ORIGINALES

Trends in maternal mortality in the department of Córdoba – Colombia, 2008 - 2020

Tendencias en la mortalidad materna en el departamento de Córdoba – Colombia, 2008 – 2020

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ABSTRACT:
Introduction: Maternal mortality is recognized worldwide as a public health issue, a situation that has been addressed by the United Nations (UN) including its reduction within the third objective of sustainable development. Likewise, the World Health Organization (WHO) and the Pan American Health Organization (PAHO) have been in charge of establishing programs focusing on promoting and improving maternal health.
Objective: Analyze the evolution of maternal mortality in the department of Córdoba - Colombia in the period 2008 to 2020 and identify changes in the trend.
Method: Ecological with retrospective information. The maternal mortality ratio was calculated for the department of Córdoba and for Colombia for the period 2008 - 2020. Using joinpoint regression, the Annual Percentage Change (APC) of the ratio was estimated and inflection points were identified.
Results: The results of the study show two periods with an increasing trend for the department of Córdoba: the first between 2008 and 2010 with a PCA of 8.3 (95% CI: -71.3 – 462.6) and the second between 2018 and 2020 with a APC of 20.8 (CI95% -63.3 – 297.3). However, the p value in both time periods is not statistically significant.
Conclusions: The MMR in the department of Córdoba presents a fluctuating behavior with large increases and sudden decreases that suggest deficiencies in the recording of information and in the notification of the event.

Keywords: Pregnancy; Maternal Death; Maternal Health; Regression Analysis.

RESUMEN:
Introducción: La mortalidad materna es reconocida globalmente como un problema de salud pública, situación que ha sido abordada por la Organización de Naciones Unidas (ONU) incluyendo su reducción dentro del tercer Objetivo de Desarrollo Sostenible. Así mismo, la Organización Mundial de la Salud (OMS) y la Organización Panamericana de la Salud (OPS) se han ocupado de instaurar programas encaminados a promover y mejorar la salud materna.
Objetivo: Analizar la evolución de la mortalidad materna en el departamento de Córdoba – Colombia en el periodo 2008 a 2020 e identificar los cambios en la tendencia.

Método: Ecológico con información retrospectiva. Se calculó la razón de mortalidad materna para el departamento de Córdoba y para Colombia para el periodo 2008 - 2020. Mediante la regresión *joinpoint* se estimó el Porcentaje de Cambio Anual (PCA) de la razón y se identificaron puntos de inflexión.
Resultados: Los resultados del estudio evidencian para el departamento de Córdoba dos periodos con tendencia creciente: el primero entre el 2008 y 2010 con un PCA de 8,3 (IC95%: -71,3 – 462,6) y el segundo 2018 y 2020 con un PCA de 20,8 (IC95% -63,3 – 297,3). Sin embargo, el valor de *p* en ambos periodos de tiempo no resulta estadísticamente significativo.
Conclusiones: La RMM en el departamento de Córdoba presenta un comportamiento fluctuante con grandes aumentos y repentinos descensos que sugieren deficiencias en el registro de la información y en la notificación del evento.

Palabras clave: Embarazo; Muerte Materna; Salud Materna; Análisis de Regresión

INTRODUCTION

Health of pregnant women which includes the prevention of maternal mortality (MM), is a priority for the international community, being this one – MM- of the goals of the third Sustainable Development Goal (SDG) (1). Colombia, like other 189 countries, pledged to reduce the maternal mortality ratio (MMR) to less than 70 deaths per 100,000 live births by the year 2030. To accomplish this goal, the country raised in the Conpes 3918 of the 2018 reduce maternal mortality to 51.0 cases by 2018 and by 2030 reduce to 32.0 maternal deaths per 100,000 live births (2). However, between 2000 and 2017, this rate could only be reduced at a rate of 0.8% per year, a percentage that is still far from the annual reduction required to achieve this goal [1].

The WHO (World Health Organization) defines maternal mortality as "the death of a woman while pregnant or within 42 days after pregnancy, regardless of the duration and location of the pregnancy, from any related or aggravated cause by the pregnancy or its management, but not by accidental or incidental causes" [3, 4]. When death takes place during the postpartum or postpartum period, it is called early or direct, if this phenomenon is a consequence of complications related to pregnancy, childbirth, or the postpartum period [5, 6].

