BMJ Open

Continuity of care and delivery of diabetes and hypertensive care among users of public healthcare services in Chile, a cross-sectional study.

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2018-027830
Article Type:	Research
Date Submitted by the Author:	09-Nov-2018
Complete List of Authors:	Leniz, Javiera; King's College London, Cicely Saunders Institute of Palliative Care, Policy & Rehabilitation Gulliford, Martin; King's College London, UK,
Keywords:	continuity of care, disease management, diabetes mellitus, Hypertension < CARDIOLOGY, health survey

Title: Continuity of care and delivery of diabetes and hypertensive care among users of public healthcare services in Chile, a cross-sectional study.

Authors:

1. Javiera Leniz, MSc Public Health student, King's College London, UK

2. Professor Martin Gulliford, Professor of Public Health, Department Primary Care & Public Health Sciences, King's College London, UK

Corresponding author: Javiera Leniz, Cicely Saunders Institute of Palliative Care, Polity & Rehabilitation, Bessemer Road, London SE5 9PJ, UK, email javiera.martelli@kcl.ac.uk, telephone number: +4402078485636

Word count: 2,999

ABSTRACT

Objectives: to explore factors related to continuity of care and its association with delivery of diabetes and hypertensive care.

Design: a cross-sectional study.

Setting: data from the Chilean Health National Survey in 2009-2010.

Participants: users of the public healthcare sector aged 15 or older.

Primary and secondary outcome measures: continuity of care levels were constructed from self-reports of affiliation with a usual doctor. Logistic regression was used to explore the association between continuity of care, sociodemographic characteristics, diabetes, and hypertensive medical care and control.

Results: 3,887 public healthcare users respondent to the doctor affiliation's question were identified. 14.7% recognised a usual GP and 82.3% of them knew their name. Continuity of care was positively associated with age > 65 years (OR 4.81, 95% CI 3.16 to 7.32), being female (OR 1.66, 95% CI 1.34 to 2.05), retired (OR 2.22, 95% CI 1.75 to 2.83), obese (OR 1.66, 95% CI 1.29 to 2.14), high cardiovascular risk (OR 2.98, 95% CI 2.13 to 4.17) and widowed (OR 1.50, 95%CI 1.13 to 1.99), and negatively associated with educational level (8-12 vs <8 years OR 0.79, 95% CI 0.64 to 0.97), smoking (OR 0.65, 95% CI 0.52 to 0.82) and physical activity (OR 0.76, 95% CI 0.61 to 0.95). In diabetic patients, continuity of care was associated with diagnosis awareness (OR 2.83, 95% CI 1.21 to 6.63), treatment (OR 2.04, 95% CI 1.15 to 3.63), and a recent foot (OR 3.17, 95% CI 1.84 to 5.45) and ophthalmologic exam (OR 3.20, 95% CI 1.66 to 6.18). In hypertensive patients, continuity of care was not associated with diagnosis awareness, treatment or blood pressure control.

Conclusions: Continuity of care was not associated with better chronic diseases control. Findings suggest patients with chronic conditions have better continuity of care access.

Keywords

Continuity of Patient Care; Chronic disease; Health surveys; Disease Management.

Strengths and limitations of this study

- First study that explores continuity of care and its relationship with health outcomes in Chile.
- The study uses a nationally representative population-based sample.
- The data used combine clinical and sociodemographic variables.
- The cross-sectional design of this study does not allow to attribute causal relationships.
- Some self-reported variables might be affected by recall bias.

BACKGROUND

Chronic diseases and long-term conditions, including cancers and circulatory diseases, account for 19% of the global burden of disease, followed closely by mental disorders.[1] Despite the availability of effective treatment, a significant proportion of patients do not achieve adequate levels for disease control measures.[2-5] Effective preventive medical interventions are available for reducing the risk of certain cancers and cardiovascular diseases.[7-12] Several authors have highlighted the role of the health system structure in the achievement of optimal outcomes for chronic diseases, especially in primary care.[13-16] One of the main attributes of a primary care-oriented service is the long-term person-focused care.[15 17]

Continuity of care can be defined as a long-term relationship between physicians and patients.[18 19] It has been associated with greater patient satisfaction, improved delivery of preventive services and lower rates of hospitalization.[20 21] Results from research focused on patients with chronic conditions suggest that continuity of care is correlated with fewer visits to emergency departments and better glycosylate haemoglobin (HbA1c) control in diabetic patients.[22] However, the quality of the evidence regarding the impact of continuity of care on health care outcomes is controversial and based mainly on observational studies from high-income countries. There is, therefore, an important gap of information regarding continuity of care in other settings. Due to the nature of the concept of continuity of care and the cultural differences that might determine patients and doctors' expectations about healthcare, evidence from developed countries might not be applicable in low-income contexts.

Chile is an OECD country where the burden of disease is similar to that observed in countries that are in an advanced stage of the epidemiological transition. Ischaemic heart diseases and stroke are the leading causes of death in the population, followed closely by cancer.[23] Even though continuity of care has been identified as a major challenge in Chile, [24 25] there are no studies assessing the level of relational continuity of care in the health system and their impact on clinical outcomes. The aim of this research is to explore factors related with different levels of continuity of care measured and its association with outcomes in chronic cardiovascular diseases and uptake of preventive services in users of the public health care system in Chile.

METHODS

This cross-sectional study drew on data from the last Health National Survey performed in Chile.

The Chilean Health National Survey 2009-2010.

The second version of the Health National Survey was conducted in 2009 and commissioned by the Ministry of Health. The survey was designed to be nationally representative; individuals from the general population from 15 years old and older were included. The sample of the HNS 2009 was a multistage sample of households and disproportionately stratified by geographic region and urban/rural area, using the Census population as a frame. The response rate was 75.3%, and the loss rate after the recruitment was 8.7%. The final survey sample size includes 5,293 individuals. Survey instruments included 42 health problems, five physiological measurements, and 17 biochemical measurements. The survey participants were interviewed in their homes, with an average of two home visits per individual. During the first home visit, they were invited to participate, signed the informed consent and answered a validated questionnaire administrated by trained interviewers. During the second home visit, a nurse performed a set of blood and urine tests, as well as anthropometric measurements.[26]

Population and sample

For this study, only users of the public health care system were analysed because the questions regarding continuity of care were asked only to users of the public health care system. Therefore, the study population corresponds to individuals with public insurance. A sample size was calculated for diabetes control and systolic blood pressure as the main outcomes. The study had more than 80% power to detect odds ratios of 1.5 and above.

Instruments and measurements

Continuity of Care

Two questions were used to assess the level of continuity of care among participants. The first one was 'Do you have your 'own' general doctor or family doctor? The question specified in brackets that a general doctor is the one they can appeal to solve the majority of their health problems. The second question asked whether or not individuals who referred having an 'own doctor' also knew the name of that doctor. A measure of continuity of care was constructed from these two questions. Three categories of continuity of care were considered. First, individuals who reported having a GP whose name they know. Second, individuals who report having a GP, but do not know his/her name. And finally, individuals who do not have a particular GP.

Cardiovascular variables

Blood pressure and hypertension management were assessed through questionnaires and direct measurement of blood pressure at home. Questionnaires included questions about self-reported diagnosis and treatment of hypertension. Individuals were considered as having hypertension if they had a mean systolic blood pressure higher than 140 mmHg and/or a mean diastolic blood pressure higher than 90 mmHg or were receiving pharmacological treatment at the time of the visit. A fasting blood sample was taken from each participant during the second home visit. Blood glucose and glycated haemoglobin (HbA1c) were estimated. Questions about self-reported diagnosis and treatment of diabetes were included in the survey. Individuals that referred to having been diagnosed with diabetes were asked about the last time they received a foot examination and an ophthalmological exam, as well as the treatment received. Individuals were considered as having diabetes mellitus if they had fasting blood glucose higher than 126 mg/dl or reported that they had been diagnosed with diabetes before the visit.

Cardiovascular risk was calculated from data related to the individual's age, cholesterol level, smoking status and blood pressure using the Framingham equation. Individuals with a probability of having a cardiovascular event less than 10%, between 10% and 20%, and more than 20% in 10 years, were considered as having a low, high, and very high cardiovascular risk respectively. The Spanish version of the global physical activity questionnaire (GPAQ) was used. The GPAQ considers three domains of physical activity: at work while commuting and during recreational activity. The sum of the three activities determines the level of physical activity of an individual. A tobacco exposure module was included in the first visit that considered basic questions about smoking, based on the minimum instrument (core questions) surveillance smoking used by the Pan-American health organization. The questions identified two categories: current smoker (daily and occasional) and former smoker.

Analysis

A descriptive analysis was performed for all variables included in the study according to the level of continuity of care. Univariate analysis using logistic regression was performed to evaluate the association between continuity of care and categorical variables. And ANOVA test was performed to analyse the association between continuous variables with continuity of care. Demographic variables that were associated with both continuity of care and the outcomes were considered as possible confounders and were therefore used to fix the model for multivariate analysis. A multivariate logistic regression analysis was used to explore the relationship between the level of continuity of care and the different outcomes, adjusting for confounders. A backward approach was used to fix the multivariate logistic regression. All variables that were related to continuity of care and the respective outcome

were included in the first model. Explanatory variables were kept in the model based on a priori hypothesis and significance in multivariate analysis (p-value < 0.2). Individuals that did not respond to the question 'Do you have a family physician or GP?' were excluded from the analysis. The 0.99.902 - © 2009-2016 version of the statistical software R was used for the analysis.

RESULTS

A total of 4,264 individuals from the Health National Survey reported that they used the public healthcare sector and were selected for the current study. Among them, 3,887 individuals responded to the question 'Do you have you a family physician or GP?', and therefore, 377 individuals were excluded and considered as missing values (Supplementary material, figure 1).

There were 572(14.7%) of the individuals included in the Health National Survey who affirmed having a GP as a usual doctor, and 471(82.3%) of these affirmed knowing the name of their doctor (Table 1). Individuals who indicated having a GP as a usual doctor and knowing their name had greater odds of age greater than 65 years (OR 4.81, 95% CI 3.16 to 7.32), female gender (OR 1.66, 95% CI 1.34 to 2.05), being widowed (OR 1.50, 95% CI 1.13 to 1.99), being retired (OR 2.22, 95% CI 1.75 to 2.83), having a high (OR 1.88, 95% CI 1.53 to 2.32) or very high cardiovascular risk (OR 2.98, 95% CI2.13 to 4.17), or having a BMI > 30 (OR 1.66, 95% CI 1.29 to 2.14). Individuals with more than eight years of education, single people, and those with moderate and high level of physical activity were less likely to mention having a GP as a usual doctor. Recognizing the name of their regular doctor was also highly associated with cardiovascular risk factors, with lower odds of having a high level of physical activity, greater odds of being obese or having a diagnosis of diabetes or hypertension. Having a regular doctor was not associated with rurality or household income (Table 1).

