, 1985). Since 2002 the Cardiovascular Health Program exists and more hypertensives are treated over time (35.6 % in 1988 versus 59.9% in 2004, (Fasce et al., 2007; Sandoval et al., 2012)). A recent study confirms that CVD mortality rates have decreased (de Fatima Marinho de Souza, Gawryszewski, Orduv√±ez, Sanhueza, & Espinal, 2012). However, Chile has seen an increase in stroke rates (Feigin, Lawes, Bennett, Barker-Collo, & Parag, 2009) with stroke incidence rates reaching 140.1 per 100 000; rates being higher in men (Lavados et al.). In fact, the relative burden of stroke and ischaemic disease can vary with stroke incidence rates often being higher in South America (Kim & Johnston, 2011). Below the age of 75, men generally have reported more coronary heart disease (CHD), whereas women have reported more strokes than men (Lloyd-Jones et al., 2010).

Few focused evaluations of the effectiveness of the new healthcare reform in Chile have been conducted (Bastias, Pantoja, Leisewitz, & Zarate, 2008; Bitran, Escobar, & Gassibe, 2010; Burrows, 2008; Vargas & Poblete, 2008) and none of them with a gender-specific purpose. Men and women are confronted with different experiences, risks and results when it comes to CVD (Regitz-Zagrosek, 2012). Rates of hypertensions have risen globally and tend to be higher in men than women, prior to menopausal age (Fasce et al., 2007; Regitz-Zagrosek, 2012). In the UK, blood pressure prevalence is observed at 32% and 29%, for men and women all ages, respectively, levelling to 62% at age of 65-74. (Scarborough et al., 2010) However, differential use of health care has been observed in Latin and Caribbean countries with men using healthcare less often, which could be confirmed for Chilean older adults where inequalities were larger (Dachs et al., 2002; Goldhaber-Fiebert, Goldhaber-Fiebert, & Andorsky, 2005). In addition, psychological factors and broader social determinants including low income, illiteracy or employment status can influence disease development (Mendes & Banerjee, 2010).

Little is known about gender-specific CVD prevalence rates and associated risk factors in Chile. Only one Chilean study on gender, from before the reform in 2003, focused on exploring inequity in access to healthcare and found that women with low socioeconomic status tend to use the healthcare system less frequently than women with high socioeconomic status (Vega, Bedregal, Jadue, & Delgado, 2003). This evidence supports the idea of monitoring the health status of the male and female population in Chile separately.

Our study updates and advances previous papers conducted with data from 10 years ago and focuses on gender differences for a range of CVDs. Findings from this study could inform and advocate for tailored interventions to improve the screening, diagnosis and treatment of some of the most prevalent health problems in Chile, including cardiovascular and cerebrovascular diseases (Chilean Ministry of Health, 2011). For example, results could inform nurses and other health professionals in primary care in Chile about the relevance and urgency of creating, implementing and evaluating novel recruitment strategies for men. Providing accurate and opportune diagnosis and treatment for CVDs among men could significantly improve population health in Chile and other countries in a similar situation. The objectives were:

To determine the prevalence of self reported CVD overall and stratified by sex

To analyse the factors associated with this conditions in the total population and by sex group

To assess possible under-diagnosis of hypertensions (as a modifiable risk factor) in the total population and by sex groups, by comparing self-reported hypertension against blood pressure measurement

Methods

Population and sample

Since 2000, the Chilean Ministry of Health has made efforts to obtain information about population´s diseases and their major risk factors through national health surveys (Encuesta Nacional de Salud, ENS) (Chilean Ministry of Health, 2010). The National Health Survey (ENS) was first conducted in 2003 and again in 2009-2010.

The sampling frame for ENS 2009-2010 was created from the Census of Population and Housing 2002 in Chile. This was a cross-sectional study using random multistage sampling of households (stratified by urban/rural) with national and regional representation. The target population was adults aged 15 years and older. The survey had a response rate in the eligible population of 85%. Finally, 5 434 people were interviewed. A nurse carried out clinical measurements and tests in 5 043 participants and 4 956 agreed to participate in laboratory tests (blood and urine). The final dataset has undergone sequential cleaning processes and this study is based on the latest release of the cleaned data (February 2012), with a total sample size of 5 277 participants interviewed and the same number of clinical measurements and laboratory tests. One hundred and forty-one participants were excluded (2.59%) from the original full dataset due to concerns on reliability of the data given their low scores in cognitive assessment (most of them elderly).

Interim standardization and iterative assessments of quality of laboratory analysis techniques were essential methodological procedures in this survey. Samples were processed in regional laboratories of the public health sector, monitored by standardized telephone interview, field visits and preparation of a set of indicators of process control.

Self-reported cardiovascular and cerebrovascular outcomes

Hypertension: Have you ever been diagnosed with high blood pressure? (yes/no answer). Questions on ever been treated for this condition (yes/no) and currently being treated at time of the interview (yes/no). Type of current treatment for hypertension: medication, diet or both (multinomial variable).

Myocardial infarction (MI): Have you ever been diagnosed with myocardial infarction? (yes/no answer). Questions on ever been treated for this condition (yes/no) and type of treatment were also captured: surgery, stunt, drugs, no treatment or don´t know (multinomial variable).

Cerebrovascular accident/thrombosis: Have you ever been diagnosed with cerebrovascular accident or thrombosis? (yes/no answer). Questions on ever been treated for this condition (yes/no) and type of treatment were also captured: surgery, drugs, both, no treatment or don´t know (multinomial variable).

