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Contraceptives, chronic illness, pregnancy, and health care costs in one health insurance in Colombia

Anticonceptivos, enfermedad crónica, embarazo y costos de salud en un seguro de salud en Colombia

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ABSTRACT

Objetive Evaluate the impact of pregnancy on women with a high disease burden, especially with Chronic Non-Communicable Diseases (CNCD) in the costs of a health insurer.
Materials and Methods Retrospective costing study conducted at Famisanar EPS between 2016 and 2018. We used multiple linear regression models to evaluate; the overall costs were calculated for each patient. The insurer's perspective was taken into account for the analysis.
Results The study universe was made up of 458 249 women of childbearing age affiliated to Famisanar EPS between 15 and 49 years, of which 24 030 (5.2%) women have some relationship with the CNCD, of these, 2 454 (10.2%) went to childbirth and caesarean section. We had determined the costs of pregnancy healthy´s women in USD 200.41 and pregnancy CNCD´s women USD 519.95 (97.5%) in terms of the costs for the complication's gestation care. Using multinomial regression, we compared the pregnancy with CNCD with the other groups of women. We did not observe any significant differences in ingress and zone. However, we observe signicant differences in the age.
Conclusion Pre-existing CNCD in pregnant women can lead to the use of additional resources in the health system. CNCD in society represent a severe burden for a health system due to high costs and especially when talking about women who have an CNCD and are in pregnant. The study also indicates that female infertility treatments are important for cost containment in health systems.

Key Words: Costs and cost analysis; health economics; epidemiology; chronic disease; pregnancy (*source: MeSH, NLM*).

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RESUMEN

Objetivo Evaluar el impacto del embarazo en mujeres con una alta carga de enfermedad, especialmente con enfermedades crónicas no transmisibles (ECNT) en los costos de una aseguradora de salud.
Materiales y Métodos Estudio de costos retrospectivos realizado en Famisanar EPS entre 2016 y 2018. Utilizamos múltiples modelos de regresión lineal para evaluar; los costos generales se calcularon para cada paciente. La perspectiva de la aseguradora fue considerada para el análisis.
Resultados El universo de estudio estuvo conformado por 458 249 mujeres en edad fértil afiliadas a Famisanar EPS entre los 15 y 49 años, de las cuales 24 030 (5,2%) mujeres tienen alguna relación con el ECNT. De ellas, 2454 (10,2%) fueron al parto y cesárea. Habíamos determinado los costos del embarazo en mujeres sanas en USD 200,41 y el embarazo en mujeres con ECNT USD 519,95 (97,5%) en términos de los costos de las complicaciones en la atención de gestación. Mediante la regresión multinomial, comparamos los embarazos de ECNT con los otros grupos de mujeres. No observamos diferencias significativas en zona e ingresos, observamos diferencias significativas en la edad.

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Conclusión El ECNT preexistente en mujeres embarazadas puede conducir al uso de recursos adicionales en el sistema de salud. El ECNT en la sociedad representa una carga severa para un sistema de salud debido a los altos costos, especialmente cuando se habla de mujeres que tienen un ECNT y están embarazadas.

Palabras Clave: Costos y análisis de costos; economía de la salud; epidemiología; enfermedad crónica; embarazo (*fuente: DeCS, BIREME*).

The reproductive process of living beings involves a series of physiological changes that occur within the specific patterns known, which is mediated by the particularities of each individual, sometimes the reproductive moment and pregnancy pass in coincidence with disease states of the mother that depends on the reproductive process itself, or that exist and known before or during the course of pregnancy (1).

The above, this leads to the magnitude of the negative impact of Chronic Non-Communicable Diseases (CNCD) in the process of pregnancy, which when pre-existing to pregnancy, exacerbate or complicate the mother and the newborn child's, which represent health and reproductive problems and cost for a health system.

Little is known, however, about the prevalence of CNCD in pregnant women or how many women with chronic illness have Access to care after delivery-either through a continuous source of insurance or a regular provider of health care. It is also not known how much CNCD adds to the health care costs in age pregnant women (2).

In studies carried out on pregnancy and the most prevalent CNCD, it has been found, in the case of Diabetes Mellitus (DM), pregnancy causes a deterioration of the metabolic control of DM1 and DM2 (3,4). There were exposed the effects of this pathology on pregnancy, finding such serious effects as: embryopathy (anencephaly, microcephaly, congenital heart disease), preeclampsia (5), polyhydramnios, macrosomia (6), abortions, fetal losses, preterm birth, dystrophic births, higher caesarean section rate, perinatal mortality, neonatal hypoglycemia, neonatal hyperbilirubinemia, and increased risk of obesity and DM2 in the child.

