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Extreme maternal morbidity in the Peruvian Instituto Nacional Materno Perinatal, experience and results

Morbilidad materna extrema en el Instituto Nacional Materno Perinatal del Perú, experiencia y resultados

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ABSTRACT

Introduction: Extreme maternal morbidity (EMM) is an indicator for estimating the quality of obstetric care in pregnant or postpartum women with severe morbidities who survive because of the care received in obstetric services. Objective: To determine the causes, dysfunctions and morbidity and mortality indicators of cases of extreme maternal morbidity attended at the Instituto Nacional Materno Perinatal between 2017 and 2023 and the results of their care. Methodology: We reviewed the medical records of pregnant women with EMM criteria, determining causes, dysfunctions, care and evolution, evaluating the results with morbidity and mortality indicators. Results: In the 1,931 medical records of women with MME, the predominant etiology was preeclampsia with 911 cases (47.2%) followed by postpartum hemorrhage with 359 cases (18.6%). The most frequent dysfunctions between 2017 and 2020 were hepatic, respiratory and coagulation dysfunctions and, from 2021 onwards, coagulation and cardiac dysfunctions. The MME ratio ranged from 12.7 to 26.1 x 1,000 live births. Since 2017, the case fatality indicator is 1.8 maternal deaths (MM) x 100 MME cases, and the MME/MM ratio has remained higher than 35 MME cases x 1 MM case. The criterion/case ratio in 2023 was 2.2, reflecting the severity of the cases. Conclusion: The good quality of care of the INMP service in MME cases points to this indicator as a strategy to reduce maternal mortality in the country.

Key words: Indicators of morbidity and mortality, Morbidity, extreme, Maternal mortality, Multiple organ failure, Pregnancy outcome

RESUMEN

Introducción. La morbilidad materna extrema (MME) es un indicador que permite estimar la calidad del cuidado obstétrico en gestantes o puérperas con morbilidades graves que sobreviven gracias a la atención recibida en los servicios obstétricos. Objetivo. Determinar las causas, disfunciones e indicadores de morbilidad y mortalidad de los casos de morbilidad materna extrema atendidos en el Instituto Nacional Materno Perinatal entre los años 2017 y 2023 y los resultados de su atención. Metodología. Se revisó las historias clínicas de gestantes con criterios de MME, determinando causas, disfunciones, atención y evolución, evaluando los resultados con los indicadores de morbilidad y mortalidad. Resultados. En las 1,931 historias clínicas de mujeres con MME, la etiología predominante fue la preeclampsia con 911 casos (47,2%) seguida de la hemorragia posparto con 359 casos (18,6%). Las disfunciones más frecuentes entre el 2017 y 2020 fueron las hepáticas, respiratorias y de coagulación y, a partir del 2021, las de coagulación y la cardiaca. La razón de MME varió de 12,7 a 26,1 x 1,000 nacidos vivos. Desde el 2017, el indicador de letalidad es de 1,8 muertes maternas (MM) x 100 casos de MME y la relación MME/MM se ha mantenido mayor de 35 casos de MME x 1 caso de MM. La relación criterio/caso en el 2023 estuvo en 2,2, que refleja la gravedad de los casos. Conclusión. La buena calidad de atención del servicio del INMP en los casos de MME señala a este indicador como estrategia para disminuir la mortalidad materna en el Perú.

Palabras clave. Indicadores de morbilidad y mortalidad, Morbilidad materna extrema, Mortalidad materna, Insuficiencia multiorgánica, Resultado del embarazo

Introduction

The United Nations 2030 Agenda for Sustainable Development set the goal of reducing the global maternal death rate to less than 70 per 100,000 live births[1]. To achieve this goal, the World Health Organization (WHO) focused on analyzing those pregnant women who were at high risk of dying but survived, which was termed near miss or extreme maternal morbidity (EMM), which helps to identify severe obstetric emergencies and the quality of care used in their management. According

to statistics from the Pan American Health Organization (PAHO), there are 20 cases of MME for every case of maternal death[2,3].

