

Original Article/Artículo Original

## Characteristics of maternal mortality in Paraguay (2014-2021)

### Características de la mortalidad materna en Paraguay (2014-2021)

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## RESUMEN

**Introducción:** la mortalidad materna (MM) es un indicador crítico de salud pública. En Paraguay, los avances logrados se vieron afectados por la pandemia de COVID-19. Este estudio examina las características de la MM en Paraguay entre 2014 y 2021.

**Objetivos:** describir las características sociodemográficas y clínicas de la mortalidad materna en Paraguay durante 2014-2021.

**Metodología:** Estudio descriptivo transversal retrospectivo utilizando datos de certificados de defunción de la DIGIES. Se analizaron 740 casos de muertes maternas en las 18 Regiones Sanitarias del país.

**Resultados:** se registraron 740 muertes maternas, con una razón promedio de 83,91 por 100,000 nacidos vivos. 2021 presentó la mayor razón (159,98). La mayoría ocurrió en mujeres jóvenes (58,65 %) y adultas (66,31 %), con causas predominantes como enfermedades del sistema respiratorio 18,11 %, toxemia 15,81 % y hemorragia 12,03 %.

**Conclusión:** la MM presentó un aumento después de la pandemia del COVID 19, por lo que es urgente fortalecer el acceso a atención prenatal y obstétrica de calidad, especialmente en instituciones públicas, y abordar las desigualdades socioeconómicas que afectan la salud materna.

**Palabras clave:** mortalidad materna; Paraguay; salud pública; toxemia del embarazo; desigualdades en salud.

## ABSTRACT

**Introduction:** maternal mortality (MM) is a critical public health indicator, especially in low- and middle-income countries. In Paraguay, although progress was made in reducing MM between 2008 and 2018, the COVID-19 pandemic reversed many of these gains. This study examines the characteristics of MM in Paraguay between 2014 and 2021.

**Objectives:** to describe the sociodemographic and clinical characteristics of maternal mortality in Paraguay during the period 2014-2021.

**Methodology:** a retrospective cross-sectional descriptive study was conducted using data from death certificates of the General Directorate of Strategic Health Information (DIGIES) of the Ministry of Public Health and Social Welfare. We analyzed 740 cases of maternal deaths registered in the 18 Health Regions of the country, considering sociodemographic variables and variables related to causes of death.

**Results:** there were 740 maternal deaths, with an average ratio of 83.91 per 100,000 live births. 2021 had the highest ratio (159.98). The majority occurred in young (58.65 %) and adult women (66.31 %), with predominant causes being diseases of Respiratory System 18.11 %, toxemia 15.81 %, and hemorrhaged 12.03 %.

**Conclusion:** MM presented an increase after the COVID 19 pandemic, so the study highlights the urgent need to strengthen access to quality prenatal and obstetric care, especially in public institutions, and to address the socioeconomic inequalities that affect maternal health.

**Keywords:** Maternal Mortality; Paraguay; Public Health; Pregnancy Toxemia; Health Inequalities.

## INTRODUCCIÓN

Maternal mortality (MM) is defined “*as the death of a woman during pregnancy, child birth or within 42 days after termination of pregnancy, due to any cause related to or aggravated pregnancy*”<sup>(1)</sup>. It constitute some of the most sensitive social and health indicators, since each maternal death brings with it a cascade of consequences that directly impact various levels, such as the family, society and health systems. Therefore, it continues to be a global public health problem, especially in low-and middle-income countries<sup>(2-4)</sup>. For this reason, it is part of the commitments of the Sustainable Development Goals (SDG)<sup>(5)</sup> and countries have committed to reducing the MM ratio to less than 70 per 100,000 live births by 2030<sup>(6)</sup>.

Worldwide, during 2015, MM were estimated at 303,000 cases, of which 99 % occurred in low- and middle-income countries. In the Americas region, the average MM ratio was 67 per 100,000 live births in 2017, but with wide disparities between countries, from less than 10 per 100,000 in Canada and the United States, to 476 per 100,000 in Haiti. Globally, the main direct causes are hemorrhage (27 %), hypertensive disorders (14 %), sepsis (11 %), unsafe abortions (8 %) and obstructed labor (5 %)<sup>(2,7)</sup>.