Scientific literature has identified different causes related to maternal death. Most authors classify them as direct and indirect. The first one concerns the difficulties and complications presented during pregnancy, childbirth, and the puerperium, as well as failures or omissions in the care of the pregnant woman and/or incorrect treatment of the same. Indirect causes are related to diseases suffered by the woman since before pregnancy or that are diagnosed during it and are not direct obstetric causes, but their signs and symptoms worsen during pregnancy [7, 8].

According to the figures of the Pan American Health Organization (PAHO) in Latin American countries in 2017, maternal mortality expressed as an indicator in terms of maternal mortality ratio (MMR) was 58.2 maternal deaths per 100,000 births. alive. Venezuela, Peru, and Paraguay presented maternal mortality figures in this same year above the regional average, while Chile, Argentina, Ecuador, and Colombia were below it [9, 10].

In Colombia, the behavior of maternal mortality expressed with the maternal mortality ratio (MMR) indicator has had a downward trend since the year 2000, going from an MMR of 104.9 to 60.7 deaths per 100,000 live births between the 2000 and 2008. Between 2008 and 2011 the indicator increased and fluctuated between 60.7 and

71.6. For the period between 2011 and 2018, the indicator again maintained the downward trend, positioning itself at 45.29 in 2018 [9, 11].

The department of Córdoba - Colombia, has been presenting an even more difficult situation regarding the reduction of maternal mortality, presenting an MMR that is above the national ones. Thus, the state government- Córdoba- in its 2020-2023 development plan set the goal of reducing the MMR to 65 maternal deaths per 100,000 live births [12]. Consequently, determining the behavior of MM in the department of Córdoba - Colombia is a fundamental instrument for decision-making in public health actions [13].

Therefore, maternal mortality is a relevant indicator for evaluating the quality of health and the degree of development of a society since this reflects equity and access to health services for its inhabitants [5]. Maternal deaths show the socioeconomic and educational level of a population [12 - 14]. The purpose of the study was to analyze the evolution of maternal mortality in the department of Córdoba - Colombia in the period 2008 to 2020 and identify changes in behavior.

MATERIALS AND METHODS

A time series analysis was conducted for the period 2008 – 2020. Maternal deaths that took place each year in Colombia and the department of Córdoba were obtained from the vital statistics module of the National Administrative Department of Statistics (NADS) of Colombia.

The records of maternal deaths reported in the Public Health Surveillance System (SIVIGILA) and the National Department of Statistics (NADS) were available. These figures represented all maternal deaths in the Department during the period examined, using the definition of maternal death and its classifications based on the International Classification of Diseases 10th revision (ICD-10) codes.

The maternal mortality ratio (MMR) was calculated for each year of the period studied in Colombia and the department of Córdoba. This indicator is defined as the number of cases of maternal deaths that occur during pregnancy, childbirth, and the following 42 days, occurring in each period, divided by the number of live births in the same period; the multiple constant multiplication was per 100,000 Live Births (LB). The purpose of the indicator is to estimate the risk of dying from problems related to pregnancy, childbirth and postpartum in a region.

To assess the trend of the annual MMR, *joinpoint* regression models [13] were adjusted, with a maximum of 3 change points and a significance level of 5%. *Joinpoint* regression models are the most widely used to estimate annual percentage change (APC) both in specific mortality rates and in the global rate, and they achieve a better fit compared to linear models, which reduce the tendency to a single regression [15]. For its application, the number of maternal deaths per calendar year and the projections of live births for the same periods were required. For each period identified in the regression, the annual percentage change (APC) was estimated with its 95% confidence intervals (95% CI) and *p* value.

To select the model with the best fit, the permutations test indicated by default in the program was used. The *joinpoint* regression model identifies the moment when significant changes in the trend occur and estimates the trend observed in the intervals of change. The analysis was performed with the Joinpoint Regression Program®, version 4.9.0.0 [16].

