Neonatal mortality and years of life potentially lost in Colombia, 2010 to 2019.

Objective: To estimate and analyze neonatal mortality and years of life potentially lost in the departments of Colombia for the period 2010 to 2019.
Methods: An exploratory ecological study was carried out using years of life lost and neonatal mortality rates as the unit of measurement. The mortality databases of the National Administrative Department of Statistics (DANE) were used, which is fed with information from individual death certificates, filled out, and reported throughout the national territory through the RUAF-ND module.
Results: The neonatal mortality rate in the country in the period from 2010 to 2019 decreased from 7.79 to 6.93 deaths per 1000 births (95%CI). In terms of years of life potentially lost, a decrease was observed from 281.11 per 1000 to 258 per 1000 in the male group and from a rate of 232.43 per 1000 to a rate of 199.25 per 1000 in the female group. Mortality was higher in the subsidized regime than in the other regimes. The department with the highest neonatal mortality rates was the Archipelago of San Andrés and Providencia.
Conclusion: Neonatal mortality is a reflection of the health determinants of a society. In terms of disease burden, work should continue on this type of study to determine whether the results justify the implementation of public health measures to meet the needs of the most vulnerable populations.

Keywords: Neonatal mortality, years of life lost, Colombia.

Introduction

From a holistic and technical point of view, neonatal death is the cessation of any vital function between zero and twenty-eight days of life. According to the World Health Organization, "it is estimated that 4 million newborns die each year worldwide, 75% in the first week of life and 25% to 45% in the first day of life", the main causes of death being infectious processes, prematurity and birth asphyxia. In developed countries it has been highlighted that the main causes of mortality are congenital malformations and gestational hypertensive disorders, as well as prematurity and sudden infant death, which are becoming more and more relevant; in contrast, events related to perinatal care such as asphyxia and infections are extremely important in African, Southeast Asian and Latin American countries, and together with prematurity are the main contributors to neonatal mortality (1,2). (1,2).

Meanwhile, the Latin American Center of Perinatology (CLAP) has shown that the highest percentage of perinatal deaths reported in Latin America occurs to a greater degree in low birth weight newborns, and the remaining percentage is very low birth weight newborns. The most relevant maternal risk factors identified are preeclampsia and premature rupture of membranes. Thus, for this Latin American entity, the main objective has been established for the year 2030, through which it seeks to reduce neonatal mortality to at least 12 per 1,000 live births (1).

From the local point of view, and according to reports from different territorial entities, the historical notification of perinatal and late neonatal mortality is gradually increasing, probably due to the improvement in technologies for adequate data collection and notification of this health event. Thus, from 2008 to 2019 there has been an average increase of 8,919 cases reported, approximately, these data are reported to SIVIGILA, National Public Health Surveillance System (3).

The high rates of neonatal mortality are the result of unmet basic needs, an increase in the barriers to access to health services, especially during prenatal control, delivery, and newborn care, but above all to the existence of a large socioeconomic gap with a high rate of poverty, especially in dispersed rural areas of our country. (4)

There are territorial entities in which the indicator is alarming since they are well above the national rate and still far from the CLAP goal of 12 per 1000 live births. For 2019 these territorial entities were: Vichada with 36.0 (it is worth noting that the reduction in this department has been substantial, going from 62.8 to 36), Chocó with 35.5 (this also had a decrease), Vaupés with 30.6, Buenaventura with 29.8 and La Guajira with 24.0 deaths per 1,000 live births (5).

On the other hand, the burden of disease studies dates back to the 1990s; before this period, there was no exhaustive and reliable source of information on the global burden of diseases, injuries, and risk factors. For this reason, and in an effort by the World Bank and the World Health Organization, the Global Burden of Disease Study (GBD) was launched in 1991 to unify the global causes of diseases and mortality. This began with the first global burden of disease studies, and in 1991, the first global burden study and report was obtained, which quantified the health effects of more than 100 diseases and injuries in eight regions of the world in 1990 (6).

The main objective of the burden of disease studies in the public health measures that can be implemented by adequately knowing which are the first causes that impact on health and carrying out the consequent public health policy measures to decrease these mortality and morbidity rates.

The main objective of this type of study is to initially determine the impact of mortality in terms of the years of life lost by a person, based on the years at which he or she died and the life expectancy that this person may have had in his or her region at the time of death.