Epidemiological surveillance of MMD is a strategy proposed within the regional actions of WHO, PAHO and the Latin American Centre for Perinatology (CLAP) to reduce the maternal mortality ratio (MM) in the world[4]. W. Stones, in 1991, used the words near miss to specify complications that can potentially lead to the death of the pregnant woman, but who survives[5].

Theoretically, the spectrum of clinical severity has two extremes: at one end are women who go through their pregnancies without complications (85%), and at the other, maternal deaths will occur and others may survive because of obstetric care (2%). On this continuum are pregnancies with non-life-threatening complications, potentially life-threatening complications and potentially life-threatening conditions or MACE that can lead to a fatal outcome if no intervention is taken[6,7].

In 2006 and 2007, the Latin American Federation of Obstetrics and Gynecology Societies (FLASOG) proposed surveillance of EMM cases in Latin American countries as a strategy to reduce maternal deaths. EMM was defined as: A serious complication occurring during pregnancy, childbirth and puerperium that puts the woman's life at risk or requires immediate attention to prevent death. Inclusion criteria for case definition were specific disease, organ dysfunction and management. Specific disease included hemorrhagic hypovolemic shock, septic shock and eclampsia; organ dysfunction included cardiovascular, respiratory, renal, hematological, hepatic, metabolic and neurological dysfunction. In the management of the case, hospitalization in an intensive care unit and procedures or surgeries complementary to delivery, cesarean section or curettage were indicated[8-10].

In 2011, the WHO adopted criteria based on organ dysfunction to define cases of EMM. This dysfunction can be cardiovascular, respiratory, renal, hematological, hepatic, neurological and others. These in turn can have a clinical criterion associated with a specific disease, a criterion based on organ or systemic dysfunction by laboratory, and a criterion based on a specific intervention[6].

The clinical criterion refers to the presence of a disease and for each disease a specific morbidity is defined (e.g. presence of preeclampsia with renal or cardiac failure), which is simple to apply, but not very specific.

The criterion based on organ or laboratory dysfunction is understood from the concept of the sequence of events leading from health to disease and death. It is more sensitive and specific, as it considers laboratory values.

Intervention-specific criteria use principles related to response/intervention based on the diagnosed disease: postpartum hysterectomy or blood transfusion. It is simpler; the source is medical history and institutional records; but it has a high variability.

EMM is an indicator to assess the quality of obstetric care at the hospital level instead of the maternal mortality indicator.

According to the Ministry of Health's (MINSA) technical health standard for epidemiological surveillance of EMM published in 2021, EMM is a serious complication that occurs during gestation, delivery or puerperium, which puts a woman's life at risk and requires immediate attention to prevent death[11].

By presenting a greater number of pregnant women with SCD compared to maternal deaths, a better analysis can be made of the actions taken to ensure the survival of pregnant women. Identification of these cases helps to evaluate and improve obstetric services[12].

Severe postpartum hemorrhage, severe preeclampsia or eclampsia, obstetric or non-obstetric sepsis or septic shock, uterine rupture or severe complications of abortion can result in maternal death but are also causes of severe maternal complications that place pregnant women at high risk of death, but which can survive with timely and quality obstetric care[12].

Methodology

The cases considered as EMM are registered in the EMM format by the medical staff and are reported to the Office of Epidemiology and Environmental Health (OEEH), which makes the corresponding report to the Ministry of Health and the follow-up of each case. The data obtained in this study correspond to the cases registered by the OEEH.

The Outcome Indicators proposed by PAHO, CLAP and MINSA, which are four, are evaluated with the case records:

- Extreme maternal morbidity ratio, defined as the number of women who survive a serious complication during pregnancy, childbirth or puerperium x 1,000 live births. This indicator reports the frequency of extreme maternal morbidity[13].
- Mortality rate, defined as the number of cases of maternal death x 100 divided by the sum of the number of cases of maternal death plus the number of cases of EMM. It assesses the quality of care[13,14].
- EMM/MM ratio, defined as the number of certified cases of EMM in the period divided by the number of cases of maternal death. It assesses the quality of care and shows the number of cases of extreme maternal morbidity that survived due to a maternal death[13,14].
- Criteria-to-case ratio, defined as the sum of inclusion criteria presented in the total number of cases in the study period divided by the number of cases of EMM occurring in the same period. It reflects the severity of maternal health compromise by indicating the average number of inclusion criteria per case[11,13,14].