RESULTS

In the period 2008 - 2020 in the department of Córdoba - Colombia, 361 maternal deaths were registered. The total number of live births for the period studied was 347,462 and the number of maternal deaths was 361, which yielded a maternal mortality ratio of 86.05; 68.23; 144.74; 93.83; 106.58; 92.45; 103.39; 104.66; 79.59; 125.93; 90.48; 108.28 and 154.83 per 100,000 live births respectively for each of the years studied, evidencing significant increases in the indicator in the years 2010, 2017 and 2022.

The MMR was reduced by 29%, going from 34 MM per 100,000 live births in 2017 to 24 MM per 100,000 live births in 2018, and from 20% compared to 2019 compared to 2017. However, in the year 2020 there was an increase of 101% compared to 2017. The annual details are shown in Table 1.

**Table 1: Maternal mortality ratio in the department of Córdoba – Colombia**

Year	Live births (LB)	Maternal deaths Córdoba	MMR Córdoba per 100.000 NV	MMR Colombia per 100.000 NV
2008	26729	23	86,05	62.76
2009	26380	18	68,23	72,88
2010	24181	35	144,74	74,09
2011	28774	27	93,83	71,22
2012	29087	31	106,58	68,7
2013	28123	26	92,45	58,59
2014	28048	29	103,39	73,68
2015	26753	28	104,66	72,01
2016	26385	21	79,59	73,51
2017	27000	34	125,93	73,85
2018	26524	24	90,48	80,26
2019	24935	27	108,28	81,08

2020	24543	38	154,83	102,48

The RMM of the department of Córdoba in the period studied does not present a stable trend; presenting fluctuations in the indicator such as those reported between the years 2008 - 2013. For the year 2010 there was an increase of 68% of the RMM with respect to the year 2008 and in the year 2013 a decrease of 36%. From 2014 to 2019, the indicator showed a more stable trend, presenting an increase of 17% compared to 2014. Later in 2020, a 41% increase in maternal deaths was reported compared to 2019.

Graph 1: Maternal Mortality Ratio department of Córdoba and Colombia, 2008 – 2020
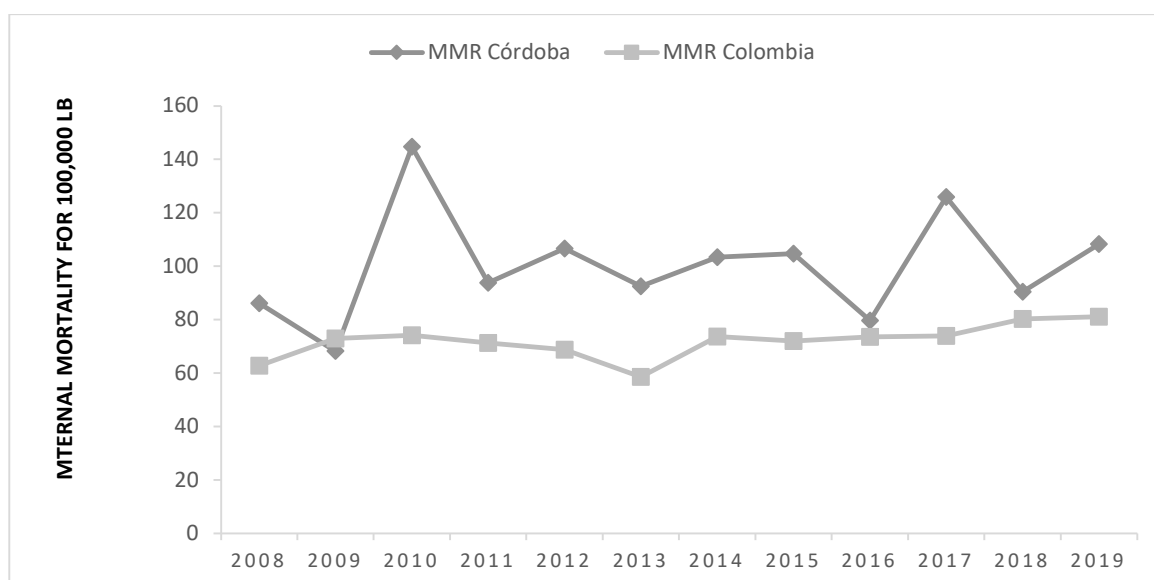
Source: self-made

The department of Córdoba presents two periods with an increasing trend: the first between 2008 and 2010 with an APC of 8.3 (CI 95% -71.3 – 462.6) and the second between 2018 and 2020 with an APC of 20, 8 (CI 95% -63.3 – 297.3). However, the p value in both time periods is not statistically significant (see Table 2).