Paraguay, during the years 2008 to 2018, has managed to reduce MM, going from a ratio of 117 to 71 per 100,000 live births<sup>(8)</sup>. However, this progress has not been equitable, with higher mortality

being recorded in some regions of the country. In 2018, seven departments accounted for 79 % of maternal deaths, with variations of up to 4 times greater between regions<sup>(3)</sup>. Analysis of trends and disparities in MM by region and age group is essential to target interventions and accelerate progress toward national health goals<sup>(9)</sup>.

The COVID-19 pandemic has had a strong impact on pregnant women, increasing the risk of MM. Recently, a multicenter study carried out between March 2020 and November 2021 in 8 Latin American countries described the characteristics of 447 maternal deaths associated with SARS-Cov-2 infections confirmed by PCR. An alarming fact was that 35 % of the deceased did not have Access to intensive care units, highlighting important barriers to Access to critical services for pregnant women in the region<sup>(10-12)</sup>.

The present study provide an updated analysis of the maternal mortality situation in the country from 2014 to 2021, identifying patterns, regional disparities and higher risk groups; providing key inputs for decision-making in public policies and the strengthening of maternal health programs, therefore the objective of the present study is to describe the characteristics of MM in Paraguay during the period from 2014 to 2021.

## **METHODOLOGY**

A descriptive, cross-sectional, retrospective study was carried out using the death certificate records of the General Directorate of Strategic Health Information (DIGIES) of the Ministry of Public Health and Social Welfare (MSP and BS) of Paraguay, the official institution responsible for national health and disease statistics<sup>(13)</sup>. The geographical scope was the 18 Health Regions including Asunción and the temporal scope considered was from 2014 to 2021.

The sampling was non-probabilistic, of consecutive cases. The study population was all maternal deaths registered in Paraguay in the study period.

The variables were classified into sociodemographic variables (age, lifecycle, educational level and marital status) and variables related to the characteristics of maternal mortality (year, basic cause of death, type of institution and professional who certified the death). The ages of the mothers were also grouped by life cycle, being adolescents (13 to 19 years), Young adults (20 to 25 years), adults (26 to 44 years) and late adults (45 to 51 years).

The MM ratio was calculated, which consisted of the number of maternal deaths per-100,000 live births. In addition, frequencies expressed in percentages were calculated. Data were analyzed with Microsoft Excel® and Epi-Info7 version 7.2.1.1.

Regarding ethical criteria, since it is a research with anonymized secondary data source without the participation of human beings, the protocol of this work did not require the approval of the Research Ethics Committee.

## RESULTS

During the period from 2014 to 2021, 740 cases of maternal deaths were recorded, with an average maternal mortality ratio of 83.91 deaths per 100,000 live births. The year with the lowest MM ratio was 2014, with 63.92, and the year with the highest ratio was 2021 with 159.98 (Table 1).

**Table 1:** Annual distribution of maternal mortality, Paraguay (2014 – 2021)

Year	Number of MM	Number of live births	Percent age of MM	Ratio of MM/1,000 live births
2014	72	112646	9,73	63,92
2015	95	116181	12,84	81,77
2016	96	111146	12,97	86,37
2017	78	115895	10,54	67,30
2018	79	111642	10,68	70,76
2019	73	107911	9,86	67,65
2020	81	102722	10,95	78,85
2021	166	103766	22,43	159,98
<b>Total</b>	<b>740</b>	<b>881,909</b>	<b>100,00</b>	<b>83,91</b>

*Source:* Vital Statistics Information Sub-System (SSIEV). Dept. of Biostatistics-DIGIES-MSP and BS. Asunción, Paraguay (2014 – 2021).