The obesity is a precursor to CNCD (7), increased risk of maternal complications such as gestational diabetes, hypertension, preeclampsia, HELLP syndrome (hemolysis, increased liver enzymes and thrombocytopenia), obstructive sleep apnea, thromboembolism, increased fetal malformations (neural tube defects, heart disease, hydrocephalus, cleft lip, ano-rectal atresia) (8). And with regard to childbirth, the higher rate of caesarean sections, surgical complications, macrosomia, greater risk of maternal and fetal obstetric trauma, plus prematurity iatrogenesis derived from maternal medical causes (3).

As for Arterial Hypertension (HT), which is defined as chronic HT in pregnancy known before pregnancy, or detected before week 20, its effects on pregnancy could be condensed into: abruptio placentae, preterm birth, cesarean section, low weight, admission to neonatal unit and perinatal death. The preeclampsia appears in 17.0-25.0% of cases (9).

Taking into account the above, it can be stated that this situation is of such importance that it results in the generation of a high economic (health system) and social (family, community) cost, by a party directly associated with the cost of care derived from complications from pregnancy, childbirth and/or the puerperium that are contemplated from a longer than expected hospital stay, increased demand for high complexity services, prolonged treatments, and even permanent disability care that can occur in relation to the effects of pregnancy in women suffering from CNCD (10).

As a mechanism to aid in the economic control of health systems, contraceptive mechanisms have been implemented in women with high-risk pregnancy, for example, in Mexico the High Reproductive Risk Modules (MARR) project has been incorporated, the intervention consists of in implementing, in the hospital units where this type of women is attended, medical care centers, which have the function of providing vulnerable patients access to a set of contraception interventions, trying to prevent pregnancy from becoming a additional morbidity factor for the patient, and that could contribute to a fatal outcome (11).

The purpose of our study was carried out an analysis on the cost of pregnancy of women with high obstetric risk where there is a directly proportional relationship between high-cost disease burden and pregnancy complications. The research question is: What is the impact of pregnant women with a high disease burden, especially with CNCD in the costs of a health insurer?

MATERIALS AND METHODS

Study type

Retrospective costing study conducted at Famisanar EPS between 2016 and 2018. The insurer's perspective was taken into account for the analysis.

Data source

In Colombia, universal healthcare services are provided by health insurance (EPS) that is obligated to insurance every citizen who wishes to join them (obligatory public health system). This study was conducted in Famisanar EPS. It has one central data base are automatically updated with differents services f.e. hospitalization, laboratory test, medical treatment and others, who is issued a unique identification number (in this study the identification number was anonymized). Famisanar EPS delivers its service via third-party providers. All medical services have a rate that can be used for billing purposes. It used differents forms payment (fee for service, per period, episode, bundled payment and others). Famisanar EPS´s databases allow for all costs to be calculated according to the medical service given for each identification number.

We calculated the pregnancy total costs for each patient for the years 2016, 2017 and 2018. Pregnancy total costs per patients was routinely calculated by the Famisanar EPS information department that included indirect and direct medical costs components without the administrative costs. We converted at a representative rate of the dollar price to the market of December 2018 (USD 1.00 = COP 3,250.00).

Famisanar EPS has several computerized patient registries. These registries were validated for physicians that use the registries to assess treatment and outcomes. Using advanced networking information technology theses registries currently make use inclusion criteria and marcation in the sistem for identification the differents diseases how hypertension, diabetes *mellitus*, diabetes *mellitus*/hypertension, oncology, rheumatology and collagen diseases and others (bariatric surgery, dyalisis, chronic obstructive pulmonary disease, multiple sclerosis, cystic fibrosis, hemophilia, pulmonary hypertension and transplant). We used International Codification Diseases version 10 (ICD-10) for diagnosis primary and secundarys and Unique Codes for the Provision of Colombian Health Services (CUPS) por the medical services (12).

Stastistical methods

The analysis had two components: descriptive and comparative. To examine the bivariate group differences in the presence of CNCD among pregnant women and among all 4 study groups, chi square test was used (P<0.05). Additionaly, logistic regression on the odds of belonging to 1 of 3 groups compared with the reference group (pregnant healthy´s women) was performed to examine group differences for age. Parameter estimates from logistic regressions were converted to Adjusted Odds Ratio (AOR) were presented for ease interpretation. All analyses were condubted using standard statistical software en this case SPSS® version 25.0 (2,13).