Table 1. Univariate association between level of continuity of care and categorical variables.

		Do you have your family doctor?				
		No (n=3,315) n (%)[a]	Yes, but not know the name (n=101) n (%)[a]	Yes, and know the name (n=471) n (%)[a]	Yes, but do not know the name/No OR (95% CI)	Yes, and know the name/No OR (95% CI)
Age						
	<25	546 (16.5)	9 (8.9)	28 (5.9)	Ref	Ref
	25 to 45	1,128 (34.0)	26 (25.7)	124 (26.3)	1.40 (0.66 to 3.01)	2.14 (1.40 to 3.27)
	46 to 65	1,041 (31.4)	40 (39.6)	124 (36.3)	2.33 (1.12 to 4.84)	3.20 (2.12 to 4.84)
	>66	600 (18.1)	26 (25.7)	148 (31.4)	2.63 (1.22 to 5.66)	4.81 (3.16 to 7.32)
Rurality (yes)		574 (17.3)	25 (24.8)	81 (17.2)	1.57 (0.99 to 2.49)	0.99 (0.77 to 1.28)
Sex (Female)		2,005 (60.5)	69 (68.3)	338 (71.8)	1.41 (0.92 to 2.16)	1.66 (1.34 to 2.05)
Marital Status						
	Married	1,804 (54.4)	56 (55.4)	262 (55.6)	Ref	Ref
	Separated or Divorced	287 (8.7)	10 (9.9)	51 (10.8)	1.12 (0.57 to 2.23)	1.22 (0.88 to 1.69)
	Single	885 (26.7)	20 (19.8)	84 (17.8)	0.73 (0.43 to 1.22)	0.65 (0.50 to 0.85)
	Widowed	339 (10.2)	15 (14.9)	74 (15.7)	1.43 (0.80 to 2.55)	1.50 (1.13 to 1.99)
Educational level						
	< 8 years	1,018 (30.7)	44 (43.6)	162 (34.5)	Ref	Ref
	8 - 12 years	1,892 (57.1)	52 (51.5)	237 (50.4)	0.64 (0.42 to 0.96)	0.79 (0.64 to 0.97)
	>12 years	402 (12.1)	5 (5.0)	71 (15.1)	0.29 (0.11 to 0.73)	1.11 (0.82 to 1.50)
Occupation						
	Worker	1,499 (45.5)	38 (37.6)	177 (37.7)	Ref	Ref
	Not worker	1,237 (37.6)	40 (39.6)	147 (31.3)	1.28 (0.81 to 2.00)	1.01 (0.8 to 1.27)
	Retired	556 (16.9)	23 (22.8)	146 (31.1)	1.63 (0.96 to 2.76)	2.22 (1.75 to 2.83)
Cardiovascular risk						
	Low	1,799 (54.3)	43 (42.6)	174 (36.9)	Ref	Ref
	High	1,322 (39.9)	47 (46.5)	241 (51.2)	1.49 (0.98 to 2.27)	1.88 (1.53 to 2.32)
	Very High	194 (5.9)	11 (10.9)	56 (11.9)	2.37 (1.20 to 4.68)	2.98 (2.13 to 4.17)
Level of physical activity						
	Low	1,013 (31.3)	45 (45.5)	162 (35.9)	Ref	Ref
	Moderate	625 (19.3)	17 (17.2)	95 (21.1)	0.61 (0.35 to 1.08)	0.95 (0.72 to 1.25)
	High	1,601 (49.4)	37 (37.4)	194 (43.0)	0.52 (0.33 to 0.81)	0.76 (0.61 to 0.95)
Current smoker (yes)		1,140 (35.2)	30 (30.9)	120 (26.3)	0.82 (0.53 to 1.27)	0.65 (0.52 to 0.82)
Nutritional status						
	BMI <25	943 (31.3)	20 (22.5)	112 (25.7)	Ref	Ref
	BMI 25 to 29.9	1,199 (39.8)	35 (39.3)	151 (34.7)	1.38 (0.80 to 2.40)	1.06 (0.82 to 1.37)
	BMI >30	873 (29.0)	34 (38.2)	172 (39.5)	1.84 (1.05 to 3.22)	1.66 (1.29 to 2.14)
Household income						
	US$<374	2,084 (64.9)	78 (78.8)	278 (61.2)	Ref	Ref
	US$ 374 to 1268	1,072 (33.4)	19 (19.2)	163 (35.9)	0.47 (0.29 to 0.79)	1.14 (0.93 to 1.40)
	>US$1268	55 (1.7)	2 (2.0)	13 (2.9)	0.97 (0.23 to 4.06)	1.77 (0.96 to 3.28)
DM diagnosis (Yes)		328 (11.1)	15 (17.4)	75 (17.3)	1.70 (0.96 to 2.99)	1.68 (1.27 to 2.20)
Years since diagnosis DM (mean (sd)) (n=327)		8.8(9.9)	9.3(5.9)	10.9(9.0)		
HbA1c (mean (sd)) (n=348)		8.4(2.5)	7.8(2.2)	8.8(2.4)		
Hypertension diagnosis (Yes)		994 (32.2)	38 (40.0)	220 (49.4)	1.40 (0.93 to 2.13)	2.06 (1.68 to 2.52)
Years since diagnosis hypertension (mean (sd)) (n=872)		11.1(12.2)	13.6(15.0)	10.7(9.8)		
PAS (mmHg) (mean(sd)) (n=1,194)		152.0(21.6)	149.7(23.8)	150.5(20.4)		
PAD (mmHg) (mean(sd)) (n=1,194)*		84.4(11.9)	80.9(12.0)	81.9(11.6)		

[a] column percent. BMI: Body mass index; DM: diabetes mellitus; Ref: reference. *ANOVA p-value<0.01

A total of 418 (10.8%) diabetic and 1,252 (32.2%) hypertensive individuals were identified in the survey. Among individuals classified as having diabetes, 324 (78.6%) were aware of a diabetes diagnosis, and 234 (56.0%) were receiving pharmacological treatment at the time of the survey. Among individuals classified as having hypertension, 891 (71.2%) were aware of a hypertension diagnosis, and 565 (45.1%) were receiving pharmacological treatment at the time of the survey.

There were 90(21.5%) diabetic patients that referred to having a usual GP. Continuity of care was not associated with optimal levels of glycemic control (Table 2). Individuals that had a personal GP and knew their name were 2.04 (95% CI 1.15 to 3.63) more likely to be receiving pharmacological treatment for diabetes and 2.83 (95% CI 1.21 to 6.63) more likely of being aware of their diagnosis than individuals without a usual GP, after adjusting for confounders. They were also more likely to have had a recent foot exam (OR 0.67, 95% CI 0.36 to 1.23) and a recent ophthalmologic exam (OR 3.17, 95% CI 1.84 to 5.45) than individuals without a usual GP.

There were 258(20.6%) hypertensive patients that referred to having a usual GP. Continuity of care was not associated with being more aware of their diagnosis, receiving pharmacological treatment or better blood pressure control for these patients (Table 2).

Table 2. Univariate and multivariate logistic regression between relational continuity of care and cardiovascular outcomes.

					Univariate		Multivariate	
		No	Yes, but do not know the name	Yes, and know the name	Yes, but do not know the name/No	Yes, and know the name/No	Yes, but do not know the name	Yes, and know the name
		n (%)[a]	n (%)[a]	n (%)[a]	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Patients with knowledge of their diagnosis of DM-2								
	No	79 (89.8)	2 (2.3)	7 (8.0)	Ref	Ref	Ref[1]	Ref[1]
	Yes	245 (75.6)	13 (4.0)	66 (20.4)	2.10 (0.46 to 9.49)	3.04 (1.34 to 6.90)	1.68 (0.34 to 8.40)	2.83 (1.21 to 6.63)
Patients under treatment for DM-2								
	No	158 (85.9)	5 (2.7)	21 (11.4)	Ref	Ref	Ref[2]	Ref[2]
	Yes	170 (72.6)	10 (4.3)	54 (23.1)	1.86 (0.62 to 5.56)	2.39 (1.40 to 4.14)	1.71 (0.53 to 5.44)	2.04 (1.15 to 3.63)
Patients with diagnosis of diabetes and HbA1c <7%								
	No	164 (76.6)	7 (3.3)	43 (20.1)	Ref	Ref	Ref[3]	Ref[3]
	Yes	108 (80.6)	6 (4.5)	20 (14.9)	1.30 (0.43 to 3.98)	0.71 (0.39 to 1.27)	1.48 (0.43 to 5.13)	0.67 (0.36 to 1.23)
Diabetic patients with last FE <1 year ago								
	No	208 (86.7)	6 (2.5)	26 (10.8)	Ref	Ref	Ref[4]	Ref[4]
	Yes	120 (67.4)	9 (5.1)	49 (27.5)	2.60 (0.90 to 7.48)	3.27 (1.93 to 5.53)	2.38 (0.81 to 7.00)	3.17 (1.84 to 5.45)
Diabetic patients with last OE <2 years ago								
	No	197 (83.8)	6 (2.6)	32 (13.6)	Ref	Ref	Ref[5]	Ref[5]
	Yes	129 (71.3)	9 (5.0)	43 (23.8)	3.30 (1.03 to 10.60)	3.43 (1.87 to 6.30)	3.67 (1.03 to 13.04)	3.20 (1.66 to 6.18)
Patients with knowledge of their diagnosis of hypertension	No	300 (83.1)	8 (2.2)	53 (14.7)	Ref	Ref	Ref[6]	Ref[6]
	Yes	694 (77.9)	30 (3.4)	167 (18.7)	1.62 (0.75 to 3.58)	1.36 (0.97 to 1.91)	1.43 (0.60 to 3.42)	1.15 (0.80 to 1.67)
Patients report receiving treatment for hypertension	No	568 (82.7)	14 (2.0)	105 (15.3)	Ref	Ref	Ref[7]	Ref[7]
	Yes	426 (75.4)	24 (4.2)	115 (20.4)	2.29 (1.17 to 4.47)	1.46 (1.09 to 1.96)	2.19 (1.10 to 4.40)	1.25 (0.91 to 1.71)
Patients with diagnoses of hypertension and BP <140/90	No	819 (79.4)	29 (2.8)	184 (17.8)	Ref	Ref	Ref[8]	Ref[8]
	Yes	175 (79.5)	9 (4.1)	36 (16.4)	1.45 (0.68 to 3.12)	0.92 (0.62 to 1.36)	1.83 (0.80 to 4.16)	0.65 (0.42 to 1.02)

[a] row percent. DM-2: diabetes mellitus type 2, HbA1c: Glycosilate haemoglobine, FE: Foot examination, OE: ophthalmologic examination, BP: Blood pressure. 1 Adjusted for age, sex, marital status, physical activity and smoking status 2 Adjusted for age, sex, marital status, educational level and smoking status. 3 Adjusted for age, sex, smoking status and BMI. 4 Adjusted for age, sex, marital status and occupation. 5 Adjusted for age, sex, occupation and BMI. 6 Adjusted for age, sex, marital status, educational level, BMI, smoking status and occupation. 7 Adjusted for age, sex, marital status, educational level, occupation and smoking status. 8 Adjusted for age, sex, marital status, educational level, BMI and physical activity.