Blood pressure measurement

Blood pressure was measured on three sequential occasions with calibrated sphygmomanometers. Mean systolic and diastolic measures were recorded as continuous variables. We categorized these variables into binary variables using conventional cut-off points of 140 mmHg for systolic (binary variable: normal [0] versus high [1] systolic blood pressure) and 90 mmHg for diastolic blood pressure (binary variable: normal [0] versus high [1] diastolic blood pressure).

Individual health risk factors

For this study we considered body mass index (continuous); drank alcohol in the past month (yes/no); ever smoked (yes/no); currently smoke (yes/no); household exposure to smoke (yes/no), occupational exposure to smoke (yes/no); having relatives with history of CVD (yes/no); having relatives with history of cerebrovascular accident or thrombosis (yes/no); self-reported metabolic syndrome (at least 3 of the following 5 conditions (National Institutes of Health, 2001): waist circumference >82 women and >87 men, high HDL level, high triglycerides levels, high blood pressure, or high blood glucose; yes/no); and level of cardiovascular risk (low, moderate, moderate-high, high, very high risk, as defined by Adult Treatment Panel III Up date (National Institutes of Health, 2001)).

Demographic factors and healthcare provision entitlement

These included age (continuous variable and categorical by age-groups), sex (binary variable, male/female), marital status (single, married/cohabitant, separated/divorced, widowed), urban versus rural area (binary variable), being born in Chile versus abroad (binary variable); and the total number of household members (count variable, range 1-12). Healthcare provision was a multinomial variable of 3 categories: public, private and other or don't know.

Socioeconomic status (SES)

Educational level: collected by the survey as the highest level achieved for each member of the household (ordinal variable): primary, secondary or higher.

Years of education: total number of completed years of education, count variable (range 0-22).

Analysis

Due to the multistage sampling strategy of the dataset, weights were applied in order to attain nationally representative estimates. It also corrected the distortion of the raw sample, making it coincident with the projection of population census in January 2010 for Chilean adults over 15 years (Chilean Ministry of Health, 2010). For this study, the final survey sample size was 5 293 adults, which was extrapolated to a weighted population size of 13 355 826 people living in Chile according to methodological recommendations and through the 'svy' family of commands in STATA software package.

Descriptive statistics for each self-reported health outcome of interest were reported as proportions with 95% confidence intervals. Prevalence of each health outcome, crude and stratified by sex, was also reported, with its corresponding chi-square test for independent samples. Crude and adjusted prevalence ratios (PRs), with their 95% confidence intervals were estimated by weighted Poisson regression models (Coutinho, Scazufca, & Menezes, 2008; Deddens & Petersen, 2008; Petersen & Deddens, 2008). For variables with more than 2 categories, we tested overall's statistical significication through the adjusted Wald test (a p-value <0.05 represented a significant variable as a whole).Data analyses were conducted using STATA 12 statistical software package.

Ethics approval

The authors downloaded this dataset from a secured governmental Web page after approval from the Ministry of Health in Chile. All data was anonymous and there was no possible way to identify individuals from the information available in the dataset. This study conducted population estimates only and no individual data is presented.

Results and discussion

Results

General sample socio-demographics

As seen in table 1, 12.95 % (95%CI [12.08-13.86]) of the sample lived in a rural area, and 98.77% (95% CI [98.07-99.22]) were Chilean-born. Women were older with slightly less men in the 75 years of age category ($p<0.05$). Furthermore, 53.98% were married and more women were widowed ($p<0.05$). About 80% (95%CI [76.03-80.28]) had public healthcare and 18.68% (95%CI [16.68-20.84]) had private healthcare with significantly more men reporting being entitled to the private healthcare provision system. The average years of education were 10.64 (95%CI [10.45-10.83]) with statistically significantly fewer men (8.18%) than women (10.43%) only having primary education.

Crude rates of CVD in Chile: general rates and stratified by sex

The crude prevalence of hypertension (28.13%, 95%CI [26.11-30.24]), myocardial infarcts (3.19%, 95%CI [2.47-4.12]) and cerebrovascular inci-

Table 1 Description of demographic variables of the population under study, by gender and overall, ENS 2009-2010, Chile

