ANALYSIS OF MATERNAL MORTALITY RATIO PATTERN BY HYPERTENSION

Análise de padrão da razão de mortalidade materna por hipertensão

Análisis de estándar de la razón de mortalidad materna por hipertensión

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ABSTRACT

Objective: analyze the pattern of the maternal mortality ratio through gestational hypertension deaths in the counties of the State of Piauí from the years 2012 to 2016. **Method**: epidemiological study of a descriptive, comparative, longitudinal quantitative approach, carried out from records of maternal deaths caused by hypertensive disorders in Piauí, from 2012 to 2016. **Results:** a total of 46 maternal deaths from hypertension were identified. Of these, 12 were women with 8 to 11 years of schooling (26.1%), 19 (41.3%) were between 30 and 39 years of age, 33 (71.7%) were brown and 12 (26.1%) were single. **Conclusion:** it is fundamental that there is a commitment of managers and professionals to develop actions to promote women's health in the pregnancy-puerperal cycle in the various health services, in a decentralized way, through a qualified, humanized and integral care.

Descriptors: Maternal mortality; Hypertension pregnancy-induced; Underregistration; Women's health; Nursing care.

RESUMO

Objetivo: analisar o padrão da razão de mortalidade materna através dos óbitos por hipertensão associados à gestação nos municípios do Estado do Piauí, dos anos 2012 a 2016. **Método:** trata-se de um estudo epidemiológico descritivo, comparativo, longitudinal de abordagem quantitativa, realizado a partir de registros de óbitos maternos ocorridos por distúrbios hipertensivos no Piauí, de 2012 à 2016. **Resultados:** foram identificados 46 óbitos maternos por hipertensão, destes 12 mulheres possuíam escolaridade de 8 a 11 anos de estudo (26,1%), 19 (41,3%) tinham de 30 a 39 anos, eram 33 (71,7%) pardas e 12 (26,1%) solteiras. **Conclusão:** é fundamental que haja

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comprometimento de gestores e profissionais, para desenvolver ações de promoção a saúde das mulheres no ciclo gravídico-puerperal nos diversos serviços de saúde, de forma descentralizado, por meio de uma atenção qualificada, humanizada e integral.

Descritores: Mortalidade materna; Hipertensão induzida pela gravidez; Sub-registro; saúde da mulher; Cuidados de enfermagem.

RESUMÉN

Objetivo: analizar el patrón de la razón de mortalidad materna a través de las muertes por hipertensión asociadas a la gestación en los municipios del Estado de Piauí, de los años 2012 a 2016. **Método:** se trata de un estudio epidemiológico descriptivo, comparativo, longitudinal de abordaje cuantitativo, realizado a partir de registros de muertes maternas ocurridas por disturbios hipertensivos en Piauí, de 2012 a 2016. **Resultados:** se identificaron 46 muertes por hipertensión, de estas 12 mujeres tenían escolaridad de 8 a 11 años de estudio (26,1%), 19 (41,3%) tenían de 30 a 39 años, eran 33 (71,7%) pardas y 12 (26,1%) solteras. **Conclusión:** es fundamental que haya compromiso de gestores y profesionales, para desarrollar acciones de promoción a la salud de las mujeres en el ciclo gravídico-puerperal en los diversos servicios de salud, de forma descentralizada, por medio de una atención cualificada, humanizada e integral.

Descriptores: Mortalidad materna; Hipertensión inducida en el embarazo; Omisiones de registro; Salud de la mujer; Atención de enfermería.

INTRODUCTION

According to the World Health Organization[1], maternal mortality (MM) is defined as the death of a woman during pregnancy or within 42 days of its termination, regardless of the duration or location of pregnancy.