Regarding age, 49.38 % (364) of the deaths corresponded to women under 30 years of age, with the highest number of deaths occurring in the age group of 30 to 34 years (22.43 %, 166). It is worth mentioning the maternal deaths that appear at the extremes of life: 0.81 %<sup>(6)</sup> in women under 15 years of age and 0.27 %<sup>(2)</sup> in women over 50 years of age. Considering the life cycle, 28.11 % (208) of the deaths occurred in adulthood. Regarding educational level, 18.65 % (138) of the mothers had completed primary school, and 58.11 % (430) were single (Table 2).

**Table 2:** Sociodemographic characteristics of the mothers, Paraguay (2014 – 2021)

<b>Sociodemographic Variables</b>	<b>Frequency</b>	<b>Percentage</b>
<b>Age</b>		
<15	6	0,81
15-19	90	12,16
20-24	128	17,30
25-29	140	18,92
30-34	166	22,43
35-39	133	17,97
40-44	62	8,38
45-49	13	1,76
≥50	2	0,27
<b>Life Cycle</b>		
Teenagers	96	12,97
Youth	434	58,65
Adult	208	28,11
Late adult	2	0,27
<b>Education al level</b>		
None	40	5,41
Incomplete primary	116	15,68
Complete primary	138	18,65
Basic School Education	80	10,81
Complete secondary school	87	11,76
Complete University or Higher Education	68	9,19
Don't know	121	16,35
<b>Marital status</b>		
Single	430	58,11
United	164	22,16
Married	122	16,49
Don't know	20	2,70
Widow	2	0,27
Separate	1	0,14
Divorced	1	0,14

*Source:* Vital Statistics Information Sub-System (SSIEV). Dept. of Biostatistics-DIGIES-MSP and BS. Asunción, Paraguay (2014 – 2021).

Among the basic causes of death, the main ones were complications of pregnancy, childbirth and the postpartum period (22,43 %, 166) and Diseases of the Respiratory System (18,11 %, 134) and toxemia (15,81 %, 117). 63,65 % (471) of the deaths occurred in an MSP and BS institution, and the non-treating physician was the most frequent professional who certified the death (59,19 %, 438) (Table 3).

**Table 3:** Characteristics of maternal mortality in Paraguay (2014 – 2021).

<b>Characteristics Basic cause of death</b>	<b>Frequency</b>	<b>Percentage</b>
Diseases of the Respiratory System.	134	18,11
Toxemia	117	15,81
Hemorrhage	89	12,03
Abortion	85	11,49
Other maternal infectious and parasitic diseases	57	7,70
Diseases of the Circulatory System.	37	5,00
Sepsis	28	3,78
Diseases of the Digestive System.	14	1,89
HIV virus disease	13	1,76
Other complications of pregnancy, child birth and the post partum period	166	22,43
<b>Type of institution</b>		
Institution of MSP and BS	471	63,65
Institute of Social Security	79	10,68
Private institution	60	8,11
Home	61	8,24
Street	19	2,57
Other	50	6,76
<b>Type of professional</b>		
Treating doctor	254	34,32
Non-treating physician	438	59,19
Medical examiner	37	5,00
Authorized health personnel	11	1,49

*Source:* Vital Statistics Information Sub-System (SSIEV). Dept. of Biostatistics-DIGIES-MSP and BS. Asunción, Paraguay (2014 – 2021).

When analyzing the life cycle in relation to the years of occurrence, it is observed that, in all years, the majority of deaths from all causes occurred in youth and adulthood. Similarly, the highest proportion of maternal deaths occurred most frequently in institutions of the Ministry of Public Health and Social Welfare (MSP and BS), followed by those of the Institute of Social Security (IPS) (Table 4).