To compare the burden of a disease with the burden of other pathologies, it is necessary to take into account the age at death and the life expectancy of people affected by each disease and to take into account the degree of disability (e.g., discomfort, pain or functional limitations) suffered by those living with each condition. Life expectancy is based on a West Table level 26, (82.5 years female, 80 years male), for the burden of disease studies. What is looked at is how many years were lost from death to the life expectancy that this person had at that time. In addition, methodologies are applied to evaluate the information available for each disease and to make systematic comparisons, estimate results for each country, and report the burden of disease for each region (6,7).

Colombia is a country that, like other countries in the world, has undergone an epidemiological transition, overcoming infectious diseases as the leading cause of death at the beginning of the 20th century and transitioning to a higher mortality rate due to chronic non-communicable diseases. A large number of the years of life lost in the country come from the death of young individuals due to accidents or violence; another particular characteristic of the mortality analysis in Colombia is that there are significant gaps between the different regions of the country about mortality parameters. In terms of disease burden, the group constituted by communicable, perinatal, and nutritional diseases contributes 15% of the global burden. (8,9)

Finally, the burden of neonatal disease in Colombia has not been described so far, generating implications related to the impossibility of comparing risks between communities, regions and thus being able to evaluate in the regions the measures of public health impact and public health surveillance. Therefore, the objective of this study was to estimate and analyze the burden of disease of neonatal mortality in Colombia for the period from 2008 to 2019.

Methodology

Type of study

This is an exploratory ecological study that estimated mortality rates and years of life potentially lost in Colombia in the period from 2010 to 2019.

Source of information

The information on neonatal mortality was obtained from the National Administrative Department of Statistics (DANE). For the analysis, data were taken from the databases of deaths of the Vital Statistics subsystem of DANE for the period from 2010 to 2019 that occurred in the country, which corresponds to a continuous record that is fed with information from individual death certificates, filled out and reported throughout the country through the RUAF-ND module.

Data analysis

Microsoft Excel data processing software was used for the tabulation, filtering, and calculation of the data. Mortality data were organized by year, department, sex, and by the variable age group 1; the latter made it possible to select from the database only deaths of children between 0 and 28 days of age at the time of death. Specific mortality rates were constructed for the national level and for the 32 departments of the country and the District of Bogotá using as numerator the neonatal mortality records (defined as that occurring between 0 and 28 days of life) and as denominators the live births. A rate adjustment was made with an indirect method using the population of Colombia as the standard population.

The standardized life expectancy method was used to calculate the DALYs. In this method, the duration of life lost is the local life expectancy in the period, at each age. It is calculated with the following formula: $APE = \sum_{x=0}^{l} d_x e_x^*$

Where x is the age at which the person dies l is the latest age at which there are survivors, x is the age at death, dx is the number of deaths at that age x and p x e is the life expectancy of the period at each age.

The World Health Organization template was used to calculate the years of life potentially lost YLLL and given that the analysis group corresponds to neonatal mortality, the data were modified in this first group; in the population column, the data obtained from the total number of live births for each department and sex were used, as well as in the death column, the information obtained from the total number of deaths between 0 and 28 days was entered, broken down by sex. The information obtained with this tabulation was the total Years of Life Potentially Lost per 1000 inhabitants. This process was carried out for the 32 departments of the Colombian territory and was also done independently for each of the 9 years of study.