Worldwide, it is estimated that approximately 1.8 to 2.4 million (73.0%) maternal deaths occur due to direct obstetric causes and, for indirect causes, 672,000 (27.0%). Direct causes include puerperal pregnancy cycle diseases and, among indirect causes, complications of pre-existing pregnancy diseases.[2]

In emerging countries hypertensive disorders in pregnancy correspond to the largest causes of MM, equivalent to 60.0% of direct maternal deaths. This condition is characterized by blood pressure levels equal to or above 140 mmHg for systolic pressure and 90 mmHg for diastolic pressure.[3]

Regarding the magnitude of this problem, the United Nations (UN) has set a goal of reducing the maternal mortality ratio by 75.0% by 2015. Global estimates of the decline in this mortality show that the results achieved were not sufficient to reach the target in most countries.[4]

In Brazil, between 1990 and 2010, was observed a reduction in MM from 141 to 68 deaths per 100,000 live births (LB). This represents a drop of 51.0%.[5] In the State of Piauí (PI), between 2008 and 2011 the rate of MM was approximately 102 maternal deaths per 100 thousand LB, which is worrying since the figure found is 50.0% above the national rate for the year 2010.[6]

Given these data, it is extremely important for health professionals to perform a qualified prenatal care, aiming to identify factors that result in complications in pregnancy, in order to prevent them and contribute to reducing Maternal Mortality Ratio (MMR).[7]

A study such as this is important to present the real health situation of this public, so that strategies for maternal death prevention and health promotion of pregnant women are elaborated and implemented in health services, to qualify the care provided.

Given the above, this research aims to analyze the pattern of maternal mortality ratio through deaths from hypertension associated with pregnancy in the municipalities of the state of Piauí, from 2012 to 2016.

METHOD

This is a descriptive, comparative, longitudinal epidemiological study of quantitative approach, conducted from the records of maternal deaths due to hypertensive disorders in the municipalities of Piauí, from 2012 to 2016. Obtained in the Mortality Information System (Sistema de Informações de Mortalidade – SIM), contained in the *webpage* of the Department of Informatics of the Unified Health System (Departamento de Informática do Sistema Único de Saúde – DATASUS).

Data collection was performed in October 2018, considering the following variables: number of maternal deaths per year of registration, municipality of residence of the woman, age at the time of death, marital status, education and race/color.

Deaths were considered from the International Classification of Diseases - ICD version 10 (ICD-10): pre-existing hypertensive disorder with overlapping proteinuria (O11); gestational hypertension (pregnancy-induced) without significant proteinuria (O13); gestational hypertension (pregnancy-induced) with significant proteinuria (preeclampsia) (O14); eclampsia (O15); and unspecified maternal hypertension (O16). For they represent direct obstetric causes of death.

To obtain MMR from 2012 to 2016, maternal deaths from hypertension were added. The resulting value was divided by the number of LB (at the same place and period of maternal deaths) then multiplied by 100,000.

The collected data were tabulated using the *software Microsoft Excel for Windows*, version 2016. In the descriptive and inferential statistical analysis we used the Analysis of Variance (ANOVA), Correspondence Analysis (CA) and Cluster Analysis (ClA), which were performed using the free distribution *software* PAST 3.14.

ANOVA was used to identify significant differences in the municipalities' MMR values per year. The CA and ClA were implemented in a complementary manner, the first used to separate municipalities into groups, characterized by similarities of MMR values, allowing as a result the allocation of municipalities in a two-dimensional graph (the correspondence map) through the linear combination of two axes (Axis 1 and Axis 2). The map allows to identify the distances between municipalities visually.

To confirm the hypothesis raised in CA, ClA was performed through hierarchical procedures with simple binding clusters.

The Gower[8] metric was applied in the ClA procedures, due to its flexibility of adaptation to data of varied natures.

As it is a study that analyzes secondary data, made available publicly and with free access on the web, the study evaluation waiver was considered by the Research Ethics Committee (Comitê de Ética em Pesquisa – CEP), based on the recommendations of Resolution No. 510/2016 of the National Research Ethics Commission (Comissão Nacional de Ética em Pesquisa – CONEP).[9]

RESULTS

From 2012 to 2016, 46 maternal deaths from hypertension were identified in the state of Piauí. Maternal deaths are described below, according to the sociodemographic variables of the population studied (Table 1).

Table1 - Characterization of maternal deaths from hypertension. Piauí, Brazil

| VARIABLES	Maternal Deaths from Hypertension	
	N	%
Schooling		
Never studied	4	8,7
1 to 3 years of study	4	8,7
4 to 7 years of study	10	21,7
8 to 11 years of study	12	26,1
≥ 12 years of study	5	10,9
Ignored	11	23,9
Age		
< 15 years old	1	2,2
15 to 19 years old	8	17,4
20 to 29 years old	16	34,8
30 to 39 years old	19	41,3
≥ 40 years old	2	4,3
Color/race		
Brown	33	71,7
White	8	17,4
Black	3	6,5
Asian	1	2,2
Ignored	1	2,2
Marital status		
Single	12	26,1
Married	11	23,9
Other	11	23,9
Ignored	10	21,7
Widow	1	2,2
Judicially divorced	1	2,2

Source: researchers themselves.

