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Revisión sistemática

# Prevalence of diabetes and hypertension in Colombia: A systematic review

Prevalencias de diabetes e hipertensión en Colombia: Una  
revisión sistemática

Prevalência da diabetes e hipertensão na Colômbia: uma  
revisão sistemática

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## Abstract

**Objective:** To conduct a systematic review determining the prevalence of diabetes and hypertension among the adult population in Colombia.

**Methodology:** A structured search was carried out in the electronic databases PubMed, SciELO and ProQuest, including studies published in Spanish and English from January 2000 to June 2016.

**Results:** Four studies in hypertension and 2 in diabetes were selected. The overall prevalence of hypertension in the 4 selected studies ranged from 13.4% (95% CI:11.5-15.2) to 70.4% (95% CI no reported). The overall prevalence of diabetes in the 2 selected studies were 8.1(95% CI:6.8-9.5) and 8.9% (95% CI no reported).

**Conclusion:** This review provides limited but useful evidence about the prevalence of two major noncommunicable diseases in Colombia. The results enhance the need of improving surveillance systems of risk factors of these diseases and standardizing methodological procedures for the estimation of prevalence studies.

**Key words:** diabetes mellitus++ hypertension++ noncommunicable diseases.

## Resumen

**Objetivo:** Llevar a cabo una revisión sistemática de las prevalencias de diabetes e hipertensión en la población adulta colombiana.

**Metodología:** Se llevó a cabo una búsqueda estructurada en las bases electrónicas PubMed, SciELO and ProQuest, la cual incluyó estudios publicados en español e inglés desde enero de 2000 a junio de 2016.

**Resultados:** Cuatro estudios en hipertensión y 2 en diabetes fueron seleccionados. Las prevalencias generales de hipertensión tuvieron un rango de valores de 13,4% (IC95%:11,5-15,2) a 70,4% (no reportó el IC95%). Las prevalencias generales de diabetes en los 2 estudios fueron 8,1% (IC95%:6,8-9,5) y 8,9% (no reportó el IC95%).

**Conclusión:** Esta revisión brinda evidencia limitada pero útil acerca de las prevalencias de dos enfermedades crónicas no-transmisibles en Colombia. Los resultados destacan la necesidad de mejorar los sistemas de vigilancia de factores de riesgo de estas enfermedades y estandarizar los procedimientos metodológicos para estimación de futuros estudios de prevalencia.

**Palabras claves:** diabetes mellitus, hipertensión, enfermedades no transmisibles.

## Resumo

**Objetivo:** Efetuar uma revisão sistemática que determine a prevalência da diabetes e hipertensão na faixa etária adulta da Colômbia.

**Metodologia:** se fez uma pesquisa estruturada nas bases de dados electrónicas PubMed, SciELO e ProQuest na qual se abrangeram os estudos publicados na língua espanhola e inglesa entre janeiro do 2000 e junho do 2016.

**Resultantes:** se escolheram quatro estudos atinentes com a hipertensão e dois concernentes com a diabetes. A prevalência total da hipertensão nos quatro estudos escolhidos oscilou entre 13,4% (95% IC: 11,5-15,2) e 70,4% (95%, IC não reportado). No alusivo com a prevalência total da diabetes nos dois estudos escolhidos, o seu valor esteve entre 8,1% (95% IC: 6,8-9,5) e 8,9% (95%, IC não reportado).

**Conclusão:** esta revisão fornece evidência limitada porem útil no tocante com a prevalência de dois doenças não contagiantes de grande saliência na Colômbia. As resultantes acrescentam a necessidade de melhorar os sistemas da vigilância para os fatores de risco destas doenças e de padronizar os procedimentos metodológicos para a estimação dos estudos de prevalência.

**Palavras chave:** diabetes mellitus, hipertensão, doenças não contagiantes.

## Introduction

According to the World Health Organization, non-communicable diseases (NCD) are the main cause of mortality and burden of disease worldwide [1]. Among them, diabetes and hypertension are of special concern because they are closely linked with cardiovascular diseases and other chronic conditions [2-5]. The mortality due to hypertension is estimated in 9.4 million persons annually worldwide and in the case of diabetes is around 1.6 million [6-7].

Over the last ten years, prevalence of diabetes and hypertension have had a more rapid increase in middle and low-income countries compared to affluent countries. In addition, the proportion of people with these two chronic conditions who are undiagnosed or untreated is also higher in middle and low-income countries, due in part to the weaknesses and unpreparedness of health care systems [8-9].