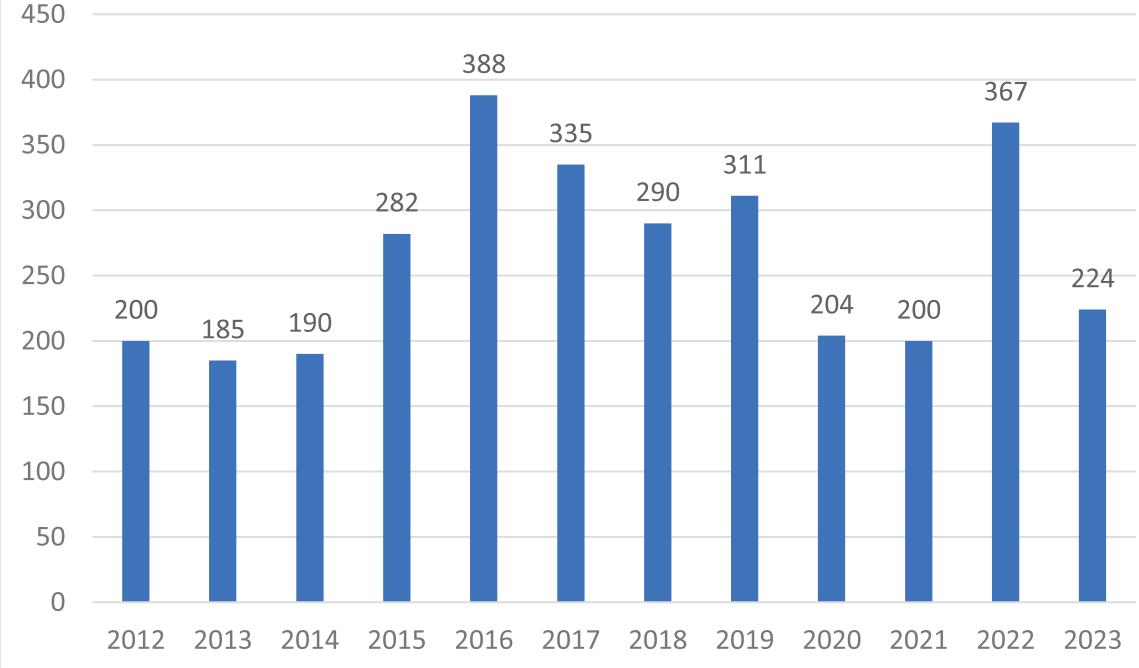
Results

The Instituto Nacional Materno Perinatal (INMP) is a health facility categorized as Level III-2, which corresponds to an institute specializing in maternal and perinatal care and is the most complex national reference center in the country for obstetric and neonatal complications. Its mission is to develop research in obstetric, gynecological and neonatal health, train health personnel and provide technical assistance at the national level, offering specialized obstetric and gynecological care to women in the different stages of life and to high-risk newborns[15].

The INMP has been registering cases of EMM since 2007, in the work carried out by FLASOG at the Latin American level. However, considering WHO criteria, records have been kept in accordance with PAHO and CLAP guidelines since 2017.

The registration of cases of EMM is carried out through the emergency service (ES) or the maternal intensive care service (MICS), and the Office of Epidemiology and Environmental Health (OEEH) monitors and reports to MINSA. Registered cases of EMM from 2012 to 2023 total 3,167 cases and, considering modifications to WHO inclusion criteria, from 2017 to 2023 there are a total of 1,931 registered cases (Figure 1)[16].

Figure 1. Number of cases of extreme maternal morbidity. Instituto Nacional Materno Perinatal 2012 – 2023.



Source: INMP. Office of Epidemiology and Environmental Health. Critical Care Department. Maternal Intensive Care Service. 2024.