According to Table 1, it was observed that from the records, 12 had 8 to 11 years of schooling (26.1%). Regarding age, 19 (41.3%) were between 30 and 39 years old, 33 (71.7%) were brown and 12 (26.1%) were single.

With the application of ANOVA it was found that there is no statistically significant variation between the MMR values of the municipalities over the years (p-value 0.876). It can be seen, then, that the MMR values remained constant. Given this result, it was decided to implement CA and ClA.

After CA processing, it was evidenced the distribution of municipalities in seven groups, which were called *clusters* A, B, C, D, E, F and G, respectively (Figure 1). The inertia is adjusted for the first two dimensions (axes) with a percentage of 51%, being 25.6% of the first dimension and 25.4% of the second dimension. Due to the similar inertia value for both dimensions, we observed a balanced dispersion of municipalities on the map (Figure 1).

Figure 1 - MMR correspondence map of the municipalities. Piauí, Brazil
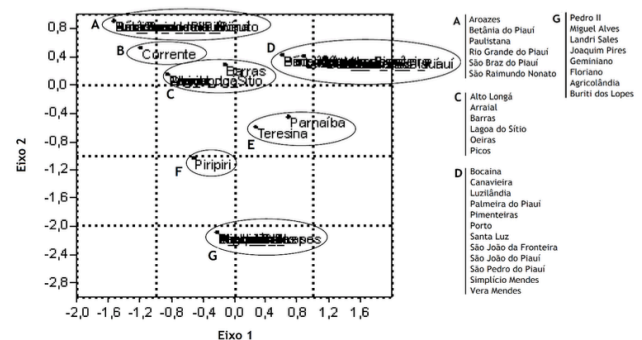
Each group, in the correspondence map, has its own peculiarities that refer to the characteristics of the MMR over the years. To characterize the size of the municipalities, the following parameters were used: small size I (up to 20 thousand inhabitants), small size II (between 20 and 50 thousand inhabitants), medium size (between 50 and 100 thousand inhabitants), and large size (over 100 thousand inhabitants).

It fits in the group 'A', small municipalities II as São Raimundo Nonato and Paulistana. In 'B' is only the municipality of Corrente, small II. In the 'C' is the medium-sized municipality of Picos. The 'D' group encompasses small municipalities II such as Luzilândia and São João do Piauí. The group 'E' contains the capital Teresina and the municipality of Parnaíba, both large size. The 'F' contains only the medium-sized Piripiri municipality and in the 'G' group there is the medium-sized Floriano municipality.

Figure 2 - Dendrogram with distribution of municipalities. Piauí, Brazil
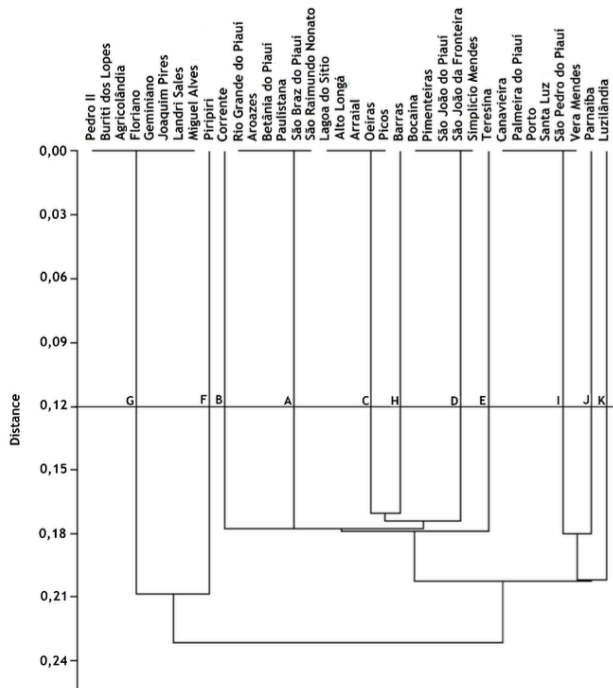
For ClA, the first three dimensions (axes) obtained through CA were used, with a percentage of 75.8% of explained variance.