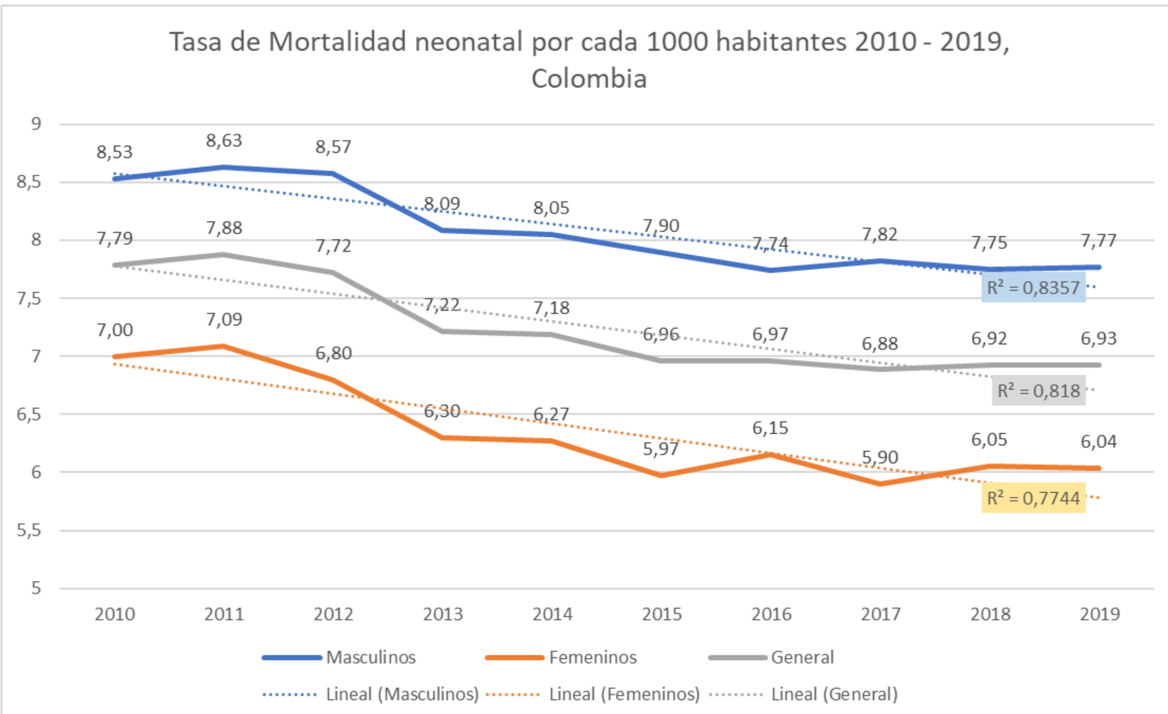
Mortality was also classified by: days elapsed since birth, by "basic cause" recorded on the death certificate with the ICD 10 code, and by social security affiliation regime for analysis.

Results

From DANE mortality records it was found that the country presents a decreasing trend in the neonatal mortality rate in the period from 2010 to 2019, going from 7.79 to 6.93 deaths per 1000 live births being statistically significant.

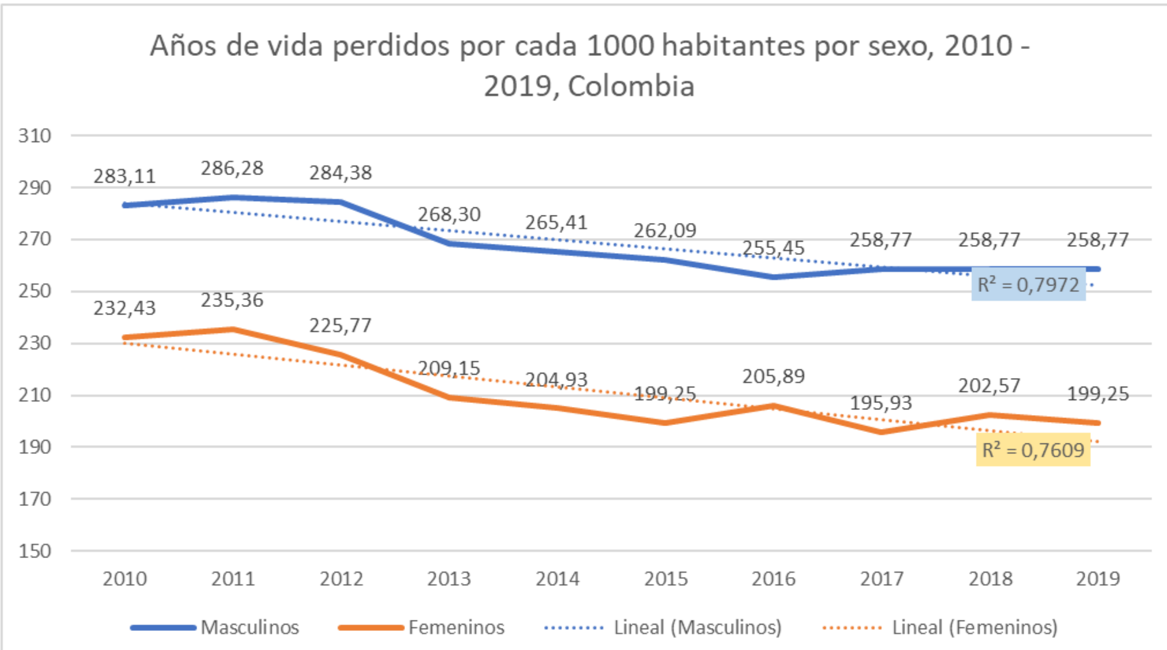
Concerning sex, the behavior of the mortality rate is very similar to the general rate, with the male sex remaining above the female sex with a difference of 1.7. From 2017 to 2019 there is evidence of a trend towards stabilization of neonatal mortality rates.