Ethical aspects

The research protocol was evaluated and approved for execution by the Research and Ethics Committee of the Famisanar EPS and School of Economics and Bussines of Pontificia Universidad Javeriana. It did not require informed consent.

RESULTS

Prevalence use of contraceptives and chonic conditions

The study universe was made up of 458 249 women of childbearing age affiliated to Famisanar EPS between 15 and 49 years, of which 24 030 (5.2%) women have some relationship with the CNCD, of these, 2 454 (10.2%) went to childbirth and caesarean section. The average age for CNCD´s were 40.0 (S.E.±7.7) and for healthy´s women 27.4 (S.E.±6.4). The average pregnancy age for CNCD´s were 32.6 (S.E.±6.4) and for pregnancy healthy´s women 36.1 (S.E.±3.2). The annual pregnancy rate was 19.5 in healthy´s women and 102.1 in CNCD´s women.

We had determined that the use of contraceptives in healthy´s women were 31.0% (18 069) and were distributed as follows: sterilization 11.4% (5 363), barrier 4.9% (2 307), injectable month 6.4% (3 030), oral 4.3% (2 027), intrauterine device (IUD) (1 947) 4.1%, injectable quarterly 2.9% (1 361) and others 11.3% (2 034). Therefore, the contraceptive methods´s failure to healthy´s women were 11.0% (1 988).

As well, we had determined that use of contraceptives in CNCD´s women were 51.2% (12 311) and were distributed as follows: sterilization 25.1% (3 091), barrier 18.6% (2 290), injectable month 10.9% (1 341), oral 10.5% (1 293), intrauterine device (IUD) (1 194) 9.7%, injectable quarterly 8.2% (1 009) and others 4.5% (2 093). Therefore, contraceptive methods´s failure in CNCD´s women were 15.4% (1 897).

The CNCD´s women were distributed as follows: hypertension 56.2% (P<0.05), diabetes *mellitus* 10.6% (P<0.05), rheumatology 8.9% (P<0.05), oncology 8.8% (P<0.05), diabetes *mellitus*/hypertension 6.6% (P<0.05) and others 8.9% (P<0.05). The pregnant CNCD´s women was made up of: hypertension 52.2% (P<0.05), diabetes *mellitus* 21.5% (P<0.05), oncology 7.2% (P<0.05), rheumatology 7.0% (P<0.05) and others 12.1% (P<0.05).

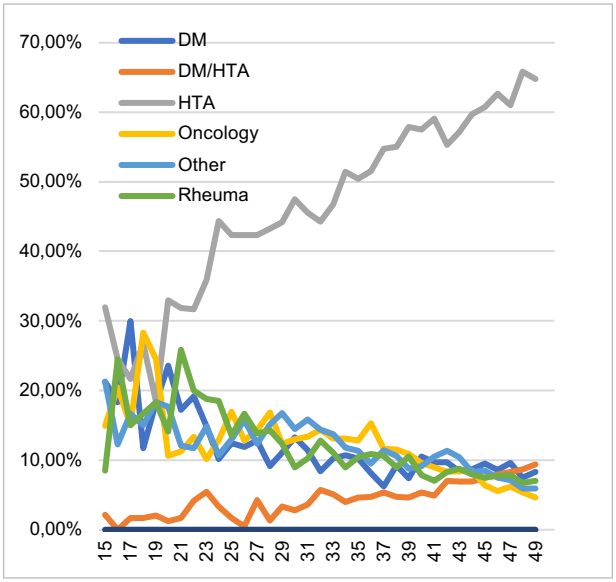
Health care expenditures

It shows that the highest costs of care in pregnancy CNCD´s women are hypertension (USD 1,477.61) and rheumatology (USD 1,316.94). The Table 1 and Figure 2 shows the distribution result by diseases and costs.