After performing this analysis, an agglomerative coefficient of 0.8212 was obtained through the metric used. This made it possible to delineate the characteristics of the groups from the visual analysis (the dendrogram) of the distribution of the municipalities in the groups, showing the distribution of the municipalities in eleven groups: A, B, C, D, E, F, G, H, I, J and K, respectively (Figure 2).

In groups 'A', 'B', 'F' and 'G' there were no changes regarding CA. In 'C', the shift from Barras municipality to group 'H' occurred. In the group "E", the municipality of Parnaíba was displaced, generating the group "J". However, it was the 'D' group where the most displacement of municipalities occurred. From the group 'D' was generated the group 'I', containing only small municipalities I, and the group 'K', which comprises only Luzilandia, a small size II municipality.

In table 2, it is possible to observe the distribution of the 11 groups obtained in ClA with the values of LB, maternal deaths from hypertension and MMR.

Table2 - Distribution of LB, maternal deaths from hypertension, and MMR, in groups generated by ClA. Piauí, Brazil

Variables by year	Groups										
	A	B	C	D	E	F	G	H	I	J	K
2012											
LB	1167	422	1693	724	13813	847	2749	757	636	2293	420
Death	-	-	-	-	2	1	8	-	-	1	-
MMR	-	-	-	-	15	118	291	-	-	44	-
2013											
LB	1154	410	1676	695	13356	940	2538	765	648	2281	388
Death	-	1	5	-	-	1	-	1	-	-	-
MMR	-	244	298	-	-	106	-	131	-	-	-
2014											
LB	1228	422	1808	703	13934	956	2819	706	633	2319	399
Death	-	-	-	-	-	-	-	-	6	2	1
MMR	-	-	-	-	-	-	-	-	948	86	251
2015											
LB	1278	441	1868	778	13976	1002	2947	780	660	2434	400
Death	-	-	-	5	3	-	-	1	-	-	1
MMR	-	-	-	643	22	-	-	128	-	-	250
2016											
LB	1244	410	1746	772	13474	955	2651	731	619	2319	343
Death	6	1	-	-	-	-	-	-	-	-	-
MMR	482	244	-	-	-	-	-	-	-	-	-

ISSN 2175-5361
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DOI: 10.9789/2175-5361.rpcfo.v12.8970
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Group 'G' had the highest maternal deaths from hypertension, eight (17.4%), compared to the number of LB, group 'E' predominated with 68,553 (53.5%), the year 2012 accounted for the most maternal deaths from hypertension, 12 (26.1%). In 2014 group I had the highest MMR value for hypertension, with 948 maternal deaths from hypertension for 100,000 LB.

From maternal deaths due to hypertension in the State of Piauí, it is demonstrated which sociodemographic characteristics predominated in each group, obtained by ClA (Table 3).

According to Table 3, it was observed that in the groups predominated, the ignored education and from 4 to 7 years of study, from 30 to 39 years, brown, and married.

Table3 - Distribution of predominant sociodemographic characteristics in groups generated by CIA. Piauí, Brazil

Groups of CIA	Predominant Sociodemographic Characteristics			
	Schooling	Age	Color/race	Marital status
A	Never studied / 4 to 7 years of study	20 to 29 years old	Brown	Ignored
B	≥ 12 years of study / Ignored	30 to 39 years old	Brown	Other
C	8 to 11 years of study	30 to 39 years old	Brown	Married
D	4 to 7 years of study / ≥ 12 years of study	30 to 39 years old	Brown	Other
E	8 to 11 years of study	30 to 39 years old	Brown	Ignored
F	Never studied / Ignored	15 to 19 years old / 30 to 39 years old	Brown	Single / Married
G	Ignored	30 to 39 years old	Brown	Single / Married
H	Ignored	20 to 29 years old	Brown	Ignored
I	4 to 7 years of study	20 to 29 years old	Brown	Single
J	8 to 11 years of study	20 to 29 years old / 30 to 39 years old / ≥ 40 years old	White	Single / Married / Divorced
K	4 to 7 years of study / ≥ 12 years of study	15 to 19 years old / 30 to 39 years old	Asian / Brown	Married / Other