DISCUSSION

Summary of findings

This study evaluated continuity of care and its relationship with health outcomes in the Chilean public health sector. Continuity of care in this study was positively associated with age, sex, occupation, nutritional, cardiovascular risk and marital status, and negatively associated with educational level, smoking and physical activity. Patients with diabetes or hypertension diagnosis were more likely to know the name of their usual GP.

Regarding chronic disease management, in diabetic patients, continuity of care was associated with receiving treatment and being aware of diabetes diagnosis, and higher odds of having a recent foot and ophthalmologic exam. In hypertensive patients, continuity of care was not associated with higher odds of being aware of their diagnosis, receiving pharmacological treatment or better levels of blood pressure control.

Individuals that knew the name of their usual GP were more likely to be retired, widowed and older, which might have some implications regarding access to healthcare. People without a regular job might have more time to ask for an appointment or attend medical appointments. However, it is likely that being retired is also associated with age and chronic conditions. It is also possible that older adults might have a greater preference for having a usual GP and they consequently make efforts to achieve a better continuity of care. Individuals who knew the name of their usual GP were more likely to have high cardiovascular risk factors, such as having a diagnosis of diabetes, hypertension, obesity and lower levels of physical activity. This association could be explained because health care provision is usually based on need, and therefore, patients with chronic conditions tend to have better access to health care and visit their doctor more regularly than other non-chronic patients. However, in absolute terms, only around 20% of patients with diabetes and hypertension in this study referred to know the name and having a regular doctor.

This study failed to prove an association between continuity of care and better patients outcomes such as diabetes and hypertension control. This probably could be explained because health care centres prioritise appointments and follow-ups for patients with poor clinical outcomes to improve their management. However, the cross-sectional design of this study does not allow to attribute a causal relationship to this association. These results are consistent with those found in Gulliford et al.,[27] where experienced continuity of care was not associated with the level of HbA1c. But differ from those obtained in two other observational studies where individuals with a usual provider had 6.69 more chances to have an Hb1C level below 7%,[28] or better continuity score was statistically associated with

lower levels of HbA1c.[29] Results from these studies are difficult to compare due to the fact that they used different measurements for continuity of care, as well as different methodologies.

The proportion of individuals that referred to having a usual GP in this sample was unusually low (14.7%). Studies from the US and the UK have reported much higher rates of having a regular doctor, between 44% and 86%.[28 30 31] Although there might be methodological differences that can explain these disparate results, it is highly possible that these discrepancies can be explained by differences in the structure and resources of the health care system among countries. Chile reported some physicians per 1,000 population of 1.87 in 2013, in contrast with 3.72 and 3.3 per 1,000 population in the UK and the US respectively.[32] Therefore, it is possible that the lower density of physicians in the country hinders the ability to maintain an adequate continuity of care, giving priority to maintaining adequate access to health care.

Strengths and limitations

The measure of continuity of care used in the study has some limitations that can account for these results. Patients' report of provider affiliation does not capture the length and strength of that relationship, which seems to be a major dimension of continuity of care. Additionally, recognizing a usual provider does not necessarily imply frequent consultations or real contact with the provider, nor the quality of care provided, factors that could be substantial in improving health outcomes. Many other measures of continuity of care have been described in the literature. Nevertheless, no other single measure has proven to be superior to the others or capture the whole concept of continuity of care. The measure of continuity used in this analysis has the advantage of considering the patient's perspective and of being easy to implement and simple to understand and has been widely employed in the literature allowing comparisons with other studies.

The fact that some individuals know or not know the name of their usual doctor, could be perceived as constituting different levels of continuity of care, assuming that patients that know the name of their doctors have a stronger relationship with them. However, the results fail to show any gradient effect among the different levels of continuity of care used in the study. These results might be explained by the low number of individuals belonging to that category. Only 101(2.6%) persons in the sample referred to having their GP but not knowing his/her name.

The study shows that diabetic patients that know the name of their GP had 3.3 times more chances of having had a foot screening in the previous year and 3.6 times more chances of having had an ophthalmological exam in the last two years. These findings are consistent with results from a similar study in Taiwan.[33] Consultations with the same physician over time might contribute to having better coordination of care, and therefore might facilitate the delivery of appropriate and timely preventive

services for diabetes care. Nevertheless, it is not possible to rule out the possibility of a spurious association between foot examination, ophthalmological exam and continuity due to recall bias. The uptake of both services in this study was assessed through individuals' self-report. Patients with a usual GP could have a different care-seeking pattern that predisposes them to be more concerned about their health and therefore remembered more easily whether they have had a foot examination or not, compared to patients without a usual provider. A more objective measure of foot and ophthalmological exam, such as information from administrative data, could help to assess the possibility of recall bias.

CONCLUSIONS

Continuity of care was not associated either with better control of the disease in diabetic and hypertensive patients among individuals with public health insurance in Chile. Differences in the age and occupation among individuals with a regular GP might be related with the presence of a chronic condition. Findings suggest patients with chronic conditions have better access to continuity of care.

Results showed an association between continuity of care and the proportion of diabetic users of the public health services in Chile receiving treatment for their diseases. However, by measuring both, the dependent and independent variables at the same time, it is not possible to rule out the possibility of reverse causation.

Only a minority of participants in this survey referred to have a regular doctor. However, the majority of them are also able to identify their doctor's name. It would be recommendable to explore strategies that might improve the level of continuity of care experienced by users of the public health care sector in Chile, such as incentives to improve the availability of physicians in the public sector and reducing the practice size.

Further investigation that incorporates a longitudinal approach would be necessary to clarify whether or not continuity of care has an impact on health care outcomes in Chile.

STATEMENTS

Ethics approval

The Health National Survey 2009-2010 was approved by the Pontifical Catholic University of Chile Ethic Committee and the Ministry of Health on 2009. The authors of the study confirmed that they had guarded the autonomy and confidentiality of patients. The database is anonymized, and therefore there is no access to the identity of the participants. Furthermore, this study does not consider additional data collection. In consideration of that, this study does not require additional ethical approval.

Consent for publication

Not applicable

Data sharing statement

The data that support the findings of this study are available from the Epidemiology Department, Ministry of Health in Chile but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of the Ministry of Health in Chile.

Competing interest

The author(s) declare(s) that they have no competing interests.

Funding

No direct funds were assigned to this research project.

Author contributions

JL contributed to the design, data analysis, interpretation and writing of first and subsequent drafts of the paper. MG contributed to the design, data analysis, interpretation and comments on the first and subsequent drafts of the paper.

Acknowledgements

The authors would like to acknowledge the support provided by the Epidemiology Department from the Ministry of Health in Chile, by facilitating the access to the database of the National Health Survey 2009-2010 and in particular, to Dr. Dario Lopez.

I would like to express my special gratitude to Dr. Paula Margozzini from the Public Health Department at the Pontifical Catholic University of Chile, for providing the contact with the National Health Survey

team, facilitating the access to the Survey questionnaires and her technical support with some specific aspects of the Survey.

REFERENCES

1. Murray CJ, Vos T, Lozano R, et al. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet (London, England)* 2012;380(9859):2197. doi: 10.1016/S0140-6736(12)61689-4 [doi]
2. de Pablos-Velasco P, Parhofer KG, Bradley C, et al. Current level of glycaemic control and its associated factors in patients with type 2 diabetes across Europe: data from the PANORAMA study. *ClinEndocrinol(Oxf)* 2014;80(1):47-56. doi: 10.1111/cen.12119
3. Egan BM, Li J, Qanungo S, et al. Blood pressure and cholesterol control in hypertensive hypercholesterolemic patients: national health and nutrition examination surveys 1988-2010. *Circulation* 2013;128(1):29. doi: 10.1161/CIRCULATIONAHA.112.000500 [doi]
4. Fox KM, Gerber Pharmd RA, Bolinder B, et al. Prevalence of inadequate glycemic control among patients with type 2 diabetes in the United Kingdom general practice research database: A series of retrospective analyses of data from 1998 through 2002. *Clin Ther* 2006;28(3):388-95. doi: 10.1016/j.clinthera.2006.03.005 [published Online First: 2006/06/06]
5. Kontopantelis E, Springate D, Reeves D, et al. Withdrawing performance indicators: retrospective analysis of general practice performance under UK Quality and Outcomes Framework. *Bmj* 2014;348:g330. doi: 10.1136/bmj.g330 [published Online First: 2014/01/29]
6. Becker SA, Foxall M. Theory department. An analysis of health behavior theories applied to breast-screening behavior for relevance with American Indian women. *Journal of Transcultural Nursing* 2006;17:272-79.
7. Lin JS, Piper MA, Perdue LA, et al. Screening for Colorectal Cancer: Updated Evidence Report and Systematic Review for the US Preventive Services Task Force. *JAMA : the journal of the American Medical Association* 2016;315(23):2576. doi: 10.1001/jama.2016.3332 [doi]
8. Nelson KE, Hersh AL, Nkoy FL, et al. Primary care physician smoking screening and counseling for patients with chronic disease. *PrevMed* 2015;71:77.
9. Piper MA, Evans CV, Burda BU, et al. Diagnostic and predictive accuracy of blood pressure screening methods with consideration of rescreening intervals: a systematic review for the U.S. Preventive Services Task Force. *Ann Intern Med* 2015;162(3):192. doi: 10.7326/M14-1539 [doi]
10. Selph S, Dana T, Blazina I, et al. Screening for type 2 diabetes mellitus: a systematic review for the U.S. Preventive Services Task Force. *Ann Intern Med* 2015;162(11):765. doi: 10.7326/M14-2221 [doi]