**Table 4:** Characteristics of maternal mortality in Paraguay (2014 – 2021)

Life cycles characteristics	Adolescence (n=96)		Youth (n=434)		Adulthood (n=208)		Late adult Hood (n=2)		TOTAL (n=740)	
	n	%	n	%	n	%	n	%	n	%
Years of occurrence										
2014	10	10,42	46	10,60	16	7,69	0	0,00	72	9,73
2015	15	15,63	53	12,21	27	12,98	0	0,00	95	12,84
2016	10	10,42	63	14,52	21	10,10	2	0,96	96	12,97
2017	6	6,25	47	10,83	25	12,02	0	0,00	78	10,54
2018	18	18,75	38	8,76	23	11,06	0	0,00	79	10,68
2019	12	12,50	41	9,45	20	9,62	0	0,00	73	9,86
2020	12	12,50	47	10,83	22	10,58	0	0,00	81	10,95
2021	13	13,54	99	22,81	54	25,96	0	0,00	166	22,43
<b>Type of institution</b>										
Institution of MSP and BS	71	73,96	275	63,36	124	59,62	1	0,48	471	63,65
Institute of Social Security	6	6,25	47	10,83	26	12,50	0	0,00	79	10,68
Private institution	6	6,25	38	8,76	16	7,69	0	0,00	60	8,11
Home	8	8,33	33	7,60	20	9,62	0	0,00	61	8,24
Street	3	3,13	13	3,00	3	1,44	0	0,00	19	2,57
Other	2	2,08	28	6,45	19	9,13	1	0,48	50	6,76

*Source:* Vital Statistics Information Sub-System (SSIEV). Dept. of Biostatistics-DIGIES-MSP and BS. Asunción, Paraguay (2014 – 2021).

The maternal mortality ratio in Paraguay during the period 2014-2021 shows notable differences between health regions. Concepción leads with the highest rate of 1.40 deaths per 100,000 live births, followed by Presidente Hayes with 1.36 and Central with 1.27. Other regions with high rates include Alto Paraná (1.02) and Amambay (1.04). At the other extreme, Ñeembucú did not report maternal deaths during this period, and Paraguari presented a low rate of 0.26 (Figure 1).



*Source:* Vital Statistics Information Sub-System (SSIEV). Dept. of Biostatistics-DIGIES-MSP and BS. Asunción, Paraguay (2014 – 2021).



**Figure 1:** Distribution of the average Maternal Mortality Ratio by regions in Paraguay (2014 – 2021)

## DISCUSSION

During the period 2014-2021, Paraguay recorded 740 maternal deaths, with an average ratio of 84 deaths per 100,000 live births. The annual analysis of the figures reveals significant fluctuations, with 2014 being the year that presented the lowest MM ratio with 63.92 deaths per 100,000 live births, which could be related to more effective health policies implemented in that period and are coincident with previous studies carried out by Mora-Escobar *et al.*<sup>(8)</sup>, who documented during the years 2008 to 2018 (pre-pandemic period) a decrease in the MM ratio from 117 to 71 per 100,000 live births. Before the pandemic, the goal was reached for the MMR to be less than 70, fulfilling the goal of “no one being left behind,” which is one of the goals of the SDGs<sup>(13)</sup>. The MMR obtained for the years 2015, 2016, 2017 and 2018 coincide with previous work on this topic, which indicates the consistency of these results<sup>(14)</sup>.

At the regional level, comparing these findings with similar studies, in Colombia during the period 2016 to 2020 the MM ratio fluctuated between 54.3 and 70.2 per 100,000 live births, presenting lower figures than those reported in Paraguay during the same period. This suggests that although both countries face similar challenges in terms of access to health care, regional disparities and socioeconomic conditions influence outcomes<sup>(15)</sup>.

During recent years, a constant increase in mortality was observed, ending 2021 with a MM ratio of 159.98. Compared to other countries in the region, the behavior of maternal mortality in Paraguay during the pandemic was similar to that of Bolivia<sup>(15)</sup>. According to Montoya *et al.*, Bolivia also experienced an increase in maternal mortality during the pandemic years, with an average ratio of 115 deaths per 100,000 live births between 2015 and 2020. These data suggest that the global health crisis affected similarly to countries with greatest challenges in terms of access to health services and resources, reflecting how the pandemic significantly impacted the progress made, underlining the vulnerability of the health system in times of crisis, suggesting the need to reinforce public health strategies to prevent future setbacks. The COVID 19 pandemic disproportionately affected pregnant women and exacerbated pre-existing inequalities in access to health services.