Of the total 1,931 patients with EMM seen between 2017 and 2023, 207 (10.7%) cases were under 20 years, 1,303 (67.5%) cases were between 20 and 35 years and 421 (21.8%) were older than 35 years.

Figure 2 shows the etiology of EMM in INMP between 2017 and 2023, with the leading cause being preeclampsia with a total of 911 cases (47.2%), followed by postpartum hemorrhage with 359 cases (18.6%), other causes 206 cases, non-obstetric sepsis 174 cases, abortion 108 cases, second half of pregnancy hemorrhage 102 cases and obstetric sepsis 71 cases. In other words, nearly 50% of all cases of EMM were caused by preeclampsia. However, as the same figure shows, there has been a shift in the last two years, with postpartum hemorrhage taking first place as a cause of SCD, followed by preeclampsia[16].

The third cause of EMM is other diagnoses, which include: dengue, decompensated diabetes mellitus, appendicitis, breast cancer, anaphylactic shock, hyperthyroidism, tuberculous meningitis, parotitis, tetralogy of Fallot, operative wound hematoma, and qualitative platelet defects[16].

The sociodemographic characteristics of patients with EMM are shown in Table 1. The majority of patients (75.9%) had secondary education, followed by higher (8.9%), technical (7.8%) and primary (6.5%).

The majority of patients with EMM (74.5%) were in a stable union, followed by single (14.0%) and married with only 11.3%.

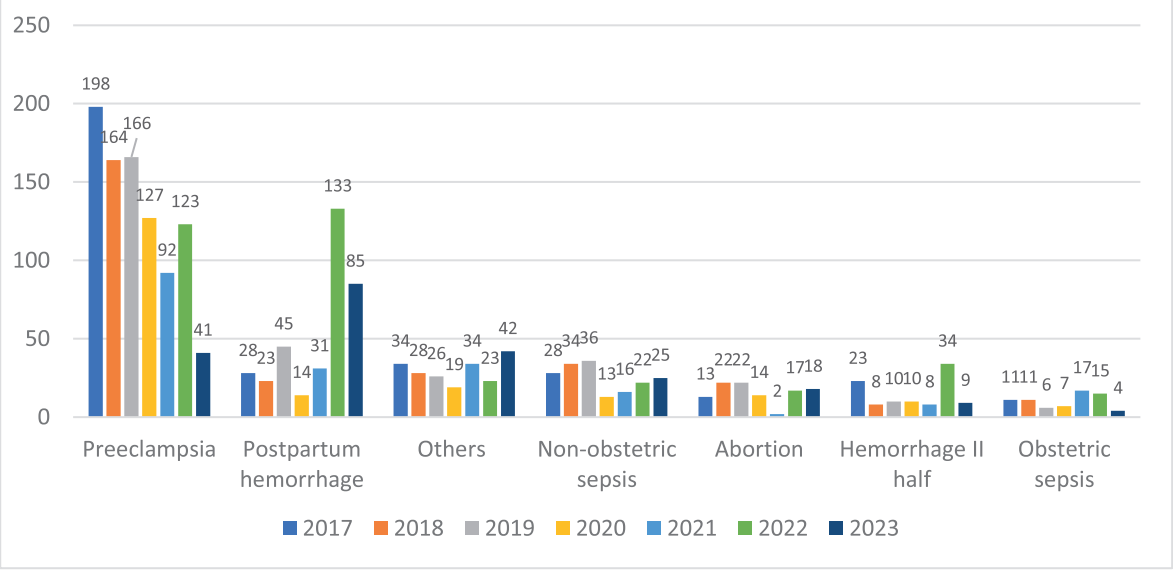
86.4% of the patients reported their occupation as housewife, followed by employee (6.2%), self-employed (4.9%) and student (2.4%).

Of the 1,931 patients with EMM, 923 (47.8%) were multiparous and 1,008 (52.2%) nulliparous.

There were 538 (27.9%) patients who had no prenatal check-ups, 955 (49.5%) had between 1 and 5 prenatal check-ups and 438 (22.7%) had more than 5 check-ups. It is noteworthy that the vast majority, 72%, had a prenatal check-up, but progressed to an EMM, which could be due to the fact that complications were not identified in a timely manner during the prenatal check-up and the corresponding referrals were not made to the third level of care[16].