Graph 1: Neonatal Mortality Rate per 1000 inhabitants 2010 - 2019, Colombia.



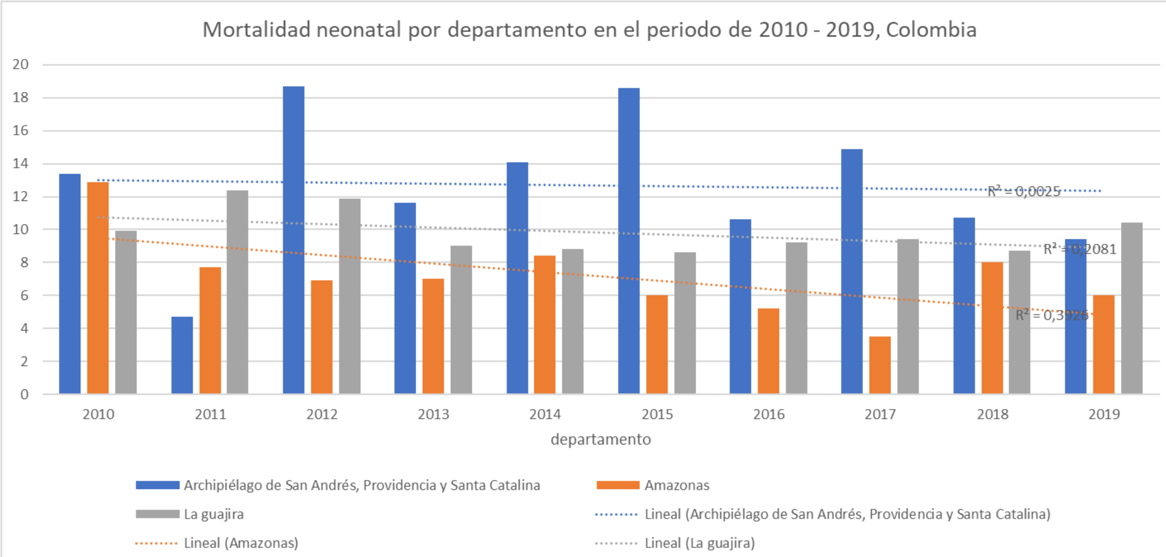
When describing the distribution of DALYs, it is evident that premature mortality due to neonatal mortality contributes to a disease burden that has decreased over time from a rate of 281.11 per 1000 to a rate of 258 per 1000 in the male group and a rate of 232.43 per 1000 to a rate of 199.25 per 1000 in the female group.

Graph 2:
Rate of Years of life lost per 1000 population, by sex, 2010 - 2019, Colombia