The inequalities in health care in Paraguay have already been pointed out by Tullo *et al.*<sup>(3)</sup> which mentions that the barriers in accessing maternal health services were particularly pronounced in rural regions and areas with less health infrastructure. These disparities, exacerbated during the pandemic, may have contributed to the alarming increase in maternal mortality observed in recent years.

Departmental gaps are important. The Department of Ñeembucú presented on average 0 notifications of MM, which should be investigated if these mortalities really did not exist, were not notified or the deaths occurred in another Department other than the maternal residence. The Departments of Alto Paraná and Concepción exceed the ratio of 70 MM expected to comply with the SDGs<sup>(13)</sup>. These results are to be expected, since the Central Department is the most populated Department in the country. The Central Department and Asunción concentrate 37.75 % of the country's total population, which represents 2,807,111 inhabitants<sup>(16)</sup>. Meanwhile, the Alto Paraná department for the year 2021 had 842,307 inhabitants (11.5 % of the country's total population), thus becoming the third most populated Department<sup>(16)</sup>.

According to the World Bank, Paraguay is the third country with the lowest Gross Domestic Product (GDP) per capita in the Region and ranks third among the countries with the greatest inequalities at the regional level<sup>(17)</sup>. One of the reasons for this inequality lies in the unequal distribution of income among the population, which translates into a low quantity and quality of

social investment, particularly in childhood, excluding the population from accessing social services. Basic health, drinking water, sanitation, education, housing, food and nutrition<sup>(18)</sup>.

Women aged 30 to 34 years presented 22.43 % (166) of the deaths, which coincides with an investigation carried out in Ethiopia where a similar prevalence was found, indicating that this trend could be common in different geographical and economic contexts<sup>(19)</sup>.

An important aspect to highlight are deaths at the extremes of life, with 0.81 % (6 cases) in adolescents aged 13 to 14 years and 0.27 % (2 cases) in women over 50 years of age. Although these percentages are relatively low, they reflect the vulnerability of extreme age groups. This finding is consistent with a study conducted in Nigeria, where adolescent girls and older women faced a significantly increase drisk of complications during pregnancy and child birth, highlighting the need for targeted interventions for these groups<sup>(20)</sup>.

The life cycle also shows that 58.64 % of deaths occurred in youth, which underlines the importance of concentrating prevention and care efforts at this stage. Regarding educational level, 18.65 % of the deceased mothers had completed primary school and 15.68 % had only completed incomplete primary school. According to data from the National Institute of Statistics (INE), on average mothers have attended 9.3 years in a formal educational institution, reaching 10.3 years in urban areas while in rural areas it reaches at 7.6 years of study<sup>(21)</sup>.

This finding is consistent with studies conducted in countries such as India, where low educational attainment has been shown to be associated with a higher risk of maternal mortality due to limited access to health services and a lowerability to make informed decisions about care. medical<sup>(22)</sup>.

Women's education constitutes one of the social determinants of health, which has been shown to have a consistent association with the use of health services by mothers. Furthermore, studies have shown that husband's education increases women's use of services<sup>(23)</sup>. In a work carried out in Ecuador, it was observed that five socioeconomic indicators demonstrated to be statistically significant with the RMM; the general fertility rate, percentage of indigenous population, percentage of households with children who do not attend school, the Gross Domestic Product (GDP) and the percentage of households with electricity<sup>(14)</sup>.

Marital status also emerged as a relevant factor, with 58.11 % of the deceased women being single. This finding suggests that single women may face additional barriers in accessing maternal health services, which has also been observed in studies in Brazil, where single women showed greater vulnerability due to lack of social and economic support<sup>(24)</sup>. Added to this situation is that 37.2 % of Paraguayan households are headed by women<sup>(25)</sup>.