Socio-demographics	Men (n=2145)		Women (n=3132)		Total sample (n=5277)	
	%	95%CI	%	95%CI	%	95%CI
Age (continuous)	***X= 40.64******	***39.37-41.90***	***X= 42.40***	***41.38-43.41***	X= 41.54	40.74- 42.34
Age, categorical:						
<35	19,91	17.8-22.2	18,97	17.18-20.9	38,88	36.45-41.37
36-45	9,96	8.36-11.82	11,71	10.2-13.43	21,68	19.57-23.95
46-55	7,95	6.59-9.55	8,35	7.21-9.66	16,3	14.57-18.19
56-65	5,77	4.75-7.00	6,07	5.22-7.04	11,84	10.5-13.33
66-75	3,34	2.57-4.34	3,87	3.2-4.67	7,21	6.17-8.41
>75	***1.54****	***1.1-2.15***	***2,56***	***2.02-3.23***	4,09	3.37-4.96
Area (rural)	6,52	5.59-7.58	6,43	5.77-7.16	12,95	12.08-13.86
Number of household member s (continuous)	X=4.16	3.98-4.34	X=4.13	4.00-4.25	X=4.14	4.04-4.25
Born in Chile (versus any other country)	48,24	45.77-50.71	50,53	48.07-52.99	98,77	98.07-99.22
Marital status:						
Single	17,18	15.17-19.4	15,97	14.34-17.76	33,16	30.8-35.6
Married/ cohabitating	27,57	25.3-29.98	26,4	24.44-28.47	53,98	51.5-56.44
Separated/ divorced	***2.93****	***2.17-3.96***	***4,6***	***3.7-5.7***	7,53	6.33-8.93
Widowed	***1.00****	***0.65-1.53***	***4,34***	***3.65-5.15***	5,34	4.54-6.27
Educational level:						
Primary	***8.18****	***6.97-9.57***	***10,43***	***9.35-11.62***	18,6	17.01- 20.32
Secondary	28,7	26.43-31.09	28,17	26.19-30.23	56,87	54.43-59.28
Higher	11,82	10.02-13.90	12,7	11.1-14.51	24,53	22.33-26.86
Years of education (continuous)	X=10.78	10.48-11.08	X=10.51	10.27-10.75	X=10.64	10.45-10.83
Type of healthcare system:						
Public	***36.64****	***34.26-39.08***	***41,59***	***39.29-43.93***	78,23	76.03-80.28
Private	10,49	8.77-12.51	8,18	6.96-9.60	18,68	16.68-20.84
Other/ Don´t know	1,55	1.08-2.23	1,54	1.14-2.09	3,09	2.44-3.91

*Chi2 test <0.05 between male and female, **t-test <0.05 between male and female

dences (2.40%, 95%CI [1.77-3.24]) and risk factors are displayed in table 2. Diagnosis of hypertension was significantly lower in men (10.92%) than women (17.20%), as was the prevalence of ever treated for hypertension (men 6.90%, women 10.11%) and currently treated for hypertension (men 4.58%, women 7.39%). Less men (22.52%) than women (39.94%) took hypertension medication. Men (0.37%, 95%CI [0.16-0.83]) were significantly more likely than women (0.07%, 95% CI [0.03-0.15]) to receive surgical treatment following a heart attack.

Individual health-risks factors: general rates and stratified by sex

More than half of the population were overweight or obese (39.20% and 22.92%, respectively) with more men statistically significantly overweight (21.93%, 95%CI [19.74-24.29]) than women (17.28%, 95%CI [15.66-19.02]), yet significantly more women were obese (14.11%, 95%CI [12.63-15.74]) than men (8.81%, 95%CI [7.57-10.22]). Around 75% of participants consumed alcohol in the past year (95%CI [72.75-76.81]),

Table 2 Description of the prevalence cardiovascular diseases in this study, diagnosis and type of treatment, by gender and in the total sample under study, ENS 2009-2010, Chile

	Men (n=2145)		Women (n=3132)		Total sample (n=5277)	
	%	95%CI	%	95%CI	%	95%CI
HYPERTENSION						
Ever diagnosed hypertension (yes)	***10.92****	***9.61-12.39***	***17,2***	***15.56-18.98***	28,13	26.11-30.24
Ever treated (yes)	***6.90****	***5.09-7.26***	***10,11***	***8.90-11.47***	16,2	14.63-17.89
Currently being treated (yes)	***4.58****	***3.73-5.62***	***7,39***	***6.36-8.57***	11,97	10.63-13.46
Type of treatment:						
Medication	***22.52****	***17.50-28.47***	***39,94***	***34.01-46.18***	62,56	56.47-68.09
Diet	7,64	5.05-11.39	8,11	5.06-11.60	15,36	11.53-20.16
Both	8,11	5.22-12.42	14,07	10.79-18.14	22,19	17.75-27.36
MYOCARDIAL INFARCTION						
Ever diagnosed myocardial infarction (yes)	1,63	1.17-2.26	1,56	1.06-2.31	3,19	2.47-4.12
Ever treated, type of treatment:						
Surgery	***0.37****	***0.16-0.83***	***0,07***	***0.03-0.15***	0,44	0.22-0.88
Stent	0,05	0.02-0.12	0,07	0.01-0.38	0,13	0.04-0.35
Drugs	0,88	0.54-1.42	0,92	0.63-1.35	1,8	1.32-2.44
No treatment	47,35	44.92-49.87	50,02	47.56-52.48	97,41	96.68-97.99
Don´t know	0,19	0.08-0.43	0,26	0.12-0.53	0,44	0.26-0.76
CEREBROVASCULAR ACCIDENT OR THROMBOSIS						
Cerebrovascular accident or thrombosis (yes)	1,44	0.92-2.26	0,95	0.67-1.35	2,4	1.77-3.24
Ever treated, type of treatment:						
Surgery	***0.04****	***0.01-0.17***	***0,08***	***0.02-0.25***	0,13	0.05-0.30
Drugs	1,79	1.20-2.67	1,14	0.81-1.61	2,93	2.22-3.87
Both	0,09	0.01-0.66	0,04	0.02-0.10	0,14	0.03-0.53
No treatment	46,72	44.25-49.20	49,74	47.29-52.19	96,46	95.43-97.26
Don´t know	0,04	0.01-0.14	0,3	0.09-0.96	0,34	0.12-0.96

*Chi2 test <0.05 between male and female, **t-test <0.05 between male and female

#SN = Staff Nurse, $EN = enrolled Nurse; †SSN = Senior Staff Nurse

and 58.42% in the past month (95%CI [56.03-60.77]). More men consumed alcohol over the past year (40.32%) and the past month (34.23%) than women (34.52%, 24.19% respectively). Around 40.19% currently smoke (95%CI [37.75-42.67]), women and men equally so, yet significantly more men (29.00%, 95%CI [26.61-31.51]) have ever smoked than women (24.59%, 95%CI [22.62-26.66]). Occupational exposure to smoke was statistically significantly higher in men (15.86%, 95%CI [13.94-17.99]) than women (9.23%, 95%CI [7.96-10.68]). A family history of myocardial infarction (20.49%, 95%CI [18.61-22.52]) was reported more frequently by women (12.02%, 95%CI [10.58-13.63]) than men (8.47%, 95%CI [7.16-9.99]).