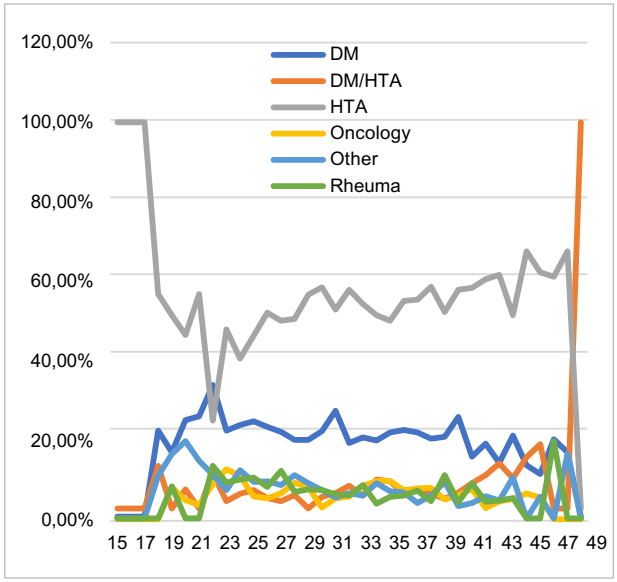
Table 1. Pregnancy CNCD´s women for diseases

Disease	Age	COP	USD
DM	31.6 (S.E. +-6.3)	1,635,216.32	503.14
DM/HT	33.4 (S.E. +-6.3)	2,682,849.16	825.50
HT	33.0 (S.E. +-6.4)	4,802,240.67	1,477.61
Oncology	32.1 (S.E. +-6.5)	2.994.603,12	921.42
Rheumatology	31.8 (S.E. +-6.2)	4.280.056,44	1,316.94
Others	31.3 (S.E. +-6.8)	2,267,092.10	697.57

Figure 2. Age and pregnancy CNCD´s women – not pregnancy CNCD´s women specific prevalence of selected. Famisanar EPS 2016 – 2018



Not pregnancy CNCD´s women



Pregnancy CNCD´s women

Similarly, it determined the costs of pregnancy healthy´s women and pregnancy CNCD´s women in terms of the costs for the gestation care (included complications) and of newborn child's complications at birth. The costs of care for newborn child's and pregnant women are higher in CNCD´s women vs. healthy´s women. The Table 3 and Figure 4 shows the results.

In the same way, it made the calculation of the costs in pregnancy CNCD´s women for diseases in childbirth and caesarean care finding that critical care represents 47.8% of costs, hospitalization 26.1%, event obstetric 15.2% and others 10.9%. In the event of the newborn child's complications the distribution is the critical care represents 51.5% of the costs, the medications 32.4% and others 16.1%.

Table 3. Costs in pregnancy care complications and newborn child's complications for CNCD´s women and healthy´s women

	CNCD´s women		Healthy´s women		Percentage
	COP	USD	COP	USD	(%)
Pregnancy care (included complications)	1,689,823.17	519.95	651,321.69	200.41	97.5
Newborn child´s complications	7,130,101.96	2,193.88	4,368,242.62	1,344.07	63,2

Differences in demographics and access to care

Similarly, the Table 5 describes the characteristics of the study sample of 4 groups of women with and without pregnant and with and without CNCD. All variables were significant in the chi-square analysis, at the 5.0% level for age, zone and ingress.

Using multinomial regression, we compared the pregnancy with CNCD with the other groups of women. We did not observe any significant differences in ingress and zone. However, we observe signicant differences in the age, (Table 6).

Figure 4. Cost per capita for pregnancy care for CNDC´s by age. Famisanar EPS 2016 – 2018