The analysis of the causes of maternal death reveals critical information about the factors that contribute to maternal mortality in the country. Excluding “*other complications of pregnancy, child*

*birth and puerperium*", the main causes of death were diseases of the respiratory system, toxemia, hemorrhage, abortion, and sepsis. The high prevalence of toxemia, which includes hypertensive disorders of pregnancy such as preeclampsia and eclampsia, highlights the importance of adequate prenatal control and early detection of these disorders. These results coincide with those of Brazil, where toxemia constitutes one of the main causes of pregnancy. Death in adulthood, since it is the stage with the highest risk of serious complications<sup>(26)</sup>. The high prevalence of maternal mortality in pregnancies with preeclampsia emphasizes the need for close monitoring and special attention to early-onset cases<sup>(27)</sup>.

Abortion as a cause of maternal death is an alarming fact, especially in contexts where access to safe abortion services is limited. These figures could be higher, since in Paraguay abortion is criminalized by law, so higher figures than those presented are to be expected. Mass contraceptive education is crucial to preventing maternal deaths from unsafe abortions, which account for around 13 % of maternal deaths annually, particularly in developing countries with limited safe reproductive services and high light the need to improve Access to health services. Reproductive health and the management of post abortion complications in this population<sup>(27,28)</sup>.

Hemorrhage, which represents 12.03 % of maternal deaths in Paraguay, is another significant cause that has been identified globally as a critical factor in maternal mortality. Studies in Latin America have shown that postpartum hemorrhage is one of the leading causes of death in pregnant women, and the lack of quick access to emergency care exacerbates this situation<sup>(29)</sup>.

Regarding sepsis, which contributed to 3.78 % of deaths, it continues to be a relevant cause, although less prevalent compared to other complications. Sepsis is a significant health burden in Latin American countries, with studies show in high mortality rates from septic shock ranging from 45.6 % to 51 % in Colombia and Argentina<sup>(30)</sup>. However, its presence underlines the importance of hygienic conditions and proper management of infections during pregnancy and the postpartum period. Maternal sepsis has been identified in other international studies as a preventable cause of death if appropriate management protocols are implemented<sup>(31)</sup>.

The analysis of life cycles in relation to the basic causes of maternal death in Paraguay between 2014 and 2021 reveals that the majority of deaths occurred in youth and adulthood, with 86.76% of cases in both life cycles, depending on the year.

The majority occurred in institutions of the Ministry of Public Health and Social Welfare (MSP and BS), followed by the Social Security Institute (IPS). This highlights the crucial role of public institutions in maternal health care in Paraguay, although it also highlights possible limitations in the capacity to respond to obstetric emergencies, especially in resource-limited contexts. A study in

Brazil also identified that the majority of maternal deaths occurred in public institutions, suggesting that public health policies should focus on improving the quality of care in these settings<sup>(26)</sup>. According to data from the INE, in 2019, women registered only 28.4% of health insurance<sup>(25)</sup>. In relation to the limitations of the present study, we can mention that by using secondary data, the researchers were notable to select or aggregate variables. In that sense, it would have been interesting to add more variables related to the Social Determinants of Health. As strengths we can mention the use of data collected in the Surveillance by the health authority, which is the MSP and BS. The maternal mortality ratio in Paraguay during the period 2014-2021 shows notable differences between health regions, which highlights the variability in maternal mortality between different regions, underscoring the need for specific approaches to improve care and reduce mortality in areas with higher rates.

## CONCLUSION

During the period 2014-2021, Paraguay experienced a worrying increase in the maternal mortality ratio, reaching its peak in 2021, coinciding with the impact of the COVID-19 pandemic. The majority of maternal deaths occurred in young, less educated, and single women. The most frequent causes were toxemia, abortion and hemorrhage and occurred in public institutions.

### Conflicts of interest

The authors declare the absence of conflicts of interest.

### Funding Source

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### Data Availability

The manuscript contains all the evidence supporting the findings. For further information, upon reasonable request, the corresponding author can provide more complete details and a data set.

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## Author collaboration

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