Factors associated with CVD, overall findings and models conditional on sex

Table 3 reports the adjusted Prevalence Ratios (PR) for presenting hypertension, myocardial infarction and cerebrovascular incidents for the total population

Table 3 Description of individual risk factor for cardiovascular and cerebrovascular diseases by gender and in the total sample under study, ENS 2009-2010, Chile

	Men (n=2145)		Women (n=3132)		Total sample (n=5277)	
	%	95%CI	%	95%CI	%	95%CI
Body Mass Index (BMI):						
Underweight	0,51	0.23-1.09	1,22	0.82-1.81	1,73	1.21-2.47
Normal	16,71	14.78-18.84	17,19	15.48-19.03	33,9	31.55-36.32
Overweight	***21.93****	***19.74-24.29***	***17,28***	***15.66-19.02***	39,2	36.78-41.68
Obese	***8.81****	***7.57-10.22***	***14,11***	***12.63-15.74***	22,92	21.05-24.90
Obese morbid	0,64	0.35-1.15	1,62	1.09-2.39	2,26	1.62-3.12
Drank alcohol in the past 12 months (yes)	***40.32****	***37.85-42.83***	***34,52***	***32.31-36.79***	74,83	72.75-76.81
Drank alcohol in the past 30 days (yes)	***34.23****	***31.78-36.77***	***24,19***	***22.25-26.24***	58,42	56.03-60.77
Ever smoked (yes)	***29.00****	***26.61-31.51***	***24,59***	***22.62-26.66***	53,58	51.14-56.01
Currently smoke (yes)	21,06	18.86-23.44	19,13	17.38-21.00	40,19	37.75-42.67
Household exposure to cigarette smoke (yes)	11,93	10.15-13.96	11,64	10.24-13.20	23,57	21.45-25.82
Occupational exposure to smoke (yes)	***15.86****	***13.94-17.99***	***9,23***	***7.96-10.68***	25,09	22.91-27.41
Metabolic syndrome (yes)	14,3	12.22-16.67	13,73	12.03-15.62	28,02	25.46-30.72
Cardiovascular risk (score, high/very high risk)	8,21	6.62-10.14	6,21	4.87-10.88	14,42	12.32-16.80
Family history of stroke (yes)	***8.47****	***7.16-9.99***	***12,02***	***10.58-13.63***	20,49	18.61-22.52
Family history of cerebro-vascular stroke or thrombosis	6,88	5.54-8.52	7,77	6.65-9.07	14,66	12.92-16.58

*Chi2 test <0.05 between male and female, **t-test <0.05 between male and female

and conditional on being men and women. In the models for the total population gender was a significantly associated with hypertension (PR 1.58 for being female versus male, 95% CI [1.23-2.03]), as was having public healthcare insurance compared to being entitled to the private healthcare provision (PR 1.45, 95% CI 1.01-2.10) when other potential confounders were controlled for (age, BMI, rural zone, education, alcohol consumption in past month, and currently smoker).

Conditional models looking at men and women separately indicated that public healthcare remained significantly associated with hypertension compared to being entitled to the private healthcare system in Chile (model for men: PR 1.45, 95% CI [1.01-2.10]; model for women: PR 1.79, 95% CI [1.06-3.02]) slightly more so in women. Interestingly, alcohol appeared as significant protector in both genders (model for men: PR= 0.76, 95% CI [0.59-0.98] and model for women: PR= 0.72, 95% CI [0.52-0.98]), even after controlling for other factors. In the models for myocardial infarction and cerebrovascular incidents/thrombosis no statistically or clinically significant predictors could be identified.

Testing under-diagnosis of hypertensions between sex groups in Chile

A comparison between self-reported hypertension and clinical measurement was made using international guidelines as cut-off points (tables 5 and 6). A discrepancy between self-report and clinical measurement were found for systolic blood pressure in 722 people (7.28%; 95% CI [6.15-8.59]) and for diastolic blood pressure in 517 people (4.50%; 95% CI [3.58-5.65]). When asked whether 'ever being diagnosed with high blood pressure', 9.72% (95% CI [7.74-12.14]) of the male population but only 4.96% (95%CI [3.96-6.21]) of the female population reported not having high systolic blood pressure yet clinical measurement showed a positive result of >= 140 mmHg. Likewise, 6.64% (95%CI [4.95-8.86]) of the male population but only in 2.47%

Table 4 Overall and conditional (on sex) adjustedα Prevalence Ratio (PR) of presenting a cardiovascular and cerebrovascular diseases, ENS 2009-2010, Chile***