11. Shimizu T, Bouchard M, Mavriplis C. Update on age-appropriate preventive measures and screening for Canadian primary care providers. *CanFamPhysician* 2016;62(2):131. doi: 62/2/131 [pii]
12. Whitlock EP, Vesco KK, Eder M, et al. Liquid-based cytology and human papillomavirus testing to screen for cervical cancer: a systematic review for the U.S. Preventive Services Task Force. *Ann Intern Med* 2011;155(10):687. doi: 10.7326/0003-4819-155-10-201111150-00376 [doi]
13. Grembowski D, Schaefer J, Johnson KE, et al. A conceptual model of the role of complexity in the care of patients with multiple chronic conditions. *Med Care* 2014;52 Suppl 3:S7-s14. doi: 10.1097/mlr.0000000000000045 [published Online First: 2014/02/25]
14. Milani RV, Lavie CJ. Health care 2020: reengineering health care delivery to combat chronic disease. *AmJMed* 2015;128(4):337. doi: 10.1016/j.amjmed.2014.10.047 [doi]
15. Starfield B, Shi L, Macinko J. Contribution of primary care to health systems and health. *Milbank Q* 2005;83(3):457. doi: MILQ409 [pii]
16. Wagner EH, Austin BT, Von Korff M. Organizing Care for Patients with Chronic Illness. *Milbank Q* 1996;74(4):511. doi: 10.2307/3350391
17. Starfield B. Primary care: An increasingly important contributor to effectiveness, equity, and efficiency of health services. SESPAS report 2012. *Gaceta Sanitaria* 2012;26(SUPPL.1):20.
18. Gulliford M, Naithani S, Morgan M. What is 'continuity of care'? *J Health Serv Res Policy* 2006;11(4):248. doi: 10.1258/135581906778476490 [doi]
19. Haggerty JL, Reid RJ, Freeman GK, et al. Continuity of care: a multidisciplinary review. *Bmj* 2003;327(7425):1219.
20. Cabana MD, Jee SH. Does continuity of care improve patient outcomes? *JFamPract* 2004;53(12):974. doi: jfp_1204_5312i [pii]
21. Saultz JW, Lochner J. Interpersonal continuity of care and care outcomes: a critical review. *Ann Fam Med* 2005;3(2):159. doi: 3/2/159 [pii]
22. Health Quality O. Continuity of care to optimize chronic disease management in the community setting: an evidence-based analysis. *Ontario health technology assessment series* 2013;13(6):1.
23. Deis. Estadisticas de Mortalidad. Departamento de Estadisticas e Informacion en Salud. Gobierno de Chile 2014 [Available from: http://www.deis.cl/estadisticas-mortalidad/.
24. Montero J, Tellez A, Herrera C. Reforma sanitaria chilena y la atencion primaria de salud. Algunos aspectos criticos. Temas de la agenda publica. Centro de Politicas Publicas. Pontificia Universidad Catolica de Chile2010.
25. Orrego C, Arancibia E, Contreras JL, et al. Fortalecimiento de la atencion primaria de salud: propuestas para mejorar el sistema sanitario chileno. Temas de la agenda publica. Centro de Politicas Publicas. Pontificia Universidad Catolica de Chile2014.

26. MINSAL. Encuesta Nacional de Salud ENS Chile 2009-2010: Ministerio de Salud. Gobierno de Chile.; 2010 [Available from: http://web.minsal.cl/portal/url/item/bcb03d7bc28b64dfe040010165012d23.pdf.

27. Gulliford MC, Naithani S, Morgan M. Continuity of care and intermediate outcomes of type 2 diabetes mellitus. *Fam Pract* 2007;24(3):245. doi: cmm014 [pii]

28. Mainous AG, 3rd, Koopman RJ, Gill JM, et al. Relationship between continuity of care and diabetes control: evidence from the Third National Health and Nutrition Examination Survey. *Am JPublic Health* 2004;94(1):66.

29. Parchman ML, Pugh JA, Noel PH, et al. Continuity of care, self-management behaviors, and glucose control in patients with type 2 diabetes. *Med Care* 2002;40(2):137.

30. Lambrew JM, DeFriese GH, Carey TS, et al. The effects of having a regular doctor on access to primary care. *Med Care* 1996;34(2):138.

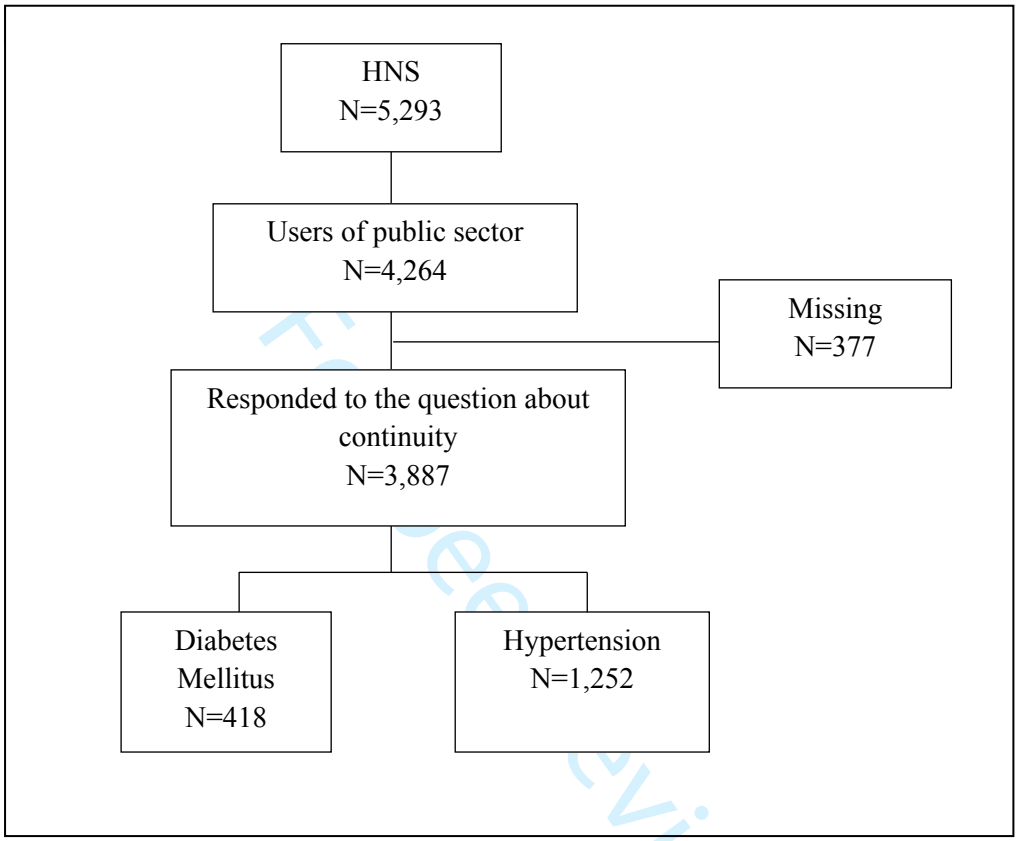
31. Xu KT. Usual source of care in preventive service use: a regular doctor versus a regular site. *Health services research* 2002;37(6):1509.

32. Oecd. OECD Health Statistics 2015 [Available from: http://www.oecd-ilibrary.org/social-issues-migration-health/data/oecd-health-statistics/oecd-health-data-health-care-utilisation_data-00542-en?isPartOf=/content/datacollection/health-data-en.

33. Kitpinyochai T, Paisansudhi S, Washirasaksiri C, et al. Clinical outcomes of type 2 diabetic patients before and after attending Siriraj Continuity of Care clinic. *JMedAssocThai* 2013;96 Suppl 2:S82.

SUPPLEMENTARY MATERIAL

Figure 1. Flowchart of the sample included in the study.



HNS: Health National Survey

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5-6
Bias	9	Describe any efforts to address potential sources of bias	5-7
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6-7
		(*b*) Describe any methods used to examine subgroups and interactions	5-7
		(*c*) Explain how missing data were addressed	5-7
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	n/a
		(*e*) Describe any sensitivity analyses	n/a
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7 Supplementary material, figure 1
		(b) Give reasons for non-participation at each stage	5-7
		(c) Consider use of a flow diagram	Supplementary material, figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1
		(b) Indicate number of participants with missing data for each variable of interest	Table 1
Outcome data	15*	Report numbers of outcome events or summary measures	7 and table 1
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 1 and 2
		(*b*) Report category boundaries when continuous variables were categorized	7
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	18	Summarise key results with reference to study objectives	11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	12-13
2Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Continuity of care and delivery of diabetes and hypertensive care among regular users of primary care services in Chile, a cross-sectional study

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2018-027830.R1
Article Type:	Research
Date Submitted by the Author:	29-Mar-2019
Complete List of Authors:	Leniz, Javiera; King's College London Faculty of Life Sciences and Medicine, School of Population Health and Environmental Sciences Gulliford, Martin; King's College London Faculty of Life Sciences and Medicine, School of Population Health and Environmental Sciences
Primary Subject Heading:	General practice / Family practice
Secondary Subject Heading:	Epidemiology, Cardiovascular medicine, Diabetes and endocrinology, Health services research
Keywords:	continuity of care, disease management, diabetes mellitus, health survey, Hypertension < CARDIOLOGY

Title: Continuity of care and delivery of diabetes and hypertensive care among regular users of primary care services in Chile, a cross-sectional study.

Authors:

1. Javiera Leniz, MSc Public Health student, King's College London, UK

2. Professor Martin Gulliford, Professor of Public Health, School of Population Health and Environmental Sciences, King's College London, UK

Corresponding author: Javiera Leniz, School of Population Health and Environmental Sciences, King's College London, Addison House, Guy's Campus, London, SE1 1UL, UK. Email javiera.martelli@kcl.ac.uk, telephone number: +4402078485636

Word count: 3,348

ABSTRACT

Objectives: explore factors related to continuity of care and its association with diabetes and hypertensive care, and disease control.

Design: cross-sectional study.

Setting: data from the Chilean Health National Survey 2009-2010.

Participants: regular users of primary care services aged 15 or older.

Primary and secondary outcome measures: proportion of hypertensive and diabetic patients with a blood pressure < 140/90 mmHg and HbA1c < 7.0% respectively, self-report of diagnosis, treatment, and recent foot and ophthalmologic exams. Associations between continuity of care, sociodemographic characteristics, and primary and secondary outcomes were explored using logistic regression.