High systolic blood pressure and high plasma fasting glucose were the first and fifth risks linked with mortality in Colombia in 2016, and the third and sixth linked with burden of disease, respectively [10]. However, to date there has not been in Colombia a rigorous evaluation and documentation of the problem of hypertension and diabetes in the population, particularly considering regional variations, which is explained in part by the absence of a standardized surveillance system in noncommunicable diseases. Due to great differences in terms of dietary and physical activity patterns, as well as on alcohol consumption and quality of health care systems [11-15], vast differences in the prevalence hypertension and diabetes between regions are anticipated. Therefore, the aim of this study was to conduct a systematic review determining the prevalence of these two chronic conditions among the adult population in Colombia. The results of this study will provide information to decision makers, civil society and academics, regarding the extent of the problem of diabetes and hypertension in the Colombian population.

## Methodology

### Data sources and search strategy

This systematic review included original quantitative studies that establish the prevalence of diabetes mellitus and hypertension in adult populations in Colombia, either at the national or local level. Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines were followed.

A structured search was carried out in the electronic databases PubMed, SciELO and ProQuest and included studies published in Spanish and English from January 2000 to June 2016. In addition, we made a manual search of all health journal included in the Bibliographic Index of the Colombian Department of Science and Technology. This timeframe was selected in order to gather information of prevalence that could reflect the current epidemiological situation of these two chronic diseases in Colombia.

The search syntax used words in Spanish or English according to the database. Three blocks of terms and Boolean operators were used: the first with the terms “diabetes” OR “hypertension”, the second with the terms “Colombia” or the names of the ten most inhabited cities in this country. In addition, all the national health and nutrition surveys were reviewed in this period. Finally, two external researchers who had published on the topic were contacted, with the purpose of finding other studies not captured by the search. This search strategy was defined to reduce the probability of omitting studies. The search was completed in September 15 2016.

### *Study selection and inclusion criteria*

This review included original quantitative studies with cross-sectional designs and conducted in general adult populations in Colombia since 2000. Studies had to have probabilistic sampling designs. The operational definition of diabetes and hypertension had to consider both a quantitative measure (blood fasting glucose in plasma or blood pressure measures) and a self-report of having been diagnosed or receiving medicines for either of these two diseases. Moreover, prevalence studies which considered both measurements of fasting plasma glucose and plasma glucose, 2 hours after a load of 75 grams of glucose were included. We did not include studies exclusively conducted in institutionalized populations and patients. We also excluded studies conducted in pregnant women.

### *Data extraction and quality assessment*

The first and the third authors independently selected the potential studies to be included in the review, based on the content of titles and abstracts. Subsequently, these two reviewers extracted the basic

information from the manuscript texts and assessed the study validity. In case of disagreement, the second author reviewed the manuscript and a final agreement was reached through a deliberative process.

The following characteristics were obtained from each study: authors, date, city or region, study population, operational definition of diabetes or hypertension, sample size, quality of the study and total prevalence.

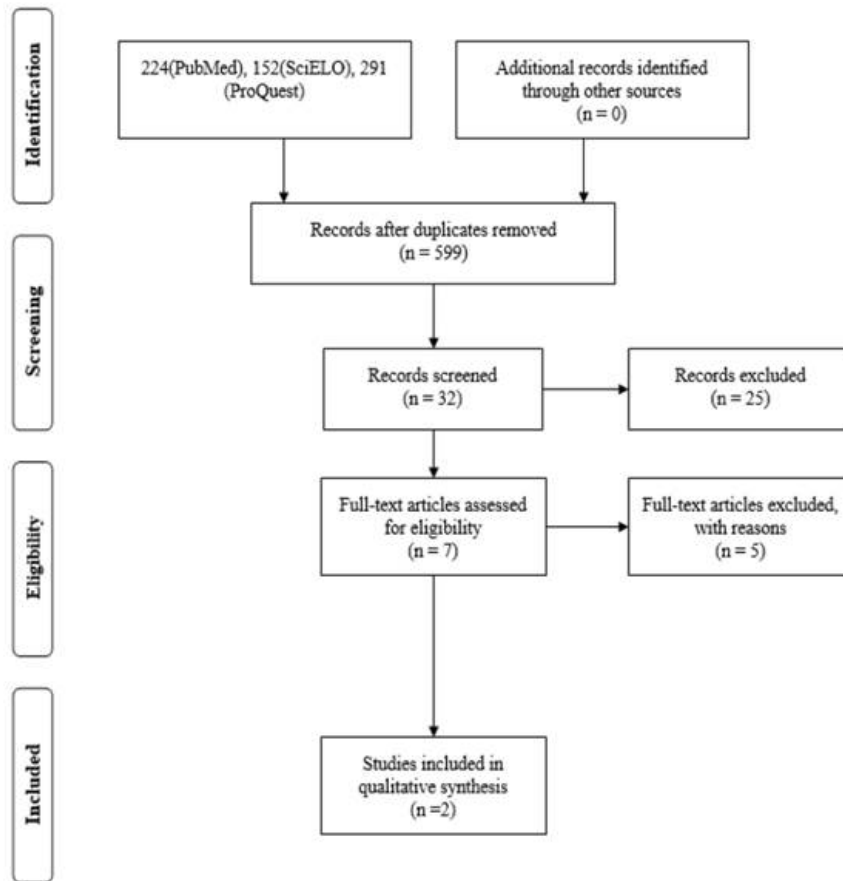
The quality assessment of each study was carried out using the following criteria: appropriateness of sample size, prevalence estimates by sex, report of confidence intervals and avoidance of selection bias. These criteria were adapted from the study conducted by Silva-Magliano et al. in Brazil [16]. Two review authors conducted this assessment. Where there was disagreement, this was resolved using a deliberative process.