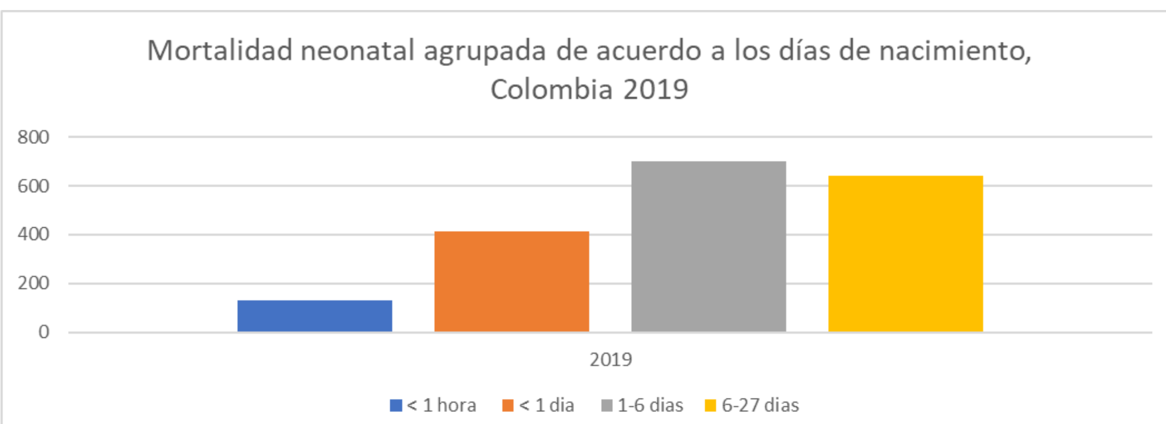
On the other hand, the years of life lost behaved the same as the mortality rates with the distribution by departments for both sexes, it is evident that San Andres y Providencia y Santa Catalina presents the highest rates along the timeline presenting the two highest rates evidenced 18.7 in 2012 and 18.6 in 2016, except in 2019 where it was in second place. Córdoba remained stable within the top places without having a significant increase or decrease over time, chocó also remained in the top places, with a significant decrease in 2018 going from 12.1 to 7.2. The other departments such as Guajira and Amazonas with high mortality rates did not show statistically significant reductions over time from 2010 to 2019.

Figure 3 Neonatal mortality by the department in the period 2010 - 2019, Colombia.



Considering the age of neonatal death during the period from 2010 to 2019, it can be observed that the highest mortality occurs during days 1 to 6 of life, followed by days 6 to 27 (Graph only with the year 2019). The time when the least deaths are recorded is in the first hour of life.

Figure 4 Neonatal mortality grouped according to days of birth, Colombia 2019.

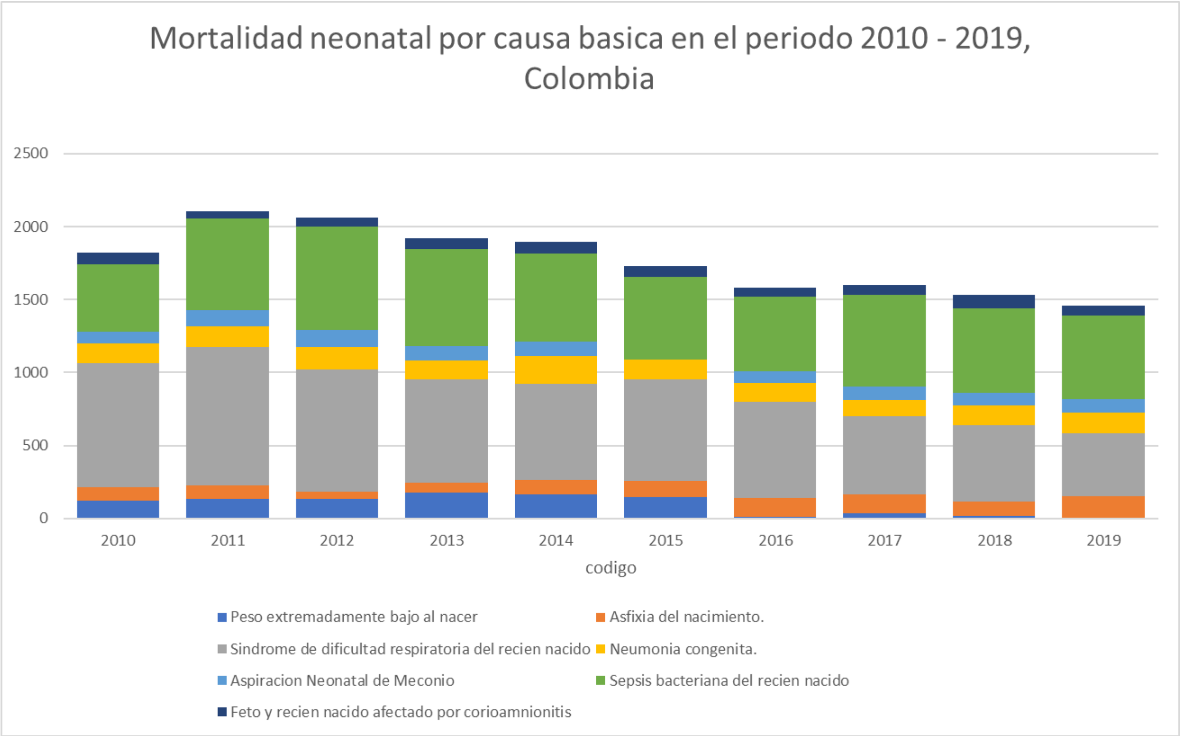


Regarding social security, a rate adjustment was made by the indirect method using the contributory regime as the standard population, the neonatal mortality rate in Colombia is higher in patients affiliated to the subsidized regime, this higher distribution in that population is sustained throughout the period evaluated from 2010 to 2019. A higher rate is evidenced in 2012