Contrary to what was found with the national MMR, which in the period from 2013 to 2018 shows a statistically significant increasing trend, with an APC of 3.7 (CI 95% 1.1 - 6.4) and with a p value of 0.026, as well as the period 2018 - 2020 with an APC of 12.5 (CI95% 4.4 - 21.3) and p value of 0.021 (See Table 3).

Table 2: Annual percentage change in maternal mortality in Córdoba 2008 – 2020

	Turning points	Bottom point	Top point	APC	CI95%	*P* - Value
Córdoba	1	2008	2010	27,1	-71,3; 462,6	0,56
	2	2010	2013	-7,5	-73,4; 221,0	0,812
	3	2013	2018	1,1	-31,0; 48,0	0,915
	4	2018	2020	20,8	-63,3; 297,3	0,565

Source: Own elaboration based on data analysis

Table 3: Annual percentage change in maternal mortality in Colombia 2008 – 2020

	Turning points	Bottom point	Top point	APC	CI95%	*P* - Value
Colombia	1	2008	2010	8,3	-0,3 ;7,6	0,054
	2	2010	2013	-4,8	-12,4 ;3,5	0,128
	3	2013	2018	3,7*	1,1 ;6,4	0,026
	4	2018	2020	12,5*	4,4 ;21,3	0,021

Source: Own elaboration based on data analysis

DISCUSSION

After analyzing the evolution of maternal mortality in the department of Córdoba it was observed that the MMR in this Department was in 92% of the years studied above the national average by up to 71 percentage points. Likewise, the study of the indicator in the Department reflected a significant decrease in the MMR in 2009, placing the indicator at approximately five percentage points below the national average and in the immediately following year an increase of 112% is reported compared to with 2009 which leaves some uncertainties as to the quality and reliability in the registration of vital statistics in the Department. It should be noted in the results that for the year 2020 there was evidence of a significant increase in the indicator compared to 2019, both nationally and locally, placing it in both cases above 100 MM per 100,000 LB, very far from the proposed goal. for the SDGs.

The objective of this article was to analyze the evolution of maternal mortality in the department of Córdoba - Colombia in the period 2008 to 2020 and to identify changes in its behavior. The MMR in the department of Córdoba is substantially higher than the national average, so it would be far from achieving the development goals proposed for 2030. Its behavior for the observation period is irregular with very marked increases for 2010, 2017 and 2020.

These findings are consistent with what was reported by the Colombian National Health Institute (NHI), which reported that in the country the MMR showed a downward trend, from 73.3 cases in 2007 to 47.1 cases per 100,000 live births in 2019. Likewise, for 2020, 587 MM were reported in the country, presenting an increase of 34.3% in the number of cases of maternal mortality when compared to the year 2019 [17]; placing the department of Córdoba in an even more complicated situation compared to the national situation. However, it is necessary to highlight that the annual MMR data for the country reported by the NHI differ from those reported by the study and that they were calculated with the NADS vital statistics reports. This may be due to failures in the public health surveillance system of maternal mortality in the Department, especially in relation to reporting the event.

In this sense, Hernández Ávila *et al*. affirm that one should reflect on the paradox of underreporting and its incidence on mortality results [18]. Regions with greater social vulnerability tend to present higher mortality rates, and, in turn, tend to have lower quality in the reporting of vital statistics. As a consequence, the error in the estimation of mortality depends on the event in which the underreporting occurs [19]. This becomes of great importance when it is reflected on information as a political instrument, which can be used to determine intervention needs, as well as to ensure deficiencies and minimize problems [20]. Appropriate information systems make it possible to study changes in the population, monitor policies, and evaluate health systems [20].