Considering these criteria, three overall levels of quality were defined based on an adaptation of the Support Unit for Research Evidence (SURE) [17]: reliable, important limitations and fatal flaws. The reliable studies have only minor limitations and can be used as a trusted source of evidence. Those studies with important limitations should be interpreted cautiously. Those studies with fatal flaws were not included in the review. Due to the heterogeneity of the design studies and the different approaches to define diabetes and hypertension, it was not feasible to conduct a meta-analysis.

This study was approved by the Institutional Review Board from the School of Medicine of Pontificia Universidad Javeriana in Bogota (FM-CIE-0102-16).

## Results

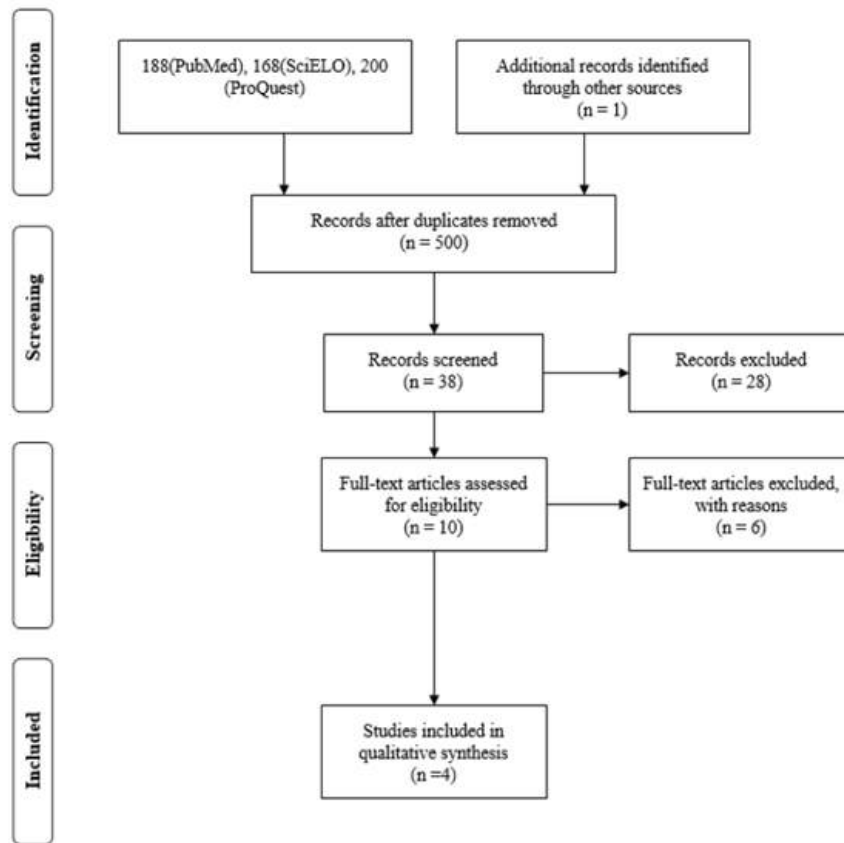
The initial search in diabetes identified 667 citations. After excluding papers based on titles and abstracts and removing duplicates, 32 articles were accepted to a complete review of the full text. Twenty five studies were excluded because they did not meet the inclusion criteria. Seven articles followed the inclusion criteria and 2 were finally included, after excluding redundant publications and studies with poor quality (See Figure 1) [11-18].



**Figure 1**  
prisma (Preferred reporting items for systematic reviews and meta-analyses) flow-chart of study selection in diabetes.