	HYPERTENSION						***MYOCARDIAL INFARCTION***						***CEREBROVASCULAR ACCIDENT OR THROMBOSIS***					
	Men		**Women**		**Total sample**		**Men**		**Women**		**Total sample**		**Men**		**Women**		**Total sample**	
	PR	95% CI	PR	95%CI	PR	95%CI	PR	95%CI	PR	95%CI	PR	95%CI	PR	95%CI	PR	95%CI	PR	95%CI
Age (cont.)	***1.05*** **	***1.03-1.07***	***1.05*** **	***1.04-1.06***	***1.05*** **	***1.04-1.06***	***1.06*** **	***1.04-1.09***	***1.05****	***1.03-1.07***	***1.05*** **	***1.03-1.06***	***1.06*** **	***1.04-1.10***	***1.04*** **	***1.03-1.07***	***1.05*** **	***1.04-1.07***
Sex (female)	-	-	-	-	***1.58*** **	***1.23-2.03***	-	-	-	-	0,67	0.40-1.22	-	-	-	-	0,62	0.32-1.19
Area (rural)	1,09	0.60-1.95	1,06	0.72-1.56	1,05	0.76-1.46	1,05	0.47-2.35	0,61	0.24-1.54	0,79	0.43-1.47	0,48	0.16-1.41	0,77	0.27-2.20	0,61	0.28-1.33
Marital status:																		
Single	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-
Married/ cohabiting	0,88	0.44-1.67	0,62	0.38-1.002	0,7	0.46-1.03	0,84	0.26-2.68	0,41	0.10-1.76	0,6	0.23-1.55	0,61	0.12-3.18	0,99	0.36-2.73	0,86	0.37-2.02
Separated/ divorced	1,99	0.79-4.97	0,77	0.46-1.77	0,96	0.61-1.52	1	0.34-2.99	0,72	0.29-1.76	0,83	0.39-1.74	2,86	0.68-12.11	***0.43****	***0.19-0.96***	0,82	0.33-2.07
Widowed	0,78	0.43-1.41	0,81	0.52-1.26	0,78	0.55-1.11	1,32	0.45-3.92	***0.21****	***0.07-0.63***	0,59	0.26-1.36	1,19	0.26-5.36	***0.22****	***0.06-0.88***	0,55	0.19-1.63
Years of education (cont.)	0,99	0.93-1.04	0,99	0.96-1.03	0,99	0.96-1.02	1,04	0.97-1.11	0,94	0.87-1.01	0,98	0.93-1.03	1	0.88-1.13	0,97	0.89-1.06	0,97	0.90-1.05
Type of healthcare system:																		
Private	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-
Public	1,2	0.70-2.05	***1.79*** **	***1.06-3.02***	***1.45****	***1.01-2.10***	1,2	0.40-3.61	1,16	0.38-3.51	1,09	0.50-2.40	0,41	0.10-1.61	1,62	0.60-4.34	0,63	0.24-1.65
Other/ Don´t know	0,47	0.21-1.06	1,65	0.68-3.96	1,03	0.55-1.93	0,38	0.07-2.11	2,46	0.35-17.46	1,37	0.30-6.21	0,13	0.01-1.54	0,2	0.02-1.83	0,2	0.04-1.04
Body Mass Index (BMI) (cont.)	***1.12*** **	***1.07-1.16***	***1.08*** **	***1.06-1.11***	***1.09****	***1.07-1.12***	***1.07****	***1.01-1.13***	***1.05****	***1.00-1.10***	***1.05****	***1.02-1.09***	***1.06****	***1.00-1.16***	1	0.94-1.06	1,03	0.99-1.07
Drank alcohol in the past 30 days (yes)	0,81	0.53-1.25	***0.72****	***0.52-0.98***	***0.76****	***0.59-0.98***	0,74	0.34-1.59	0,78	0.32-1.90	0,73	0.40-1.31	0,79	0.31-1.98	0,53	0.22-1.24	0,64	0.34-1.23
Currently smoke (yes)	0,91	0.82-1.02	0,96	0.88-1.05	0,94	0.88-1.01	***0.80****	***0.65-0.98***	0,91	0.74-1.13	0,88	0.76-1.01	1,06	0.84-1.32	0,91	0.73-1.13	0,99	0.84-1.16
Pseudo R2 in %	16,28	-	17,63	-	17,36	-	12,16	-	10,73	-	10,99	-	12,45	-	11,08	-	11,18	-

**** Trend p-values for categorical variables with 3 or more categories appear in grey shade in the table, adjusted Wald test

αAdjusted by age, BMI, rural zone, education, alcohol consumption in past month, and currently smoker

*p-value <0.05

**p-value<0.001

βp-value <0.05 indicates a poor goodness of fit of the model

Table 5 Comparison between self-reported hypertension and blood pressure measures by gender, ENS 2009-2010, Chile. Cut-off points for hypertension systolic >=140*

Systolic hypertension	**Male population (n=2145)**		**Female population (n=3132)**		**Total population (n=5277)**	
	Systolic <140 mmHg Absolute Frequency (weighted % [95%CI])	Systolic >=140 mmHg Absolute Frequency (weighted % [95%CI])	Systolic <140 mmHg Absolute Frequency (weighted % [95%CI])	Systolic >=140 mmHg Absolute Frequency (weighted % [95%CI])	Systolic <140 mmHg Absolute Frequency (weighted % [95%CI])	Systolic >=140 mmHg Absolute Frequency (weighted % [95%CI])
Self reported hypertension **NO**	1148	***394***	1671	***328***	2819	***722***
	(67.87 [64.37-71.14])	***(9.72 [7.74-12.14])***	(61.51 [58.47-64.46])	***(4.96 [3.96-6.21])***	(64.69 [62.29-66.84])	***(7.28 [6.15-8.59])***
Self reported hypertension **YES**	250	353	620	513	870	866
	(10.25 [8.38-12.49])	(12.18 [10.22-14.45])	(21.21 [18.75-23.49])	(12.32 [10.44-14.48])	(15.87 [14.25-17.64])	(12.25 [10.87-13.78])