On the other hand, The United Nations Organization (UN) estimates that the maternal mortality rate expressed in MMR in the countries of Latin America and the Caribbean, although it has shown a significant regional decline in recent years, of 88 million per 100,000 live births in 2005 to 74 million per 100,000 live births in 2017, presenting fluctuations in the period and realizing that the problem has not been resolved. According to their data, several countries in the region, including Colombia, registered an indicator of MM above the target 3.1 of the SDGs [21].

The results of the study reveal a high number of maternal deaths throughout the period studied without a clear trend. Maternal health is an aspect that evaluates the progress of a region; since avoidable maternal mortality is considered a manifestation of inequality and inequity, as well as the lack of empowerment of women [22]. Maternal death is the most certain health outcome that highlights the inequality and inequity that women face, especially in developing countries.

In this regard, Say L *et al* indicate that the promotion of social development, as well as the strengthening of health systems through public health surveillance protocols are the determining path to obtain a country free of maternal deaths [23]. Consequently, to achieve a significant reduction in MM, each region, with its particularities, must direct its efforts to carry out a specific analysis of each case that seeks to create a sufficient base to generate strategies aimed at minimizing the consequences that this event produces on health. of the groups [23].

Maternal mortality results from a series of determinant factors related to the different contexts that surround women throughout their reproductive years, among which the disadvantages linked to the economic situation, education, and health status of women prior to birth stand out. pregnancy, as well as access and quality of health services for maternal care and family planning [20, 24]. Women of productive age and belonging to

populations with an adverse economic situation and without access to higher education are the ones with the highest mortality [5, 25], perhaps adding to these factors inequitable access to health services [5, 26].

The study and measurement of social inequalities in health is a central topic of public health research because it stratifies such as socioeconomic level and employment status, among others, that are directly related to negative health outcomes, among which stands out maternal mortality [27]. For the year 2018, according to data from the Unsatisfied Basic Needs Indicators (BNI) reported by NADS, the department of Córdoba reported a proportion of people in NBI of 35.08% and a proportion of people in poverty of 3.80% [28]. These indicators place the Department in sixth place with the highest NBI index among the 33 departments that make up the national territory, which would explain the high numbers in the RMM in the region.

It is significant to note that women are at risk throughout the gestational period, a risk that accumulates during reproductive life and increases with each pregnancy. A significant number of women who survive complications derived from pregnancy suffer significant sequelae in their sexual and reproductive function, as well as difficulties of a social and family nature [29]. Taking this into account, knowing the dimension and particularities of maternal mortality is essential to establish policies and actions of a social and public health nature that entail adequate monitoring of pregnancy and improvement of maternal health. In this sense, the fundamental root of health interventions to reduce maternal deaths lies in the fact that pregnant women have timely access to prenatal care, institutional delivery care and obstetric complications in health institutions with diagnostic and treatment capacity. suitable [29].

Consequently, there is a need to analyze the various social, economic, cultural and political factors that affect the department of Córdoba and its health service provider institutions; since the reproductive process of the human being understood as the transformation of nature generated by the interaction of man with it, is one of the contexts where these factors obtain a greater meaning, directly affecting a greater vulnerability of the pregnant woman [7].

In this way, the department of Córdoba is required to carry out more studies that analyze the epidemiological profile of maternal deaths and expand these towards the causes and factors that determine them, with the purpose of understanding which of them are related to mortality., in such a way that concrete and real solutions are proposed that contribute to improving maternal health in the region.

The main limitation of the study is related to the nature of the data. In Colombia, the registry of the basic cause of death oversees the attending physician or the one who certifies the death in the institutions that provide health services, which limits the data to the quality of the information registered by the professional. Underreporting and poor-quality information can limit the validity of the conclusions; however, despite being an important aspect, it is a common element in this type of research [30].

CONCLUSIONS

The department of Córdoba has not been able to achieve the stated goal of reducing the MMR. Likewise, the indicator presents a fluctuating behavior with large increases

and sudden decreases that suggest deficiencies in the recording of the information and in the notification of the event.

Consequently, it is necessary for the department to evaluate the quality of its information system in vital statistics, as well as the notification of MM as an event of interest in public health, seeking to identify problems that may be decreasing the validity and reliability of the data. indicators as socially sensitive as the RMM; to contribute to closing the gaps in the quality of information in the region as a political tool for decision-making and allocation of resources for maternal health.

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