Fuente: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta- Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097. For more information, visit [www.prisma-statement.org](http://www.prisma-statement.org)

Regarding hypertension, the initial search identified 556 citations. Thirty-eight articles were reviewed. Ten articles followed the inclusion criteria, including a doctoral dissertation extracted from the repository of Michigan University. Twenty eight studies were excluded because they did not meet the inclusion criteria. Finally, 4 articles were included (See Figure 2). One of these studies examined both the prevalence of diabetes and hypertension [18].



**Figure 2**  
prisma (Preferred reporting items for systematic reviews and meta-analyses) flow-chart of study selection in hypertension

Fuente: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta- Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097. For more information, visit [www.prisma-statement.org](http://www.prisma-statement.org)

Table 1 shows the results of the quality assessment of the articles that finally followed the inclusion criteria. Four studies were judged as reliable [18:19:23:25], one had important limitations [20] and three had fatal flaws [21:22:24].



**Table 1**  
Results of the quality assessment of the articles that followed the inclusion criteria.

Study	Chronic conditions	Appropriateness of sample size %	Prevalence estimates by sex	Report of confidence intervals	Avoidance of selection bias	Overall quality of the study	Observations
Schargrotsky et al, 2006 [11]	Diabetes	++	+++	+++	+++	Reliable	
Alayón et al, 2006 [12]	Diabetes	-	+++	---	++	Reliable	
Navarro-Lechuga et al, 2009 [13]	Hypertension	++	++	---	+	Important limitations	The study reported the prevalence in absolute frequency.
Patrio-Villada et al, 2011 [14]	Diabetes and hypertension	--	++	---	---	Fatal flaws	The study has a high risk of selection bias.
Gakidou et al, 2011 [15]	Diabetes	+++	---	---	+++	Fatal flaws	The study only reported the prevalence in a graphic and did not include any value.
Lucumí-Cuesta, 2014 [16]	Hypertension	+++	+++	+++	+++	Reliable	
Cataño-Bedoya et al, 2015 [17]	Diabetes and hypertension	-	+++	---	+++	Fatal flaws	The small sample size did not allow to have acceptable estimations of prevalence
Cano-Gutiérrez et al, 2015 [18]	Hypertension	++	+++	---	+++	Reliable	

### Hypertension

Table 2 shows the characteristics of the included studies on prevalence of hypertension in Colombia with data collected since 2000. The CARMELA study was conducted by Schargrotsky et al., in 7 Latin American cities, including Bogotá. In this city the global prevalence of hypertension was 13.4% among adults aged 25 to 64 years, which was higher in men (14.6%) than in women (12.4%). Compared with other cities of the region, the prevalence was lower in Barquisimeto (24.7%), Buenos Aires (29.0%) and Santiago (23.8%), but higher than Quito (8.6%), Lima and Mexico (11.7%) [18].

**Table 2**  
Characteristics of the included studies on prevalence of hypertension in Colombia published since 2000. (All studies were cross-sectional and had probabilistic sampling designs).

Study	Municipality (department)	Study population	Definition of hypertension	Sample size	Overall prevalence and by sex (CI 95%)
Schargrotsky et al, 2006 [18]	Bogotá (Capital District – urban area)	Adults (25-64 years)	Blood pressure $\geq 140/90$ mm Hg, or use of antihypertensive drugs	1553	13.4% (11.5-15.2) Females: 12.4% (10.2-14.7) Males: 14.6% (11.9-17.2)
Navarro-Lechuga et al, 2009 [20]	Afro-Colombian communities. Barranquilla (Atlántica – urban area)	Adults (18 years and over)	Blood pressure $\geq 140/90$ mm Hg, or use of antihypertensive drugs	1017	21.3% (CI no reported) Prevalence were not reported by sex
Lucumí-Cuesta, 2014 [23]	National level (urban and rural areas)	Adults (18-69 years)	Blood pressure $\geq 140/90$ mm Hg, or use of antihypertensive drugs	12878	25.1% (24.0-26.2) Females: 21.8% (20.5-23.2) Males: 29.0% (27.2-30.9)
Cano-Gutiérrez et al, 2015 [25]	Bogotá (Capital District – urban area)	Adults (60 years and over)	Blood pressure $\geq 150/90$ mm Hg or diagnosed by physician or nurse	1793	70.4% (CI no reported) Females: 69.9% Males: 71.2%



Navarro-Lechuga et al, conducted a study in adults ages 18 years and older from four districts of Barranquilla where the majority of inhabitants were afro-descendants. They found 217 subjects with hypertension among 1017 people evaluated. The prevalence for this study was higher in women (11.8%) than in men (9.5%) calculating a total prevalence of 21.3% [20].