*Mean systolic blood pressure 129.52 [128.21-130.83] in men and 121.73 [120.50-122.96] in women (t-test p<0.01)

Table 6 Comparison between self-reported hypertension and blood pressure measures by gender, ENS 2009-2010, Chile. Cut-off points for hypertension diastolic >=90 mmHg*

Diastolic hypertension	**Male population (n=2145)**		**Female population (n=3132)**		**Total population (n=5277)**	
	Diastolic <90 mmHg Absolute Frequency (weighted % [95%CI])	Diastolic >90 mmHg Absolute Frequency (weighted % [95%CI])	Diastolic <90 mmHg Absolute Frequency (weighted % [95%CI])	Diastolic >90 mmHg Absolute Frequency (weighted % [95%CI])	Diastolic <90 mmHg Absolute Frequency (weighted % [95%CI])	Diastolic >90 mmHg Absolute Frequency (weighted % [95%CI])
Self reported hypertension **NO**	1250	***292***	1774	***225***	3024	***517***
	(70.93 [67.55-74.09])	***(6.64 [4.95-8.86])***	(64.00 [60.98-66.91])	***(2.47 [1.81-3.36])***	(67.37 [65.11-69.56])	***(4.50 [3.58-5.65])***
Self reported hypertension **YES**	380	223	886	247	1266	470
	(13.85 [11.72-16.30])	(8.58 [6.91-10.61])	(28.70 [25.98-31.59])	(4.82 [3.61-6.41])	(21.47 [19.65-23.42])	5.60-7.89])

*Mean diastolic blood pressure 78.37 [77.57-79.17] in men and 73.96 [73.31-74.61] in women (t-test p<0.01)

(95%CI [1.81-3.36]) of the female population had reported not having high diastolic blood pressure yet clinical measurement showed a positive result of >=90mmHg. This suggests a lack of knowledge and lower diagnostic rates in men.

Discussion

Summary of key findings

We found that the crude overall prevalence of self-reported hypertension was significantly lower in men than women. Gender was significantly associated with hypertensions as well as having public healthcare insurance compared to being entitled to the private healthcare system in Chile.

Contrasting key findings with current evidence

The prevalence of hypertension was lower in Chile than in the US population, especially in men (Lloyd-Jones et al., 2010). More men were found to have exposure to risk factors and hence one would expect at least similar prevalence of hypertension compared with women. When comparing self-reported hypertension to clinical measurements a higher mismatch in men was found. We speculate that gender has an influence on healthcare system/service use. In fact, a recent representative sample of the hypertensive population in a CVD prevention programme in Chile showed a 2.1:1 female to male rate. Authors suggested poor cover of the male population (Sandoval et al., 2012). Other

found that over the past 15 years, awareness of hypertension decreased in men and hypertension control is higher in women (Fasce et al., 2007). Along with Sandoval and colleagues improved access to, awareness and appropriateness of CVD care is advocated here.

A consistent association between healthcare provision entitlement and CVDs was observed in this study, for men and women, being higher if entitled to the public healthcare system. This might be explained by the fact that private healthcare insurers in Chile increase their annual cost based on gender and previous heath conditions. This particular characteristic of the private healthcare system pushes the women and also the sick, the old, and the poorer away from private insurers and towards the public healthcare system. In turn, the public system is overloaded with those who cannot pay or pay very little and yet are very sick. This is a major public health issue in Chile and needs further consideration.

Men were more likely to receive surgical treatment following an MI. Especially young women have higher death rates after MI, but those conditions occur more with higher age. In hospital, women undergo treatment for ACS and MI later than men largely due to differential symptom presentation and women report higher levels of morbidity (Pilote et al., 2007; Regitz-Zagrosek, 2011). South America is said to have a greater relative burden through stroke than ischemic disease but prevalence rates here do not confirm this finding (Kim & Johnston, 2011).

Strengths and limitations

This study is the first one on sex patterns of CVD after healthcare reform of 2005 in Chile, it uses a national representative survey, it compares self-reported data with actual clinical measures on blood pressure, and it collects relevant data on potential confounders that can be included in single regression models. These characteristics give relevance and novelty to this study, which informs about the existence of a large population of under-diagnosed men with respect to CVDs, particularly hypertension.

This study also has some limitations. Due to the cross-sectional nature of this study, we cannot determine whether socio-demographic characteristics are a causal factor on the observed under-diagnosis of CVD among men versus women. Nonetheless, the discussion on the causal relationship between gender, SES, and CVD has been considered extensively in the past, suggesting an existing link between them. There is also the risk of self-report bias in this study, not only on CVD, but also SES and other demographic and behavioural measures. Although some limitations on these measures have been recognized in the past, they remain considered robust measures and are widely used in health research (Gray et al., 2012; Roberts, Bergstralh, Schmidt, & Jacobsen, 1996; Sutton, Carr-Hill, Gravelle, & Rice, 1999). Also, findings from this study cannot be extrapolated to the 15% of the population that did not respond the ENS survey. Issues related to recruiting hard to reach populations, including those that preferred not to participate in this survey for reasons that are not collected in the survey, will need to be considered by the Chilean government in the future.