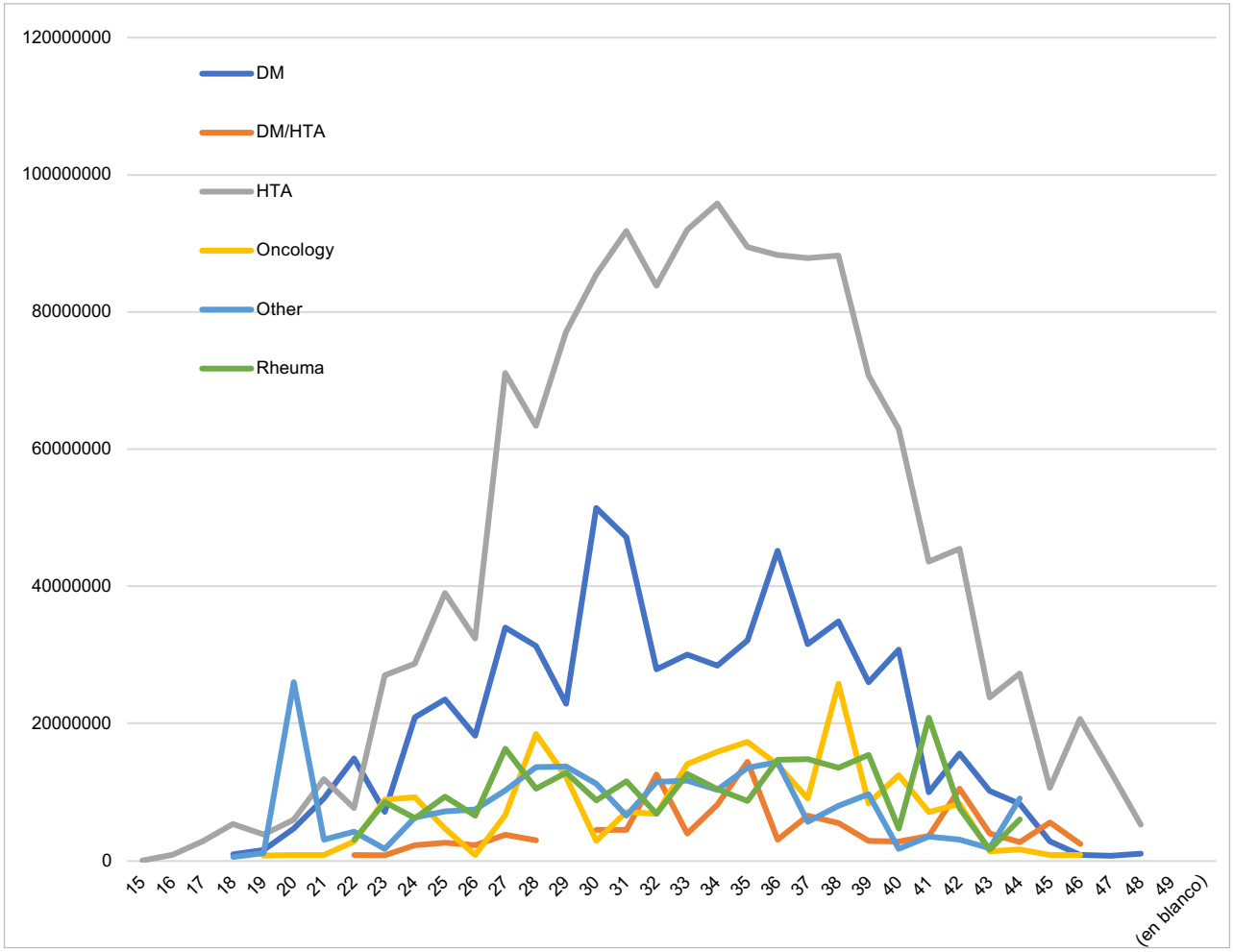


Table 5. Profile of women in the age group 19 – 49 years by pregnancy and CNCD. Famisanar EPS 2016 – 2018

	Not pregnant healthy´s women		Not pregnant CNCD´s women		Pregnant healthy´s women		Pregnant CNCD´s women	
	N	wt%	N	wt%	n	wt%	N	wt%
All	63,895	71,6	21,575	24,2	1,269	1,4	2,454	2,8
Age								
15-29	3,189	53,5	2,019	33,9	1	0,0	752	12,6
30-34	4,836	60,8	1,974	24,8	459	5,8	683	8,6
35-39	18,535	79,6	3,507	15,1	585	2,5	650	2,8
40-49	37,335	71,8	14,075	27,1	224	0,4	369	0,7
Zone								
Atlantic Sea	1,493	74,3	436	21,7	43	2,1	37	1,8
Center Country	5,161	39,1	6,593	50,0	720	5,5	720	5,5
Bogotá D.C.	55,663	77,2	14,307	19,8	452	0,6	1,677	2,3
Eastern plains	1,578	85,1	239	12,9	18	1,0	20	1,1
Ingress								
< USD 250	9,896	84,3	1,458	12,4	124	1,1	267	2,3
USD 251 – USD 500	41,075	88,1	4,446	9,5	434	0,9	664	1,4
USD 501 – USD 750	6,099	76,9	1,479	18,6	133	1,7	223	2,8
USD 751 <	6,825	78,8	1,551	17,9	112	1,3	176	2,0

Table 6. Adjusted Odds Ratio (AOR) and 95% confidence interval from multinomial on pregnancy and CNDC categories. Famisanar EPS 2016 – 2018