The doctoral dissertation of Lucumi was based on data from the 2007 Colombian National Survey of Health (CNSH) and considered a subsample of 12,878 Colombian people aged 18-69 years. This study reported a global prevalence of hypertension of 25.0%, being 30.2% in men and 21.8% in women [23].

Cano et al, conducted a study on prevalence of factors associated with hypertension among older adults ages 60 years and older living in Bogotá, using data of the cross sectional study “Salud, bienestar y envejecimiento (SABE), 2012” (In English: Health, well-being and Aging study). They found a prevalence of hypertension of 56.9% according to self-report (Men 55.4%, Women 57.8%) and a prevalence of undiagnosed hypertension of 13.5% (Men 15.8%, Women 12.1%), calculating a global prevalence of 70,4% [25].

### Diabetes

Two studies that established the prevalence of diabetes were finally included in the review (see Table 3). Schargrotsky et al., reported in the CARMELA study, a global prevalence of diabetes of 8.1% (8.7 women % vs 7.4% men) among adults ages 25 to 64 years, with the second highest prevalence in some Latin-American cities, exceeded by Mexico City (8.9%) [18]. Alayon et al. conducted a study in Cartagena during 2004-2005 in adult population ages 30 years and older. The global overall prevalence found in this study was 8.9% [19].

**Table 3**

Characteristics of the included studies on prevalence of diabetes mellitus in Colombia published since 2000. (All studies were cross-sectional and had probabilistic sampling designs).

Study	Municipality (department)	Study population	Definition of diabetes	Sample size	Overall prevalence and by sex (CI 95%)
Schargrotsky et al, 2006 [18]	Bogotá (Capital District – urban area)	Adults (25-64 years)	Fasting plasma glucose $\geq$ 126 mg/dl or self-reported diabetes	1553	8.1% (6.8-9.5) Females: 8.7% (6.8-10.6) Males: 7.4% (5.7-9.2)
Alayón et al, 2006 [19]	Cartagena (Bolívar – urban area)	Adults (30 years and over)	Fasting plasma glucose $\geq$ 126 mg/dl OR 2-h plasma glucose $\geq$ 200 mg/dl	749	8.9% (CI no reported) Prevalence were not reported by sex

## Discussion

This systematic review provides limited but useful evidence about the prevalence of two major NCDs in Colombia from studies conducted since 2000. Despite the few studies finally included in this review, the

results shows that diabetes and hypertension are important public health problems in Colombia. The results enhance the need of improving surveillance systems of risk factors of NCD and standardizing several methodological procedures for the estimation of future prevalence studies.

Some of the studies reviewed showed that the prevalence of hypertension by sex was higher in men than in women [18:23:25] but only in the secondary analysis conducted by Lucumi-Cuesta the confidence intervals were not overlapped [23]. For diabetes, out of the two studies selected, only one explored differences by sex being slightly higher in women [18]. These results are contrary to those found in several prevalence studies of hypertension conducted in Brazil and Chile, which found higher prevalence in women [26-28]. Further studies should be conducted, in order to better understand these differences.

Several limitations can be identified in this systematic review. First, the reduced number of studies included in the review does not allow to make regional comparisons or to assess time trends. Second, two studies did not disaggregate the prevalence by sex [19:20]. Third, three studies did not calculate the confidence intervals which hinders assessing the precision of the estimates [19:20:25]. Fourth, the prevalence studies of hypertension included in this review were conducted, before the changes of cutoff values recently recommended by the American College of Cardiology [29]. Fifth, we did not include in our search the databases Web of Science and Scopus. Sixth, the scope of this study is restricted to studies published since 2000. Finally, most of the studies included were carried out among urban population, which limits the implication of the results in rural regions, where the prevalence of these two conditions are mostly unknown.

Despite these limitations, this systematic review provides insights that can guide policy actions and improvements in surveillance systems in the area of NCDs. First, the results enhance the need of standardizing the operational definitions of diabetes and hypertension in population surveys. This requires the appropriate use of indicators that combines self-report and objective measures, that allow to consider both undiagnosed and diagnosed diabetes and hypertension. This approach is in accordance with the recommended operational definitions of the National Health and Nutrition Examination Survey [30:31]. Second, the sample sizes and sampling designs of future prevalence studies in the area of NCDs should guarantee the estimation of prevalence of diabetes and hypertension, not only by sex and basic age groups, but also by socioeconomic position, region and ethnic groups.

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## Conflict of interest declaration

**Conflict of interest** The authors declare no conflict of interest.