Conclusion

Men appeared to be less aware of their actual blood pressure and therefore were less likely to report being hypertensive. This poses a great challenge to current CVD programmes in the country as they need to attract men that are not perceiving the need of a health assessment or do not define themselves as sick. On the other hand, women are more likely to be aware of their CVD status but are also more likely to be part of the public healthcare system that is characterised by a constrained budget and human resources. These findings support the existence of gender inequalities that are unfair and largely preventable with appropriate health promotion, health education and access to opportune and adequate treatment. These results could inform nurses and other health professionals in primary care about the relevance and urgency of creating, implementing and evaluating novel recruitment strategies for men. Providing accurate and opportune diagnosis and treatment for CVDs among men could significantly improve population health in countries that experience this problem. Future research could further analyse the CVDs status of the more vulnerable groups in Chile, particularly the elderly, the disabled and those in socioeconomic deprivation.

Conflict of Interest

The authors declare that they have no conflict of interest.

References

Albala, C., & Vio, F. (1995). Epidemiological transition in Latin America: the case of Chile. *Public Health, 109*(6), 431-442.

Albala, C., & Yanez, F. V. D. (1997). Epidemiological transition in Latin America. A comparison of four countries. [Article]. *Revista Medica De Chile, 125*(6), 719-727.

Arteaga, O., Astorga, I., & Pinto, A. M. (2002). [Inequalities in public health care provision in Chile]. *Cad Saude Publica, 18* (4), 1053-1066. doi: S0102-311X2002000400011 [pii]

Arteaga, O., Thollaug, S., Nogueira, A. C., & Darras, C. (2002). [Information for health equity in Chile]. *Rev Panam Salud Publica, 11*(5-6), 374-385. doi: S1020-49892002000500012 [pii]

Atena, E. (Ed.). (1991). *Chile: Sistema de Salud en Transición a la Democracia.* Santiago: J. Jiménez org. .

Bastias, G., Pantoja, T., Leisewitz, T., & Zarate, V. (2008). Health care reform in Chile. *CMAJ, 179*(12), 1289-1292. doi: 179/12/1289 [pii]10.1503/cmaj.071843

Bitran, R., Escobar, L., & Gassibe, P. (2010). After Chile's health reform: increase in coverage and access, decline in hospitalization and death rates. *Health Aff (Millwood), 29*(12), 2161-2170. doi: 29/12/2161 [pii]10.1377/hlthaff.2010.0972

Burrows, J. (2008). Inequalities and healthcare reform in Chile: equity of what? *J Med Ethics, 34*(9), e13. doi: 34/9/e13 [pii] 10.1136/jme.2007.022715

Chilean Ministry of Health. (2010). National Health Survey 2009-2010. Executive Summary. M. a. PUC (Ed.) Retrieved from www.minsal.cl

Chilean Ministry of Health. (2011). National Health Objectives 2011-2020. Retrieved 23rd June, 2012, from www.minsal.cl

Coutinho, L. M., Scazufca, M., & Menezes, P. R. (2008). Methods for estimating prevalence ratios in cross-sectional studies. *Rev Saude Publica, 42*(6), 992-998. doi: S0034-89102008000600003 [pii]

Cruz-Coke, R. (1985). Cardiovascular diseases in Chile. *Preventive Medicine, 14*(4), 541-547. doi: 10.1016/0091-7435(85) 90013-1

Dachs, J. N. W., Ferrer, M., Florez, C. E., Barros, A. J. D., Narvaez, R., & Valdivia, M. (2002). Inequalities in health in Latin America and the Caribbean: descriptive and exploratory results for self-reported health problems and health care in twelve countries. [; Research Support, Non-U.S. Gov't]. *Revista panamericana de salud publica = Pan American journal of public health, 11*(5-6), 335-355.

de Fatima Marinho de Souza, M., Gawryszewski, V. P., Ordu√±ez, P., Sanhueza, A., & Espinal, M. A. (2012). Cardiovascular disease mortality in the Americas: current trends and disparities. *Heart, 98*(16), 1207-1212. doi: 10.1136/heartjnl-2012-301828

Deddens, J. A., & Petersen, M. R. (2008). Approaches for estimating prevalence ratios. *Occup Environ Med, 65*(7), 481, 501-486. doi: 65/7/501 [pii]10.1136/oem.2007.034777

Fasce, E., Campos, I., Ibanez, P., Flores, M., Zarate, H., Romdn, O., & Fasce, F. (2007). Trends in prevalence, awareness, treatment and control of hypertension in urban communities in Chile. *Journal of Hypertension, 25*(9), 1807-1811. doi: 10.1097/HJH.0b013e328244e481

Feigin, V. L., Lawes, C. M. M., Bennett, D. A., Barker-Collo, S. l., & Parag, V. (2009). Worldwide stroke incidence and early case fatality reported in 56 population-based studies: a systematic review. [Review]. *Lancet Neurology, 8*(4), 355-369. doi: 10.1016/s1474-4422(09)70025-0

Goldhaber-Fiebert, J. D., Goldhaber-Fiebert, S. N., & Andorsky, D. J. (2005). Male involvement in cardiovascular preventive healthcare in two rural Costa Rican communities. [Article]. *Preventive Medicine, 40*(6), 690-695. doi: 10.1016/j.ypmed.2004.09.009

Gray, L., Merlo, J., Mindell, J., Hallqvist, J., Tafforeau, J., O'Reilly, D., . . . Leyland, A. H. (2012). International differences in self-reported health measures in 33 major metropolitan areas in Europe. *Eur J Public Health, 22*(1), 40-47. doi: ckq170 [pii]10.1093/eurpub/ckq170

Infante, A., De la Matta, I., & Lopez-Acuna, D. (2000). Reforma de los sistemas de salud en América Latina y el Caribe: Situación y tendencias. . *Revista Panamericana de la Salud, 8*, 13-20.