Results: 3,887 primary care service users were included. 14.7% recognised a usual GP, 82.3% of them knew their name. Continuity of care was positively associated with age > 65 years (OR 4.81, 95% CI 3.16 to 7.32), being female (OR 1.66, 95% CI 1.34 to 2.05), retired (OR 2.22, 95% CI 1.75 to 2.83), obese (OR 1.66, 95% CI 1.29 to 2.14), high cardiovascular risk (OR 2.98, 95% CI 2.13 to 4.17) and widowed (OR 1.50, 95%CI 1.13 to 1.99), and negatively associated with educational level (8-12 vs <8 years OR 0.79, 95% CI 0.64 to 0.97), smoking (OR 0.65, 95% CI 0.52 to 0.82) and physical activity (OR 0.76, 95% CI 0.61 to 0.95). Continuity of care was associated with diagnosis (OR 2.83, 95% CI 1.21 to 6.63) and treatment awareness (OR 2.04, 95% CI 1.15 to 3.63), and a recent foot (OR 3.17, 95% CI 1.84 to 5.45) and ophthalmologic exam (OR 3.20, 95% CI 1.66 to 6.18) in diabetic but not in hypertensive patients.

Conclusions: Continuity of care was associated with higher odds of having a recent foot and ophthalmologic exam in patients with diabetes, but not with better diseases control. Findings suggest patients with chronic conditions have better continuity of care access.

Keywords

Continuity of Patient Care; Chronic disease; Health surveys; Disease Management.

Strengths and limitations of this study

- First study that explores continuity of care and its relationship with health outcomes in Chile.
- The study uses a nationally representative population-based sample.
- The data used combine clinical and sociodemographic variables.
- The cross-sectional design of this study does not allow to attribute causal relationships.
- Some self-reported variables might be affected by recall bias.

BACKGROUND

Chronic diseases and long-term conditions, including cancers and circulatory diseases, account for 19% of the global burden of disease, followed closely by mental disorders.[1] Despite the availability of effective treatment, a significant proportion of patients do not achieve adequate levels for disease control measures.[2-5] Effective preventive medical interventions are available for reducing the risk of complications and cardiovascular diseases.[6-8] Several authors have highlighted the role of the health system structure in the achievement of optimal outcomes for chronic diseases, especially in primary care.[9-12] One of the main attributes of a primary care-oriented service is the long-term person-focused care.[11-13]

Continuity of care can be defined as a long-term relationship between physicians and patients.[14 15] It has been associated with greater patient satisfaction, improved uptake of preventive services, lower rates of hospitalization and emergency department visits, and lower mortality rates.[16-20] Results from research focused on patients with chronic conditions suggest that continuity of care is correlated with fewer visits to emergency departments and better glycosylate haemoglobin (HbA1c) control in diabetic patients.[21] However, the evidence regarding the impact of continuity of care on health care outcomes is based mainly on studies from the United states, Canada or European countries. There is, therefore, an important gap of information regarding continuity of care in other settings. Due to the nature of the concept of continuity of care and the cultural differences that might determine patients and doctors' expectations about healthcare, evidence from developed countries might not be applicable in low-income contexts.

Chile is an OECD country where the burden of disease is similar to that observed in countries that are in an advanced stage of the epidemiological transition. Ischaemic heart diseases and stroke are the leading causes of death in the population, followed closely by cancer.[22] Even though continuity of care has been identified as a major challenge in Chile,[23 24] there are no studies assessing the level of relational continuity of care in the health system and their impact on clinical outcomes. The aim of this research is to explore factors related with different levels of continuity of care measured and its association with delivery of diabetes and hypertensive care and disease control in regular users of primary care in Chile.

METHODS

This cross-sectional study drew on data from the last Health National Survey performed in Chile.

The Chilean Health National Survey 2009-2010.

The second version of the Health National Survey was conducted in 2009 and commissioned by the Ministry of Health. The survey was designed to be nationally representative; individuals from the general population from 15 years old and older were included. The sample of the HNS 2009 was a multistage sample of households and disproportionately stratified by geographic region and urban/rural area, using the Census population as a frame. The response rate was 75.3%, and the loss rate after the recruitment was 8.7%. The final survey sample size includes 5,293 individuals. Survey instruments included 42 health problems, five physiological measurements, and 17 biochemical measurements.[25]

The survey participants were interviewed in their homes, with an average of two home visits per individual. During the first home visit, they were invited to participate, signed the informed consent and answered a validated questionnaire administrated by trained interviewers. Questions regarding whether individuals had been diagnosed with hypertension or diabetes, were receiving treatment for hypertension or diabetes and have had a foot and ophthalmologic exam were included in the questionnaire. During the second home visit, a trained nurse performed blood and urine samples. Blood glucose and glycated haemoglobin (HbA1c) were estimated from that sample. Participants were asked during the first visit to do not eat any food 11 hours prior the second visit and participants with a diagnosis of diabetes were scheduled for the first visit in the morning. During this second visit, anthropometric measures were taken, including height, weight and blood pressure. Three measurements of blood pressure were obtained, prior to five minutes resting and with an interval of two minutes between each measurement. An automatic pressure sphygmomanometer was used (Omron HEM 742 ®).[25]

Population and sample

For this study, only patients with public insurance were analysed because the questions regarding continuity of care were asked only to regular users of primary care services deliver by the government, with correspond to 80% of the overall population in the survey. Individuals were considered as having hypertension if they had a mean systolic blood pressure higher than 140 mmHg and/or a mean diastolic blood pressure higher than 90 mmHg or were receiving pharmacological treatment at the time of the survey. Individuals were considered as having diabetes mellitus if they had fasting blood glucose higher than 126 mg/dl or reported that they had been diagnosed with diabetes before the visit.

A sample size was calculated for diabetes control and systolic blood pressure as the main outcomes. The study had more than 80% power to detect odds ratios of 1.5 and above.

Instruments and measurements

Continuity of Care

Two questions were used to assess the level of continuity of care among participants. The first one was 'Do you have your 'own' general doctor or family doctor? The question specified in brackets that a general doctor is the one they can appeal to solve the majority of their health problems. The second question asked whether or not individuals who referred having an 'own doctor' also knew the name of that doctor. A measure of continuity of care was constructed from these two questions. Three categories of continuity of care were considered. First, individuals who reported having a GP whose name they know. Second, individuals who report having a GP, but do not know his/her name. And finally, individuals who do not have a particular GP.

Primary and secondary outcome variables

The primary outcomes were the proportion of hypertensive patients with a systolic and diastolic blood pressure less than 140mmHg and 90mmHg respectively, and the proportion of diabetic patients with an HbA1c < 7.0% (53 mmol/mol).

Hypertension and diabetes care was assessed using the self-reported questions from the questionnaire. The proportion of individuals who referred having received a diagnosed of hypertension or diabetes and the proportion of individuals who referred having received treatment were included as secondary outcomes, as well as the proportion of diabetic patients who referred have had a foot examination in the last year, and an ophthalmologic exam in the last 2 years.

Co-variables

Cardiovascular risk was calculated from data related to the individual's age, cholesterol level, smoking status and blood pressure using the Framingham equation. Individuals with a probability of having a cardiovascular event less than 10%, between 10% and 20%, and more than 20% in 10 years, were considered as having a low, high, and very high cardiovascular risk respectively. The Spanish version of the global physical activity questionnaire (GPAQ) was used. The GPAQ considers three domains of physical activity: at work while commuting and during recreational activity. The sum of the three activities determines the level of physical activity of an individual. A tobacco exposure module was included in the first visit that considered basic questions about smoking, based on the minimum

instrument (core questions) surveillance smoking used by the Pan-American health organization. The questions identified two categories: current smoker (daily and occasional) and former smoker.

Analysis

A descriptive analysis was performed for all variables included in the study according to the level of continuity of care. Univariate analysis using logistic regression was performed to evaluate the association between continuity of care and categorical variables. And ANOVA test was performed to analyse the association between continuous variables with continuity of care. Demographic variables that were associated with both continuity of care and the outcomes were considered as possible confounders and were therefore used to fix the model for multivariate analysis. A multivariate logistic regression analysis was used to explore the relationship between the level of continuity of care and the different outcomes, adjusting for confounders. A backward approach was used to fix the multivariate logistic regression. All variables that were related to continuity of care and the respective outcome were included in the first model. Explanatory variables were kept in the model based on a priori hypothesis and significance in multivariate analysis (p-value < 0.2). Individuals that did not respond to the question 'Do you have a family physician or GP?' were excluded from the analysis. The 0.99.902 - © 2009-2016 version of the statistical software R was used for the analysis.

Patient and Public involvement

Patient or public were not involved in this study.

RESULTS

A total of 4,264 individuals from the Health National Survey reported having a public insurance and were selected for the current study. Among them, 3,887 individuals responded to the question 'Do you have you a family physician or GP?', and therefore, 377 individuals were excluded and considered as missing values (Supplementary material, figure 1).

There were 572(14.7%) of the individuals included in the Health National Survey who affirmed having a GP as a usual doctor, and 471(82.3%) of these affirmed knowing the name of their doctor (Table 1). Individuals who indicated having a GP as a usual doctor and knowing their name had greater odds of age greater than 65 years (OR 4.81, 95% CI 3.16 to 7.32), female gender (OR 1.66, 95% CI 1.34 to 2.05), being widowed (OR 1.50, 95% CI 1.13 to 1.99), being retired (OR 2.22, 95% CI 1.75 to 2.83), having a high (OR 1.88, 95% CI 1.53 to 2.32) or very high cardiovascular risk (OR 2.98, 95% CI2.13 to 4.17), or having a BMI > 30 (OR 1.66, 95% CI 1.29 to 2.14). Individuals with more than eight years of education, single people, and those with moderate and high level of physical activity were less likely to mention

having a GP as a usual doctor. Recognizing the name of their regular doctor was also highly associated with cardiovascular risk factors, with lower odds of having a high level of physical activity, greater odds of being obese or having a diagnosis of diabetes or hypertension. Having a regular doctor was not associated with rurality or household income (Table 1).

Table 1. Univariate association between level of continuity of care and categorical variables.