Inclusion criteria for organ dysfunction are included in Figure 3. Liver, respiratory, coagulation, metabolic, renal, vascular, neurological and cardiac dysfunction were present. The most frequent dysfunctions between 2017 and 2020 were hepatic, respiratory and coagulation dysfunctions. From 2021 onwards, liver and respiratory dysfunctions started to decrease, with coagulation and cardiac dysfunctions taking first place. This change is due to the fact that the INMP is managing cases of preeclampsia early and preventing

Figure 2. Causes of extreme maternal morbidity, 2017 – 2023.

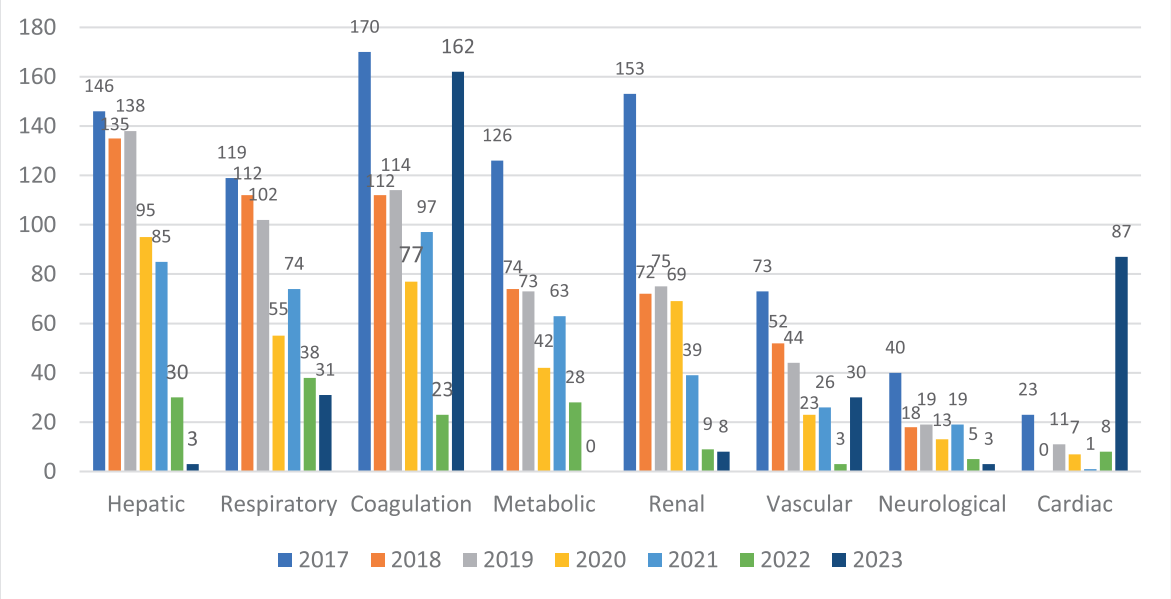


Source: INMP. Office of Epidemiology and Environmental Health. Critical Care Department. Maternal Intensive Care Service. 2024.

Table 1. Sociodemographic characteristics 2017–2023.

Variable	2017	2018	2019	2020	2021	2022	2023	Total	%
	N°	N°	N°	N°	N°	N°	N°		
Level of education									
Secondary	230	222	229	195	154	269	167	1466	75.9
Superior	35	19	39	2	20	36	22	173	8.9
Technical	31	30	25	1	18	39	18	162	7.8
Primary	39	19	17	6	7	21	16	125	6.8
Illiterate	0	0	1	0	1	2	1	5	0.6
Marital status									
Stable union	249	220	228	151	150	297	169	998	74.4
Single	52	41	43	28	24	31	22	188	14.0
Married	34	29	40	23	26	39	27	152	11.3
Other	0	0	0	2	0	0	6	2	0.3
Employment									
Housewife	260	245	261	199	158	357	188	1668	86.4
Independent	26	17	13	2	19	6	13	96	4.9
Employee	36	18	26	2	18	3	17	120	6.3
Student	13	10	11	1	5	1	6	47	2.4

Figure 3. Inclusion criteria for organ dysfunction in extreme maternal morbidity.