	Not pregnancy healthy´s women			Not pregnancy CNCD´s women			Pregnancy CNCD´s women		
	AOR	95% CI	P	AOR	95% CI	P	AOR	95% CI	P
Age									
15-29	0.32	0.32-0.2		31.2	4.3-222.7	*	440.9	61.6-3,156.8	*
30-34	0.09	0.07-0.12		0.07	0.06-0.08	*	0.91	0.74-1.11	
35-40	0.37	0.3-0.45		0.1	0.08-1.15	*	0.69	0.57-0.85	
40-49									
Zone									*
Atlantic Sea	0.38	0.18-0.8		0.73	0.4-1.32		0.86	0.39-1.91	
Center Country	0.58	0.32-1.03	*	0.66	0.4-1.07		0.88	0.46-1.68	
Bogotá D.C.	0.56	0.31-1.0	*	2.46	1.5-4.0		3.38	1.77-6.47	
Eastern plains									
Ingress						*			*
< USD 250	0.92	0.67-1.24		1.44	1.13-1.83		1.77	1.33-2.37	
USD 251 – USD 500	0.87	0.67-1.12		1.17	0.95-1.43		1.22	0.95-1.57	
USD 501 – USD 750	0.74	0.53-1.04		0.97	0.75-1.26	*	1.15	0.84-1.57	*
USD 751 <									

Note: Based on 63,895 women aged between 15 and 49 years. Asterisks denote significant (P<0.05) group differences compared to the reference group based on multinomial logistic regression on the precence of CDCD and pregnancy. The regression also includes an intercept term. The reference group for the depend variable is a pregnancy healthy´s women.

DISCUSION

This is one study using a Colombia insurance database to describe the prevalence use of contraceptives, CNCD in pregnancy women and health care expenditures. We found that the prevalence of CNCD overall was lower in non pregnant women (25.2) than pregnant women (65.9) age 15-49 years.

Our study is very close to the results found in the Women's Health Study of the Center of Pennsylvania, Weisman et al. (2006) regarding arterial hypertension, however, we did not take into account mental illnesses (14).

According to our study results, despite the implementation of contraceptive mechanisms, these have failed between 11.0% and 15.4% of pregnancies in CNCD´s women; the results prove what Holton et al. (2018) on the consequences for health care providers and CNCD´s women and the importance of addressing possible assumptions about the inability of CNCD´s women to get pregnant. It is very important that women receive information on affected contraceptive methods and pre-pregnancy care (15).

Additionaly, the objetive of this study was to examine indirectal and indirectal costs of CNCD in pregnancy. Our results indicate that treatment of CNCD in pregnancy imposes a substancial economic borden on Famisanar EPS in Colombia, checking what was mentioned by Chodick et al. (2010) (13). Common pre-existing conditions in pregnant women may result in the use of additional resources and cost for mothers and newborn child's (16). Pregnancy in CNCD women costs 97.5% more in pregnancy and 63.2% again in the CNCD mother's newborn children. This is a new contribution from our study.

We check what is mentioned by Chodick et al. (2010) and Jovanovic et al. (2015) on the complications and costs of medical care were higher with diabetes *mellitus*, which highlights the need to optimize the treatment of diabetes *mellitus* during pregnancy (13,17). The results indicate that hypertension and diabetes *mellitus* impose a considerable economic burden (18). We agree with the statement of Barton et al. The use of outpatient treatment services for women with pregnancy-related hypertension reduces the need for hospital care and is cost effective (19). Likewise, the increase in the use of health services and health costs during pregnancy are associated with the increase of obesity (20).

We found that CNCD was relatively common in pregnancy and childbearing women and found few significant cost differences between pregnant healthy´s women and pregnant CNCD´s women. This is very interesting for insurances.

There are limitations to our study. First, we did not include all CNCD in our analysis, we excluded chronic neurologics and mental diseases. Second, we use ICD-10 in Colombia for primary and secondary diagnosis, but the number of secondary diagnoses in information systems is very poor (21). Third, the study did not include the out of pocket of families. Finally, by limitations in the database we were not able to access the data model as important as marital status, education and employment.

In conclusion, our study presents the use of a population-based computerized database to comprehensively assess the cost CNCD diseases (hypertension, diabetes *mellitus*, rheumatology, oncology, diabetes *mellitus*/hypertension and others). Pre-existing CNCD in pregnant women can lead to the use of additional resources in the health system. CNCD in society represent a severe burden for a health system due to high costs and especially when talking about women who have an CNCD and are pregnant. The study also indicates that female infertility treatments are important for cost containment in health systems ♣

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Conflicts of interest: None.

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