		Do you have your family doctor?				
		No (n=3,315) n (%)[a]	Yes, but not know the name (n=101) n (%)[a]	Yes, and know the name (n=471) n (%)[a]	Yes, but do not know the name/No OR (95% CI)	Yes, and know the name/No OR (95% CI)
Age						
	<25	546 (16.5)	9 (8.9)	28 (5.9)	Ref	Ref
	25 to 45	1,128 (34.0)	26 (25.7)	124 (26.3)	1.40 (0.66 to 3.01)	2.14 (1.40 to 3.27)
	46 to 65	1,041 (31.4)	40 (39.6)	124 (36.3)	2.33 (1.12 to 4.84)	3.20 (2.12 to 4.84)
	>66	600 (18.1)	26 (25.7)	148 (31.4)	2.63 (1.22 to 5.66)	4.81 (3.16 to 7.32)
Rurality (yes)		574 (17.3)	25 (24.8)	81 (17.2)	1.57 (0.99 to 2.49)	0.99 (0.77 to 1.28)
Sex (Female)		2,005 (60.5)	69 (68.3)	338 (71.8)	1.41 (0.92 to 2.16)	1.66 (1.34 to 2.05)
Marital Status						
	Married	1,804 (54.4)	56 (55.4)	262 (55.6)	Ref	Ref
	Separated or Divorced	287 (8.7)	10 (9.9)	51 (10.8)	1.12 (0.57 to 2.23)	1.22 (0.88 to 1.69)
	Single	885 (26.7)	20 (19.8)	84 (17.8)	0.73 (0.43 to 1.22)	0.65 (0.50 to 0.85)
	Widowed	339 (10.2)	15 (14.9)	74 (15.7)	1.43 (0.80 to 2.55)	1.50 (1.13 to 1.99)
Educational level						
	< 8 years	1,018 (30.7)	44 (43.6)	162 (34.5)	Ref	Ref
	8 - 12 years	1,892 (57.1)	52 (51.5)	237 (50.4)	0.64 (0.42 to 0.96)	0.79 (0.64 to 0.97)
	>12 years	402 (12.1)	5 (5.0)	71 (15.1)	0.29 (0.11 to 0.73)	1.11 (0.82 to 1.50)
Occupation						
	Worker	1,499 (45.5)	38 (37.6)	177 (37.7)	Ref	Ref
	Not worker	1,237 (37.6)	40 (39.6)	147 (31.3)	1.28 (0.81 to 2.00)	1.01 (0.8 to 1.27)
	Retired	556 (16.9)	23 (22.8)	146 (31.1)	1.63 (0.96 to 2.76)	2.22 (1.75 to 2.83)
Cardiovascular risk						
	Low	1,799 (54.3)	43 (42.6)	174 (36.9)	Ref	Ref
	High	1,322 (39.9)	47 (46.5)	241 (51.2)	1.49 (0.98 to 2.27)	1.88 (1.53 to 2.32)
	Very High	194 (5.9)	11 (10.9)	56 (11.9)	2.37 (1.20 to 4.68)	2.98 (2.13 to 4.17)
Level of physical activity						
	Low	1,013 (31.3)	45 (45.5)	162 (35.9)	Ref	Ref
	Moderate	625 (19.3)	17 (17.2)	95 (21.1)	0.61 (0.35 to 1.08)	0.95 (0.72 to 1.25)
	High	1,601 (49.4)	37 (37.4)	194 (43.0)	0.52 (0.33 to 0.81)	0.76 (0.61 to 0.95)
Current smoker (yes)		1,140 (35.2)	30 (30.9)	120 (26.3)	0.82 (0.53 to 1.27)	0.65 (0.52 to 0.82)
Nutritional status						
	BMI <25	943 (31.3)	20 (22.5)	112 (25.7)	Ref	Ref
	BMI 25 to 29.9	1,199 (39.8)	35 (39.3)	151 (34.7)	1.38 (0.80 to 2.40)	1.06 (0.82 to 1.37)
	BMI >30	873 (29.0)	34 (38.2)	172 (39.5)	1.84 (1.05 to 3.22)	1.66 (1.29 to 2.14)
Household income						
	US$<374	2,084 (64.9)	78 (78.8)	278 (61.2)	Ref	Ref
	US$ 374 to 1268	1,072 (33.4)	19 (19.2)	163 (35.9)	0.47 (0.29 to 0.79)	1.14 (0.93 to 1.40)
	>US$1268	55 (1.7)	2 (2.0)	13 (2.9)	0.97 (0.23 to 4.06)	1.77 (0.96 to 3.28)
DM diagnosis (Yes)		328 (11.1)	15 (17.4)	75 (17.3)	1.70 (0.96 to 2.99)	1.68 (1.27 to 2.20)
Years since diagnosis DM (mean (sd)) (n=327)		8.8(9.9)	9.3(5.9)	10.9(9.0)		
HbA1c (mean (sd)) (n=348)		8.4(2.5)	7.8(2.2)	8.8(2.4)		
Hypertension diagnosis (Yes)		994 (32.2)	38 (40.0)	220 (49.4)	1.40 (0.93 to 2.13)	2.06 (1.68 to 2.52)
Years since diagnosis hypertension (mean (sd)) (n=872)		11.1(12.2)	13.6(15.0)	10.7(9.8)		
PAS (mmHg) (mean(sd)) (n=1,194)		152.0(21.6)	149.7(23.8)	150.5(20.4)		
PAD (mmHg) (mean(sd)) (n=1,194)*		84.4(11.9)	80.9(12.0)	81.9(11.6)		

[a] column percent. BMI: Body mass index; DM: diabetes mellitus; Ref: reference. *ANOVA p-value<0.01

A total of 418 (10.8%) diabetic and 1,252 (32.2%) hypertensive individuals were identified in the survey. Among individuals classified as having diabetes, 324 (78.6%) were aware of a diabetes diagnosis, and 234 (56.0%) were receiving pharmacological treatment at the time of the survey. Among individuals classified as having hypertension, 891 (71.2%) were aware of a hypertension diagnosis, and 565 (45.1%) were receiving pharmacological treatment at the time of the survey.

There were 90(21.5%) diabetic patients that referred to having a usual GP. Continuity of care was not associated with optimal levels of glycemic control (Table 2). Individuals that had a personal GP and knew their name were 2.04 (95% CI 1.15 to 3.63) more likely to be receiving pharmacological treatment for diabetes and 2.83 (95% CI 1.21 to 6.63) more likely of being aware of their diagnosis than individuals without a usual GP, after adjusting for confounders. They were also more likely to have had a recent foot exam (OR 0.67, 95% CI 0.36 to 1.23) and a recent ophthalmologic exam (OR 3.17, 95% CI 1.84 to 5.45) than individuals without a usual GP.

There were 258(20.6%) hypertensive patients that referred to having a usual GP. Continuity of care was not associated with being more aware of their diagnosis, receiving pharmacological treatment or better blood pressure control for these patients (Table 2).

Table 2. Univariate and multivariate logistic regression between relational continuity of care and cardiovascular outcomes.

					Univariate		Multivariate	
		No	Yes, but do not know the name	Yes, and know the name	Yes, but do not know the name/No	Yes, and know the name/No	Yes, but do not know the name	Yes, and know the name
		n (%)[a]	n (%)[a]	n (%)[a]	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Patients with knowledge of their diagnosis of DM-2								
	No	79 (89.8)	2 (2.3)	7 (8.0)	Ref	Ref	Ref[1]	Ref[1]
	Yes	245 (75.6)	13 (4.0)	66 (20.4)	2.10 (0.46 to 9.49)	3.04 (1.34 to 6.90)	1.68 (0.34 to 8.40)	2.83 (1.21 to 6.63)
Patients under treatment for DM-2								
	No	158 (85.9)	5 (2.7)	21 (11.4)	Ref	Ref	Ref[2]	Ref[2]
	Yes	170 (72.6)	10 (4.3)	54 (23.1)	1.86 (0.62 to 5.56)	2.39 (1.40 to 4.14)	1.71 (0.53 to 5.44)	2.04 (1.15 to 3.63)
Patients with diagnosis of diabetes and HbA1c <7%								
	No	164 (76.6)	7 (3.3)	43 (20.1)	Ref	Ref	Ref[3]	Ref[3]
	Yes	108 (80.6)	6 (4.5)	20 (14.9)	1.30 (0.43 to 3.98)	0.71 (0.39 to 1.27)	1.48 (0.43 to 5.13)	0.67 (0.36 to 1.23)
Diabetic patients with last FE <1 year ago								
	No	208 (86.7)	6 (2.5)	26 (10.8)	Ref	Ref	Ref[4]	Ref[4]
	Yes	120 (67.4)	9 (5.1)	49 (27.5)	2.60 (0.90 to 7.48)	3.27 (1.93 to 5.53)	2.38 (0.81 to 7.00)	3.17 (1.84 to 5.45)
Diabetic patients with last OE <2 years ago								
	No	197 (83.8)	6 (2.6)	32 (13.6)	Ref	Ref	Ref[5]	Ref[5]
	Yes	129 (71.3)	9 (5.0)	43 (23.8)	3.30 (1.03 to 10.60)	3.43 (1.87 to 6.30)	3.67 (1.03 to 13.04)	3.20 (1.66 to 6.18)
Patients with knowledge of their diagnosis of hypertension	No	300 (83.1)	8 (2.2)	53 (14.7)	Ref	Ref	Ref[6]	Ref[6]
	Yes	694 (77.9)	30 (3.4)	167 (18.7)	1.62 (0.75 to 3.58)	1.36 (0.97 to 1.91)	1.43 (0.60 to 3.42)	1.15 (0.80 to 1.67)
Patients report receiving treatment for hypertension	No	568 (82.7)	14 (2.0)	105 (15.3)	Ref	Ref	Ref[7]	Ref[7]
	Yes	426 (75.4)	24 (4.2)	115 (20.4)	2.29 (1.17 to 4.47)	1.46 (1.09 to 1.96)	2.19 (1.10 to 4.40)	1.25 (0.91 to 1.71)
Patients with diagnoses of hypertension and BP <140/90	No	819 (79.4)	29 (2.8)	184 (17.8)	Ref	Ref	Ref[8]	Ref[8]
	Yes	175 (79.5)	9 (4.1)	36 (16.4)	1.45 (0.68 to 3.12)	0.92 (0.62 to 1.36)	1.83 (0.80 to 4.16)	0.65 (0.42 to 1.02)

[a] row percent. DM-2: diabetes mellitus type 2, HbA1c: Glycosilate haemoglobine, FE: Foot examination, OE: ophthalmologic examination, BP: Blood pressure. 1 Adjusted for age, sex, marital status, physical activity and smoking status 2 Adjusted for age, sex, marital status, educational level and smoking status. 3 Adjusted for age, sex, smoking status and BMI. 4 Adjusted for age, sex, marital status and occupation. 5 Adjusted for age, sex, occupation and BMI. 6 Adjusted for age, sex, marital status, educational level, BMI, smoking status and occupation. 7 Adjusted for age, sex, marital status, educational level, occupation and smoking status. 8 Adjusted for age, sex, marital status, educational level, BMI and physical activity.