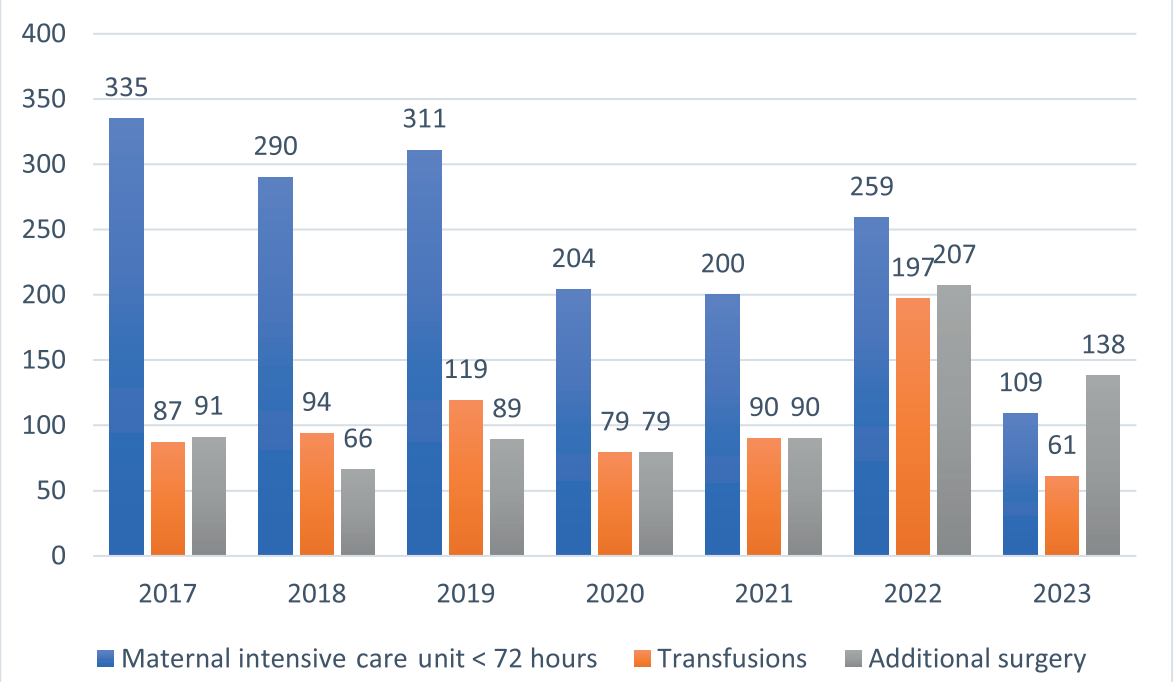


Source: INMP. Office of Epidemiology and Environmental Health. Executive Directorate of Obstetrics and Gynecology. Critical Care Department. Maternal Intensive Care Service. 2024.

them from evolving into HELLP syndrome, which has significant liver and coagulation dysfunction that evolves into EMM. As can be seen in Figure 2, there has been an increase in cases of postpartum hemorrhage and hemorrhage in the second half of pregnancy. Postpartum hemorrhage cases were frequently referred to the INMP for management in the MICS with transfusions of blood components. On the other hand, the INMP has seen an increase in cases of the placental accretism spectrum that cause hemorrhage in the second half of pregnancy, with coagulation and cardiac dysfunction, many of them presenting hypovolemic shock. They require specialized surgical management and transfusions of blood components. Thus, in 2023 alone, of the 224 cases of EMM, 138 cases (62%) required 1,722 transfusions of blood products[16].

Case management criteria are shown in Figure 4 and include admission to IMCS for more than 72 hours, blood component transfusions and

Figure 4. Management of extreme maternal morbidity cases.