Infante A., D. l. M., I., Lopez-Acuna D. . (2000). Reforma de los sistemas de salud en América Latina y el Caribe: Situación y tendencias. . *Revista Panamericana de la Salud, 8*, 13-20.

Jadue, L., & Marin, F. (2005). Determinantes sociales de la salud en Chile. En la perspectiva de la equidad. Available (First ed.). Santiago: Universidad del Desarrollo, MINSAL.

Kim, A. S., & Johnston, S. C. (2011). Global Variation in the Relative Burden of Stroke and Ischemic Heart Disease. [Article]. *Circulation, 124*(3), 314-U132. doi: 10.1161/circulationaha.111.018820

Lavados, P. M., Sacks, C., Prina, L., Escobar, A., Tossi, C., Araya, F., . . . Alvarez, G. Incidence, 30-day case-fatality rate, and prognosis of stroke in Iquique, Chile: a 2-year community-based prospective study (PISCIS project). *The Lancet, 365* (9478), 2206-2215. doi: 10.1016/s0140-6736(05)66779-7

Lloyd-Jones, D., Adams, R. J., Brown, T. M., Carnethon, M., Dai, S., De Simone, G., . . . Subcommittee, S. S. (2010). Heart Disease and Stroke Statistics - 2010 Update. *Circulation, 121*(7), e46-e215. doi: 10.1161/circulationaha.109.192667

Mendes, S., & Banerjee, A. (2010). Cardiovascular disease: equity and social determinants. In E. Blas & S. A. Kurup (Eds.): World Health Organisation.

National Institutes of Health. (2001). Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). Executive Summary Vol. No. 01-3670. I. National heart, and blood institute (Ed.) *National Cholesterol Education Programme* Retrieved from http://www.nhlbi.nih.gov/guidelines/cholesterol/atp_iii.htm

Oyarzo, C. (2000). La descentralización financiera en Chile en la década de los noventa. *Revista Panamericana de Salud Publica, 8*, 72-82.

Petersen, M. R., & Deddens, J. A. (2008). A comparison of two methods for estimating prevalence ratios. *BMC Med Res Methodol, 8*, 9. doi: 1471-2288-8-9 [pii]10.1186/1471-2288-8-9

Pilote, L., Dasgupta, K., Guru, V., Humphries, K. H., McGrath, J., Norris, C., Tagalakis, V. (2007). A comprehensive view of sex-specific issues related to cardiovascular disease. [Review]. *Canadian Medical Association Journal, 176*(6), S1-S44. doi: 10.1503/cmaj.051455

Pramparo, P. (2002). The epidemiology of hypertension in South America. [Article]. *Journal of Human Hypertension, 16*, S3-S6. doi: 10.1038/sj/jhh/1001331

Regitz-Zagrosek, V. (2011). Sex and gender differences in symptoms of myocardial ischaemia. *European Heart Journal*. doi: 10.1093/eurheartj/ehr272

Regitz-Zagrosek, V. (2012). Sex and gender differences in health. [10.1038/embor.2012.87]. *EMBO Rep, 13*(7), 596-603.

Roberts, R. O., Bergstralh, E. J., Schmidt, L., & Jacobsen, S. J. (1996). Comparison of self-reported and medical record health care utilization measures. *J Clin Epidemiol, 49*(9), 989 -995. doi: 0895-4356(96)00143-6 [pii]

Sandoval, D., Bravo, M., Koch, E., Gatica, S., Ahlers, I., Henríquez, O., & Romero, T. (2012). Overcoming Barriers in the Management of Hypertension: The Experience of the Cardiovascular Health Program in Chilean Primary Health Care Centers. *International Journal of Hypertension, 2012*, 8. doi: 10.1155/2012/405892

Scarborough, P., GBhantanagar, P., Wickramasinghe, K., Smolina, K., Mitchell, C., & Rayner, M. (2010). Coronary heart disease statistics - 2010 edition. In B. H. F. H. P. R. Group (Ed.). Oxford: British Heart Foundation

Sutton, M., Carr-Hill, R., Gravelle, H., & Rice, N. (1999). Do measures of self-reported morbidity bias the estimation of the determinants of health care utilisation? *Soc Sci Med, 49* (7), 867-878. doi: S0277953699001690 [pii]

Vargas, V., & Poblete, S. (2008). Health prioritization: the case of Chile. *Health Aff (Millwood), 27*(3), 782-792. doi: 27/3/782 [pii]10.1377/hlthaff.27.3.782

Vega, J., Bedregal, P., Jadue, L., & Delgado, I. (2003). Gender inequity in the access to health care in Chile. *Revista Medica De Chile, 131*(6), 669-678.

World Health Organization. (2010, 2010). Cardiovascular Diseases. Retrieved 24.05.2010, 2010, from http://www.who.int/mediacentre/factsheets/fs317/en/index.html