Figure 5 Neonatal mortality rate by the social security system, Colombia 2019

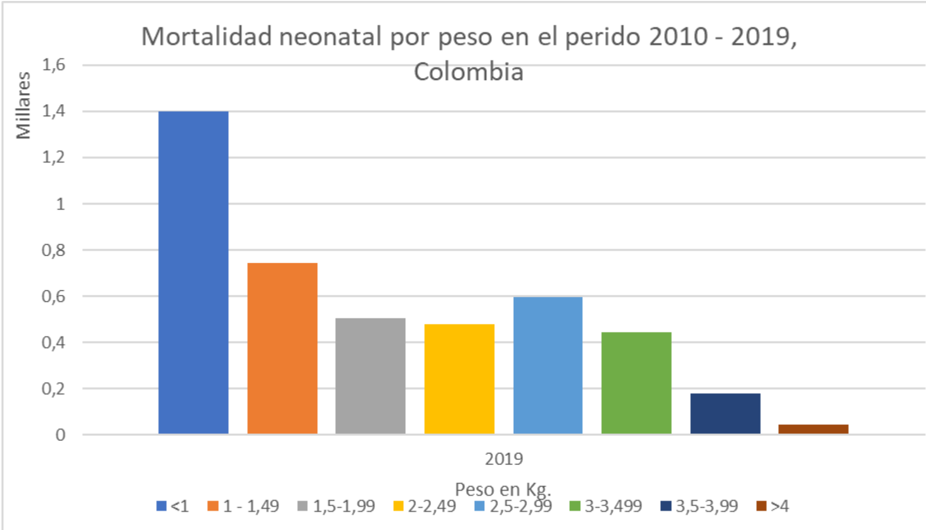
As for the basic cause of death, the predominant causes and those maintained throughout the 9 years of follow-up were "Respiratory distress syndrome of the newborn" and "bacterial sepsis of the newborn", followed by "congenital pneumonia", "extremely low birth weight", "meconium aspiration", "birth asphyxia, unspecified" and "respiratory failure of the newborn".

Figure 6 Neonatal mortality by basic cause in the period 2010 - 2019, Colombia.



Mortality was highest in infants weighing less than 1000 grams, followed by those weighing between 1000 and 1499 grams throughout the timeline. Children between 2500 and 2999 grams presented more deaths in all years than children between 1500 and 2499 grams, the last two places were occupied by newborns with weights above 3500 grams.

Figure 7 Neonatal mortality by weight for the period 2010-2019, Colombia



Discussion:

Colombia has gradually reduced mortality rates; however, according to the information found in the study, there is evidence of a plateau without a decrease in recent years with a stationary trend. The figures reported in this article correspond only to neonatal mortality, i.e., that between 0 and 28 days, and not perinatal mortality, which is the most commonly reported in the literature. The high rates of neonatal mortality are the result of unsatisfied basic needs, an increase in the barriers to access to health services, especially during prenatal control, delivery, and newborn care, but above all to the existence of a large socioeconomic gap with a high rate of poverty in dispersed rural areas of our country. (10)

In the analysis, it became evident as important limitations that studies on the burden of disease in the neonatal period are not found in the literature, for this reason, a discussion to compare our results with other regions or countries represents a difficulty for the analysis. This may be related to various questions regarding statistical power, such as those raised by Romeder and McWhinie, who state that DALYs should be calculated from deaths over 1 year of age so that they are not affected by infant mortality (2).

On the other hand, the analysis of the data in this research yields relevant information that could have an impact on public health policies. Compared to the Colombian literature, in general, the findings are similar to those published by entities such as the National Institute of Health or the DANE. It is important to mention that all the data in this research were taken from the National Administrative Department of Statistics (DANE), so the reports may have limitations, either due to underreporting or poor completion of the primary sources of information such as death certificates, even though the databases have been cleaned.