Source: INMP. Office of Epidemiology and Environmental Health. Executive Directorate of Obstetrics and Gynecology. Critical Care Department. Maternal Intensive Care Service. 2024.

additional surgery. Between 2017 and 2022, the main management criterion has been admission to IMSC. However, since 2022, transfusions and additional surgeries rank first. Transfusions of hemocomponents respond to the increase in cases of postpartum hemorrhage and pregnant women with placental accreta, and the increase in additional surgery such as hysterectomy for postpartum hemorrhage due to uterine atony that did not respond to medical treatment or conservative surgical management, such as B-Lynch or Hayman type compressive sutures.

The clinical histories of pregnant women with MME are recorded in MINSA's formats, which allows us to have the data to elaborate the corresponding indicators shown in Table 2.

The EMM ratio assesses the prevalence of EMM. Its ideal value should be less than 8 x 1,000 live births. Its formula results from dividing the number of cases of EMM by the total number of live births and multiplying by 1,000. For the period 2017-2023 it has remained between 12.7 as the lowest value and 26.1 as the highest value, which shows that the prevalence is above the established values. The reason for this high prevalence is that the INMP is a tertiary level facility that receives referrals from Metropolitan Lima and all regions of the country.

Table 2. Extreme maternal morbidity outcome indicators.

Extreme maternal morbidity indicators	2017	2018	2019	2020	2021	2022	2023
EMM ratio	17.2	16.0	18.16	12.7	14.6	26.1	18.2
Death rate	3.2	2.4	1.9	1.9	1.9	0.8	0.6
EMM/MM ratio	30.5	41.4	51.8	51	50	173.5	112
Ratio criterion/ case	4.4	3.8	7.4	5.4	6.5	2.0	2.2

Source: INMP. Office of Epidemiology and Environmental Health. Executive Directorate of Obstetrics and Gynecology. Critical Care Department. Maternal Intensive Care Service. 2024.

The mortality index evaluates the quality of care of the service and its ideal target is less than 4%. Its formula results from dividing the number of maternal deaths x 100 by the sum of the number of MM and EMM cases. Since 2017, the case fatality indicator has been below 4%, with an average of 1.8 maternal deaths per 100 cases of MM. In 2023, the value was 0.6 maternal deaths per 100 EMM cases and is the lowest value from 2017 to 2023, demonstrating the improvement in the quality of care provided to EMM patients.

The EMM/maternal mortality ratio indicates the total number of pregnant women with EMM per maternal death. It also reveals the quality of care of the service and its target is greater than 35. Its formula results from dividing the number of

pregnant women with EMM by the number of maternal deaths. In the INMP, with the exception of 2017, all years the values have remained above 35. In 2023, for 112 cases of EMM there was one maternal death, which ratifies the good quality of care that translates into a decrease in maternal deaths in the INMP.

The criteria-to-case ratio demonstrates the severity of EMM and ideally should be less than 5. The formula is obtained by dividing the total number of inclusion criteria by the number of EMM cases. For 2023 it is 2.2.

Discussion

The INMP, a category III-2 health facility, has been registering cases of EMM since 2012. Between 2017 and 2023, 1,931 cases of EMM were reported according to PAHO and MINSA inclusion criteria, with an average of 276 cases per year until 2023. The years 2020 and 2021 we saw the lowest number of cases, with 204 and 200 cases of EMM respectively, probably due to the COVID pandemic.

The results obtained in the EMM indicators show that there is a high prevalence of EMM cases, well above international standards. In this period the prevalence was 17.6 per 1,000 live births, which is above the standard of 8 per 1,000 live births, demonstrating the high prevalence of EMM in the INMP.

Most cases of EMM were caused by preeclampsia with severity criteria; however, as of 2022 and 2023 obstetric hemorrhage has become the leading cause of MME. This is because the management of preeclampsia with severity criteria has been standardized, so care is timelier in the emergency department and in the maternal intensive care unit, preventing the progression of the disease. In the case of obstetric hemorrhage, there has been an increase in many cases of pregnant women with a history of previous cesarean section, total placenta previa and placenta accreta spectrum (PAS), all of them with a high risk of postpartum hemorrhage. As the INMP is the national reference center for critically ill pregnant women, it receives many referrals of pregnant women with these diagnoses. For this reason, a team of obstetrics and gynecology doctors specialized in the conservative surgical management of the placenta accreta spectrum has been set up in the Obstetrics Department B; the Emergency Department has also trained all obstetrics and gynecology doctors in such management. As a result, many cases are referred from PAS and are managed immediately or if hemodynamically stable are managed with scheduled surgery.