DISCUSSION

Summary of findings

This study evaluated continuity of care and its relationship with health outcomes in the Chilean public health sector. Continuity of care in this study was positively associated with age, sex, occupation, nutritional, cardiovascular risk and marital status, and negatively associated with educational level, smoking and physical activity. Patients with diabetes or hypertension diagnosis were more likely to know the name of their usual GP. In diabetic patients, continuity of care was associated with receiving treatment and being aware of diabetes diagnosis, and higher odds of having a recent foot and ophthalmologic exam. In hypertensive patients, continuity of care was not associated with higher odds of being aware of their diagnosis, receiving pharmacological treatment or better levels of blood pressure control.

Individuals that knew the name of their usual GP were more likely to be retired, widowed and older, which might have some implications regarding access to healthcare. People without a regular job might have more time to ask for an appointment or attend medical appointments. However, it is likely that being retired is also associated with age and chronic conditions. It is also possible that older adults might have a greater preference for having a usual GP and they consequently make efforts to achieve a better continuity of care. Individuals who knew the name of their usual GP were more likely to have high cardiovascular risk factors, such as having a diagnosis of diabetes, hypertension, obesity and lower levels of physical activity. This association could be explained because health care provision is usually based on need, and therefore, patients with chronic conditions tend to have better access to health care and visit their doctor more regularly than other non-chronic patients. However, in absolute terms, only around 20% of patients with diabetes and hypertension in this study referred to know the name and having a regular doctor.

Diabetic patients that referred to have a usual GP and knowing the name of their doctor were 3.2 times (95% CI 1.66 to 6.18) more likely to have had a foot examination in the last year and 3.17 times (95% CI 1.84 to 5.45) more likely to have had an ophthalmologic examination in the last 2 years. These findings are consistent with those found in two other studies,[26 27] and suggest patients with a better continuity of care might receive better quality of care. Consultations with the same physician over time might contribute to having better coordination of care, and therefore might facilitate the delivery of appropriate and timely preventive services for diabetes care. Nevertheless, it is not possible to rule out the possibility of a spurious association between foot examination, ophthalmological exam and continuity due to recall bias. The uptake of both services in this study was assessed through individuals' self-report. Patients with a usual GP could have a different care-seeking pattern that predisposes them

to be more concerned about their health and therefore remembered more easily whether they have had a foot examination or not, compared to patients without a usual provider. A more objective measure of foot and ophthalmological exam, such as information from administrative data, could help to assess the possibility of recall bias.

This study failed to prove an association between continuity of care and better patients outcomes such as diabetes and hypertension control. This probably could be explained because health care centres prioritise appointments and follow-ups for patients with poor clinical outcomes to improve their management. However, the cross-sectional design of this study does not allow to attribute a causal relationship to this association. These results are consistent with those found in Gulliford et al.[28] and O'Connor et al.,[27] where experienced continuity of care was not associated with the level of HbA1c. But differ from those obtained in two other observational studies where individuals with a usual provider had 6.69 more chances to have an Hb1C level below 7%,[29] or better continuity score was statistically associated with lower levels of HbA1c.[30] Results from these studies are difficult to compare due to the fact that they used different measurements for continuity of care, as well as different methodologies.

The fact that some individuals know or not know the name of their usual doctor, could be perceived as constituting different levels of continuity of care, assuming that patients that know the name of their doctors have a stronger relationship with them. However, the results fail to show any gradient effect among the different levels of continuity of care used in the study. These results might be explained by the low number of individuals belonging to that category. Only 101(2.6%) persons in the sample referred to having their GP but not knowing his/her name.

The proportion of individuals that referred to having a usual GP in this sample was unusually low (14.7%). Studies from the US and the UK have reported much higher rates of having a regular doctor, between 44% and 86%.[29 31 32] While there might be methodological differences that can explain these disparate results, it is highly possible that these discrepancies can be explained by differences in the structure and resources of the health care system among countries. Chile reported some physicians per 1,000 population of 1.87 in 2013, in contrast with 3.72 and 3.3 per 1,000 population in the UK and the US respectively.[33] Therefore, it is possible that the lower density of physicians in the country hinders the ability to maintain an adequate continuity of care, giving priority to maintaining adequate access to health care. In addition, differences in health care resources and treatments in different settings might limit the generalizability of these findings.

Strengths and limitations

The measure of continuity of care used in the study has some limitations that can account for these results. Patients' report of provider affiliation does not capture the length and strength of that relationship, which seems to be a major dimension of continuity of care. Additionally, recognizing a usual provider does not necessarily imply frequent consultations or real contact with the provider, nor the quality of care provided, factors that could be substantial in improving health outcomes. Many other measures of continuity of care have been described in the literature. Nevertheless, no other single measure has proven to be superior to the others or capture the whole concept of continuity of care. The measure of continuity used in this analysis has the advantage of considering the patient's perspective and of being easy to implement and simple to understand and has been widely employed in the literature allowing comparisons with other studies.[34-38]

As in any observational epidemiological study, unmeasured confounders might have biased the associations found in this study. Patients with better continuity of care were more likely to have being receiving pharmacological treatment for their disease. The cross-sectional design of this study cannot rule out the possibility that patients with a diagnosis of diabetes and hypertension had a better continuity of care as a consequence of the process of monitoring the disease treatment, due to lack of temporality in the measurement of both variables. We did not have information about the type of treatment each patient was receiving or the appropriateness of that treatment and therefore, it was not possible to account for the fact that some individuals might have been receiving pharmacological schemes that might be more effective to achieve control of the disease. We did not have either information on physicians' characteristics that might influence the quality of care received by patients.

CONCLUSIONS

Continuity of care was associated with higher odds of having a recent foot and ophthalmologic exam in patients with diabetes, but not with better diseases control. Differences in the age and occupation among individuals with a regular GP might be related with the presence of a chronic condition. Findings suggest patients with chronic conditions have better access to continuity of care.

Results showed an association between continuity of care and the proportion of diabetic users of the public health services in Chile receiving treatment for their diseases. However, by measuring both, the dependent and independent variables at the same time, it is not possible to rule out the possibility of reverse causation.

Only a minority of participants in this survey referred to have a regular doctor. However, the majority of them are also able to identify their doctor's name. It would be recommendable to explore strategies

that might improve the level of continuity of care experienced by users of the public health care sector in Chile, such as incentives to improve the availability of physicians in the public sector and reducing the practice size.

Further investigation that incorporates a longitudinal approach would be necessary to clarify whether or not continuity of care has an impact on health care outcomes in Chile.

STATEMENTS

Ethics approval

The Health National Survey 2009-2010 was approved by the Pontifical Catholic University of Chile Ethic Committee and the Ministry of Health on 2009. The authors of the study confirmed that they had guarded the autonomy and confidentiality of patients. The database is anonymized, and therefore there is no access to the identity of the participants. Furthermore, this study does not consider additional data collection. In consideration of that, this study does not require additional ethical approval.

Consent for publication

Not applicable

Data sharing statement

The data that support the findings of this study are available from the Epidemiology Department, Ministry of Health in Chile but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of the Ministry of Health in Chile.

Competing interest

The author(s) declare(s) that they have no competing interests.

Funding

JL was funded by CONICYT, Programa Formacion de Capital Humano Avanzado, Magister Becas Chile, 2015, Folio 73161335.

Author contributions

JL contributed to the design, data analysis, interpretation and writing of first and subsequent drafts of the paper. MG contributed to the design, data analysis, interpretation and comments on the first and subsequent drafts of the paper.

Acknowledgements

The authors would like to acknowledge the support provided by the Epidemiology Department from the Ministry of Health in Chile, by facilitating the access to the database of the National Health Survey 2009-2010 and in particular, to Dr. Dario Lopez.

I would like to express my special gratitude to Dr. Paula Margozzini from the Public Health Department at the Pontifical Catholic University of Chile, for providing the contact with the National Health Survey team, facilitating the access to the Survey questionnaires and her technical support with some specific aspects of the Survey.

REFERENCES

1. Murray CJ, Vos T, Lozano R, et al. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet (London, England)* 2012;380(9859):2197-223. doi: 10.1016/s0140-6736(12)61689-4 [published Online First: 2012/12/19]

2. de Pablos-Velasco P, Parhofer KG, Bradley C, et al. Current level of glycaemic control and its associated factors in patients with type 2 diabetes across Europe: data from the PANORAMA study. *Clinical endocrinology* 2014;80(1):47-56. doi: 10.1111/cen.12119 [published Online First: 2012/12/01]

3. Egan BM, Li J, Qanungo S, et al. Blood pressure and cholesterol control in hypertensive hypercholesterolemic patients: national health and nutrition examination surveys 1988-2010. *Circulation* 2013;128(1):29-41. doi: 10.1161/circulationaha.112.000500 [published Online First: 2013/07/03]

4. Fox KM, Gerber Pharmd RA, Bolinder B, et al. Prevalence of inadequate glycemic control among patients with type 2 diabetes in the United Kingdom general practice research database: A series of retrospective analyses of data from 1998 through 2002. *Clinical therapeutics* 2006;28(3):388-95. doi: 10.1016/j.clinthera.2006.03.005 [published Online First: 2006/06/06]

5. Kontopantelis E, Springate D, Reeves D, et al. Withdrawing performance indicators: retrospective analysis of general practice performance under UK Quality and Outcomes Framework. *BMJ (Clinical research ed)* 2014;348:g330. doi: 10.1136/bmj.g330 [published Online First: 2014/01/29]

6. Standards of Medical Care in Diabetes—2014. *Diabetes Care* 2014;37(Supplement 1):S14. doi: 10.2337/dc14-S014

7. Dorresteijn JAN, Kriegsman DMW, Assendelft WJJ, et al. Patient education for preventing diabetic foot ulceration. *Cochrane Database of Systematic Reviews* 2014(12) doi: 10.1002/14651858.CD001488.pub5

8. Nelson KE, Hersh AL, Nkoy FL, et al. Primary care physician smoking screening and counseling for patients with chronic disease. *Preventive medicine* 2015;71:77-82. doi: 10.1016/j.ypmed.2014.11.010 [published Online First: 2014/12/03]

9. Grembowski D, Schaefer J, Johnson KE, et al. A conceptual model of the role of complexity in the care of patients with multiple chronic conditions. *Medical care* 2014;52 Suppl 3:S7-s14. doi: 10.1097/mlr.0000000000000045 [published Online First: 2014/02/25]

10. Milani RV, Lavie CJ. Health care 2020: reengineering health care delivery to combat chronic disease. *The American journal of medicine* 2015;128(4):337-43. doi: 10.1016/j.amjmed.2014.10.047 [published Online First: 2014/12/03]

11. Starfield B, Shi L, Macinko J. Contribution of primary care to health systems and health. *The Milbank quarterly* 2005;83(3):457-502. doi: 10.1111/j.1468-0009.2005.00409.x [published Online First: 2005/10/06]