On the other hand, findings consistent with similar studies have been found. Firstly, there is a relationship between the basic causes of death, with what is reported in other countries; observing the 2018 Global Burden Diseases data, among the most relevant causes, the authors report congenital malformations, prematurity, respiratory infections, asphyxia and sepsis, and other neonatal infections, the data of our research yield similar results, in which prematurity, low birth weight, sepsis, asphyxia, and respiratory problems were the most presented during the ten years of the present review of these data, so we can conclude that these are the most important preventable events and to which we must direct efforts to reduce neonatal mortality. (10,11)

It should be noted that the codes used for reporting mortality are those of ICD10, in which there is no unique code for surfactant deficiency disease, so it is reported as respiratory distress syndrome.

Regarding birth weight, the data analyzed show that extremely low birth weights below 1,000 g are those with the highest mortality, which is directly related to extreme immaturity, being this the clear reason why mortality is high in this group of patients, this is a constant during the 10 years observed. It is important to mention that according to the data of this research we found that patients with a weight between 2,500 and 2,999, have more mortality compared to those with a weight between 1,500 and 2,500, this is related to the fact that in the previously mentioned period perinatal asphyxia plays a more preponderant role and it is when the incidence of this occurs more and therefore mortality increases (2,12).

In relation to the distribution of mortality by territorial entity (Departments in Colombia), the behavior of the Archipelago of San Andres and Providencia is striking, remaining in the first places over time; in the analysis of the health situation 2013 for the department, "newborn diseases" was identified as the first cause of infant mortality; being this a small, island population it is evident that for the department there is a barrier in the access to suitable health services, there are failures in the system to generate public health policies that respond to the identified needs and the research group considers that public health measures aimed at reducing maternal and infant morbimortality should be strengthened, strict monitoring by the territorial entity to compliance with resolution 3202 of 2016 in which the maternal perinatal route and the route of promotion and maintenance of health are established as mandatory; The same applies to the department of Córdoba and Chocó; likewise, it is worthwhile to inquire what strategies were used in departments such as Guainía and Amazonas in which the behavior was towards improvement so as to evaluate whether such strategies, can be used, taking into account the determinants in health in each of the departments that were sustained in the first places. (13)

Understanding that the health system in Colombia is governmentally regulated and that Law 100 established in 1993 the mandatory affiliation of all the inhabitants of the national territory to the General System of Social Security in Health through different regimes as follows: Contributory regime (to which people with the ability to pay are affiliated), subsidized regime (to which the poor and vulnerable population without the ability to pay are affiliated) and other regimes such as the special or excepted regime (military forces and public university officials), for our study it was of great relevance to evidence the differences in neonatal mortality between these regimes finding that the health regime that presents a higher neonatal mortality over time is the subsidized regime; Given that the regulations require health activities to be carried out for people regardless of their health affiliation regime, it is worth asking whether it is the other social determinants, specific to this population, such as educational level, poverty, food insecurity, lack of access to work, etc., that cause these newborns to be born in the subsidized regime, which is the reason for the high mortality rate of these newborns. which causes these newborns to have a higher number of deaths than in other health regimes. (14)

In conclusion, given that neonatal mortality is ultimately a reflection of the health determinants of a society, this research allows us to affirm that there are still many efforts to be made from the public health point of view in Colombia to reduce neonatal mortality, addressing the leading causes of mortality in this period and the departments with the highest mortality rates. Likewise, it is necessary to continue working on the burden of disease to know if these data are relevant and can be used as a justification to meet the needs of the most vulnerable populations, such as the neonatal population.

Biases and limitations

Given that the source of information for this study was the DANE registry, we have a classification bias in the study because the information available depends on the quality and relevance of the information recorded; to minimize this bias we classified mortality by age subgroups, within the group of interest and by basic cause; Additionally, there is a coverage bias given that the RUAF in the country has an approximate coverage of 92 to 95%, this bias cannot be minimized because there is no way to impute the data, for this same reason we could be facing an underreporting bias, which minimizes the source of information, DANE, which directs efforts to strengthen the quality of official statistics in a rigorous manner, which is why the reporting of the data has a delay of two years and the present study could take data up to 2019.

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