The majority of EMM cases in the INMP have a stable union, secondary education and are housewives. Only 22% of pregnant women with EMM have had six prenatal check-ups as recommended by MINSA, so prenatal visits should be insisted on at the first level of care so that patients at risk of preeclampsia and risk of postpartum hemorrhage can be detected for referral from the first trimester of pregnancy to the third level of care in Metropolitan Lima. These types of pregnant women at risk should also be derived from the first level of care in the regions to the regional hospitals. Unfortunately, these referrals are being made too late and the pregnant woman is at greater risk when the complications that lead to EMM occur.

Between 2017 and 2020 the main dysfunctions were liver, respiratory and coagulation dysfunctions, but from 2021 onwards coagulation and cardiac dysfunction ranked first. These dysfunctions can be adequately managed if a blood bank is available to provide globular packs, platelets, fresh frozen plasma and cryoprecipitate for the management of preeclampsia and hemorrhage. The INMP has an adequately implemented blood bank with all blood components. Cardiac dysfunction can only be managed in the maternal intensive care unit, where hydration is strictly monitored and vasoactive agents are used.

In order to manage cases of EMM, hospitals must have a maternal intensive care service, a blood bank, an emergency department with the capacity to perform damage control surgery such as pelvic packing, compressive sutures of the uterus and packing of the liver in cases of subcapsular hepatic hematoma. And it is essential to have a shock-trauma room in the emergency department, as time is of the essence in dealing with an obstetric emergency with a multidisciplinary team.

Since 2017, the mortality or lethality indicator is below 4%, with an average of 1.8 maternal deaths per 100 cases of EMM. In 2023, the val-

ue was 0.6 maternal deaths per 100 cases of EMM, and is the lowest value from 2017 to 2023, demonstrating a better quality of care provided to EMM patients.

In the INMP, with the exception of 2017, all years the EMM/MM ratio values have remained above 35. In 2023, for 112 cases of EMM there was one maternal death, which confirms the good quality of care provided.

Both indicators are within international standards and therefore maternal mortality is very low in these EMM cases.

The quantification of the EMM indicators allows the country to compare itself with other countries in the region since internationally standardized criteria are being used.

The recorded EMM cases allow institutional committees to identify the EMM case (prospective, retrospective) and to follow up and confirm that it did not progress to maternal death. It is a process similar to the analysis that is done with maternal death and allows the institution with low maternal mortality to extend the analysis to EMM[17].

This analysis has enabled the INMP to draw up improvement and intervention plans based on the EMM indicators, including the updating of obstetric keys in conjunction with PAHO, the increase in specialized human resources, the updating of clinical and procedural guidelines for obstetrics and perinatology, the improvement of the surgical skills of obstetrician-gynecologists for the packing of hepatic and pelvic subcapsular hematoma, the implementation of a shock/trauma unit in the emergency department, the strengthening of the maternal intensive care and neonatal intensive care services, the annual equipment replacement plan and preventive/corrective maintenance of biomedical equipment (in coordination with the biomedical engineering unit), the availability of 3 operating theatres 24 hours a day, the availability of a blood bank 24 hours a day, the availability of medicines and supplies 24 hours a day, among others. These plans have led to a decrease in maternal deaths in the last 5 years in the institute[16], contributing to the improvement of maternal health in the country.

It can be concluded that the EMM is a more frequent event than MM. It is a positive indicator, since it quantifies and characterizes women who, having presented a serious complication, manage to survive. It is a strategy adopted by WHO, PAHO, CLAP and MINSA to reduce maternal deaths.

It is necessary for all hospitals in Peru to register and report cases of EMM in order to improve the quality of care.

It is necessary to prevent the development of EMM in pregnant women from the first level of care of the health system, through the proper identification of pregnant women with risk factors and their timely referral to the second and third levels of care.

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