12. Wagner EH, Austin BT, Von Korff M. Organizing care for patients with chronic illness. *The Milbank quarterly* 1996;74(4):511-44. [published Online First: 1996/01/01]

13. Starfield B. Primary care: an increasingly important contributor to effectiveness, equity, and efficiency of health services. SESPAS report 2012. *Gaceta sanitaria* 2012;26 Suppl 1:20-6. doi: 10.1016/j.gaceta.2011.10.009 [published Online First: 2012/01/24]

14. Gulliford M, Naithani S, Morgan M. What is 'continuity of care'? *Journal of health services research & policy* 2006;11(4):248-50. doi: 10.1258/135581906778476490 [published Online First: 2006/10/05]

15. Haggerty JL, Reid RJ, Freeman GK, et al. Continuity of care: a multidisciplinary review. *BMJ (Clinical research ed)* 2003;327(7425):1219-21. doi: 10.1136/bmj.327.7425.1219 [published Online First: 2003/11/25]

16. Cabana MD, Jee SH. Does continuity of care improve patient outcomes? *The Journal of family practice* 2004;53(12):974-80. [published Online First: 2004/12/08]

17. Pereira Gray DJ, Sidaway-Lee K, White E, et al. Continuity of care with doctors-a matter of life and death? A systematic review of continuity of care and mortality. *BMJ open* 2018;8(6):e021161. doi: 10.1136/bmjopen-2017-021161 [published Online First: 2018/07/01]

18. Sandall J, Soltani H, Gates S, et al. Midwife-led continuity models versus other models of care for childbearing women. *The Cochrane database of systematic reviews* 2016;4:Cd004667. doi: 10.1002/14651858.CD004667.pub5 [published Online First: 2016/04/29]

19. Saultz JW, Lochner J. Interpersonal continuity of care and care outcomes: a critical review. *Annals of family medicine* 2005;3(2):159-66. doi: 10.1370/afm.285 [published Online First: 2005/03/31]

20. Wasson JH, Sauvigne AE, Mogielnicki RP, et al. Continuity of outpatient medical care in elderly men. A randomized trial. *Jama* 1984;252(17):2413-7. [published Online First: 1984/11/02]

21. Continuity of care to optimize chronic disease management in the community setting: an evidence-based analysis. *Ontario health technology assessment series* 2013;13(6):1-41. [published Online First: 2013/10/30]

22. DEIS. Estadisticas de Mortalidad. Departamento de Estadisticas e Informacion en Salud. Gobierno de Chile 2014 [Available from: www.deis.cl/estadisticas-mortalidad/.

23. Orrego C, Arancibia A, Contreras JL, et al. Fortalecimiento de la atencion primaria de salud: propuestas para mejorar el sistema sanitario chileno. Temas de la agenda publica. Centro de Politicas Publicas. Pontificia Universidad Catolica de Chile 2014 [Available from: https://politicaspublicas.uc.cl/wp-content/uploads/2015/02/fortalecimiento-de-la-atencion-primaria-de-salud-propuestas-para-mejorar-el-sistema-sanitario.pdf accessed 15-03 2019.

24. Montero J, Tellez A, Herrera C. Reforma sanitaria chilena y la atencion primaria de salud. Algunos aspectos criticos. Temas de la agenda publica. Centro de Politicas Publicas. Pontificia Universidad Catolica de Chile 2010 [Available from: https://politicaspublicas.uc.cl/wp-content/uploads/2015/02/reforma-sanitaria-chilena-y-la-atencion-primaria-de-salud.pdf accessed 15-03 2019.

25. MINSAL. Encuesta Nacional de Salud ENS Chile 2009-2010. Ministerio de Salud. Gobierno de Chile 2010 [Available from: http://web.minsal.cl/portal/url/item/bcb03d7bc28b64dfe040010165012d23.pdf accessed 15-03 2019.

26. Kitpinyochai T, Paisansudhi S, Washirasaksiri C, et al. Clinical outcomes of type 2 diabetic patients before and after attending Siriraj Continuity of Care clinic. *Journal of the Medical Association of Thailand = Chotmaihet thangphaet* 2013;96 Suppl 2:S82-90. [published Online First: 2013/04/18]

27. O'Connor PJ, Desai J, Rush WA, et al. Is having a regular provider of diabetes care related to intensity of care and glycemic control? *The Journal of family practice* 1998;47(4):290-7. [published Online First: 1998/10/28]

28. Gulliford MC, Naithani S, Morgan M. Continuity of care and intermediate outcomes of type 2 diabetes mellitus. *Family practice* 2007;24(3):245-51. doi: 10.1093/fampra/cmm014 [published Online First: 2007/05/12]

29. Mainous AG, 3rd, Koopman RJ, Gill JM, et al. Relationship between continuity of care and diabetes control: evidence from the Third National Health and Nutrition Examination Survey. *American journal of public health* 2004;94(1):66-70. [published Online First: 2004/01/10]

30. Parchman ML, Pugh JA, Noel PH, et al. Continuity of care, self-management behaviors, and glucose control in patients with type 2 diabetes. *Medical care* 2002;40(2):137-44. [published Online First: 2002/01/22]

31. Xu KT. Usual source of care in preventive service use: a regular doctor versus a regular site. *Health services research* 2002;37(6):1509-29. [published Online First: 2003/01/28]

32. Lambrew JM, DeFriese GH, Carey TS, et al. The effects of having a regular doctor on access to primary care. *Medical care* 1996;34(2):138-51. [published Online First: 1996/02/01]

33. OECD. OECD Health Statitics 2015 [Available from: http://www.oecd-ilibrary.org/social-issues-migration-health/data/oecd-health-statistics/oecd-health-data-health-care-utilisation_data-00542-en?isPartOf=/content/datacollection/health-data-en. accessed 15-03 2019.

34. Kogan MD, Alexander GR, Teitelbaum MA, et al. The effect of gaps in health insurance on continuity of a regular source of care among preschool-aged children in the United States. *Jama* 1995;274(18):1429-35. [published Online First: 1995/11/08]

35. Hemingway H, Saunders D, Parsons L. Social class, spoken language and pattern of care as determinants of continuity of carer in maternity services in east London. *Journal of public health medicine* 1997;19(2):156-61. [published Online First: 1997/06/01]

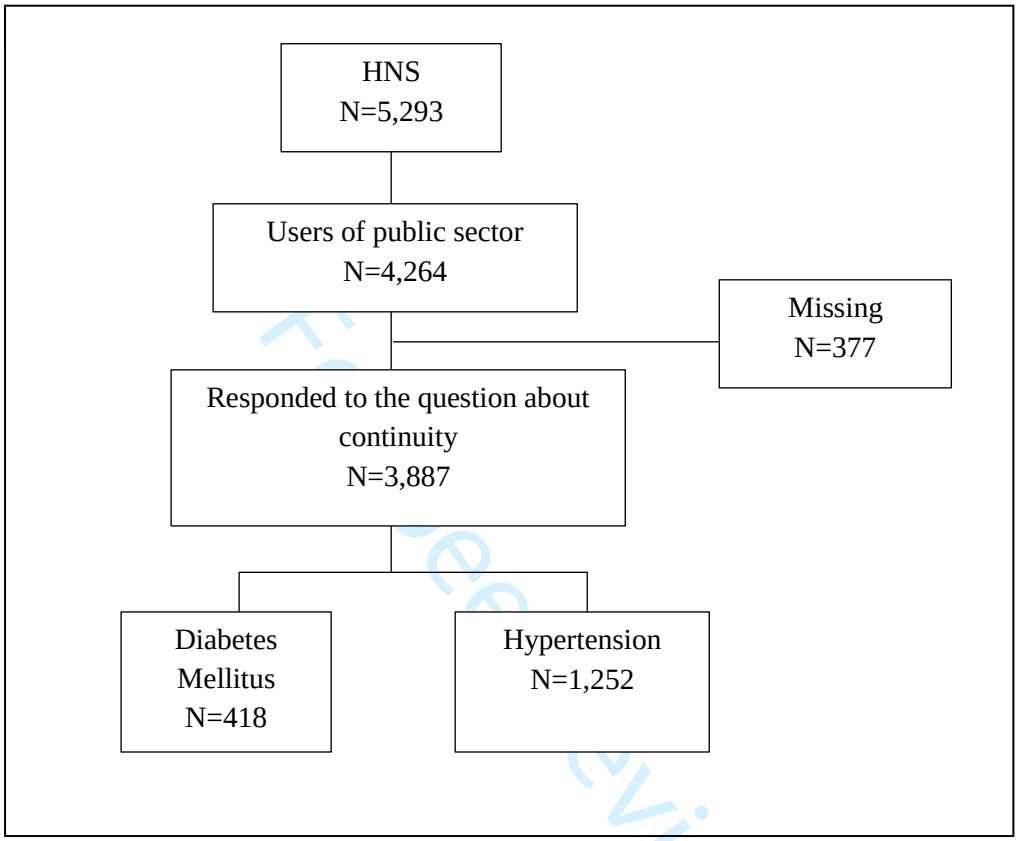
36. Donahue KE, Ashkin E, Pathman DE. Length of patient-physician relationship and patients' satisfaction and preventive service use in the rural south: a cross-sectional telephone study. *BMC family practice* 2005;6:40-40. doi: 10.1186/1471-2296-6-40

37. Haggerty JL, Pineault R, Beaulieu MD, et al. Practice features associated with patient-reported accessibility, continuity, and coordination of primary health care. *Annals of family medicine* 2008;6(2):116-23. doi: 10.1370/afm.802 [published Online First: 2008/03/12]

38. Adler R, Vasiliadis A, Bickell N. The relationship between continuity and patient satisfaction: a systematic review. *Family practice* 2010;27(2):171-8. doi: 10.1093/fampra/cmp099 [published Online First: 2010/01/08]

SUPPLEMENTARY MATERIAL

Figure 1. Flowchart of the sample included in the study.



HNS: Health National Survey

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5-6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5-7
Bias	9	Describe any efforts to address potential sources of bias	5-7
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	5-7
		(*c*) Explain how missing data were addressed	5-7. Supplementary material
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	n/a
		(*e*) Describe any sensitivity analyses	n/a

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7 Supplementary material
		(b) Give reasons for non-participation at each stage	5-7
		(c) Consider use of a flow diagram	Supplementary material
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1
		(b) Indicate number of participants with missing data for each variable of interest	Table 1
Outcome data	15*	Report numbers of outcome events or summary measures	7-10 and table 1
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 1 and 2
		(*b*) Report category boundaries when continuous variables were categorized	7-8
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	12-14
2Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	16

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.