DISCUSSION

Between 2012 and 2016 there were 46 maternal deaths from hypertension in the State of Piauí, from 2009 to 2013 there were 8,470 maternal deaths in Brazil. Of these, the Northeast region accounted for 2,979 (35.2%). It is noteworthy that these deaths are due to direct obstetric cause, representing a challenge for health professionals, because indices such as these result from preventable causes, because they depend on the quality of care provided during the pregnancy-puerperal period.[10,11]

After the survey of these deaths, some sociodemographic variables were analyzed: education, age, color/race and marital status. According to Dias[12], aspects such as these, associated with the socioeconomic pattern, are capable of demonstrating that there is a more vulnerable population with a high risk of complications during pregnancy, childbirth and the puerperium.

When investigating the education of women who died, it was observed that the majority, 12 (26.1%) were classified in 8 to 11 years of study. In Brazil from 2009 to 2013, 27.0% of the cases had schooling from 8 to 11 years.

In the Northeast, however, there was a predominance with 26.3% of the cases with ignored education.[11]

It is extremely important to point out that a significant portion of women with low education may not have adequate follow-up, negatively interfering in their adherence to the guidelines provided since prenatal delivery, as they are essential to reduce the risk of death, especially in preventable causes.[13]

Regarding the age group, the most prevalent was 30 to 39 years, with 19 (41.3%) cases. In a study conducted in the State of Alagoas from 2004 to 2013, about MM by gestational hypertensive syndromes, similar result was verified, with 20 (40.0%) records, aged between 30 and 39 years. It is clear that maternal age greater than 35 years is considered a pre-existing gestational risk factor, which requires special attention during prenatal care.[3]

Regarding color/race there was a predominance of maternal deaths in brown women with 33 (71.7%) records. In the state of Amazonas, an epidemiological study on MM, indicates a predominance of deaths in brown women with 236 (71.7%) in the capital and 146 (62.1%) in the interior of the state.[14]

ISSN 2175-5361
Oliveira ETA, Cavalcante AEO, Santos LCM et al.

DOI: 10.9789/2175-5361.rpcfo.v12.8970
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These results are in line with the research by Theophilo[15], which highlights the vulnerability found in black or brown women; this serves as a warning to the whole society and especially the public power. Reinforcing the need to ensure the principle of equity in care to provide adequate care to this population.

Regarding marital status, deaths of single women prevailed, with 12 (26.15%). In the State of Maranhão, from 2006 to 2010, there were 388 (67.0%) deaths of married women, followed by 126 (21.7%) single women.[16]

The higher frequency of single women may be related to the lack of family structure, break of bond between the baby's parents, incoherent decision-making in finding a pregnancy as well as lack of family support.[17]

Statistical analyzes such as ANOVA, AC and ClA were employed. In ANOVA, p-value 0.876 was verified, confirming the absence of significant statistical variation between the MMR values of the municipalities over the years. Noting that there was no reduction in maternal deaths from hypertension over the years, as the values of MMR between municipalities remained constant.

In a survey conducted in Brazil from 2009 to 2013, the MMR was calculated, in 2009 a rate of 64.96 was obtained, and in 2013 the rate was 58.06, highlighting the reduction of this value. The same study provided data on the northeast region, in 2009 the MMR rate was 72.99 and in 2013 75.11. During these years MMR remained constant, with an increase of 2.9% in 2013.[11]

Figure 1 allowed us to identify the distribution of municipalities through the CA, which demonstrated the creation of groups from the agglomeration of municipalities in geographically close locations. The municipalities found in the center of the correspondence map have a lower MMR, while those that scattered to the periphery have a high rate of MM.

Priority was given to implementing ClA, as it allowed the use of three dimensions (axes) obtained through CA, with a percentage of 75.8% of explained variance. The dendrogram shown in figure 2 shows the 36 municipalities of the State of Piauí distributed in eleven groups, according to their similarities, which are evident when analyzing them in accordance with Table 2.

Since the value of MMR is derived from the number of LB and maternal deaths from hypertension that occurred in the same year, the groups that contain large municipalities have lower rates of MMR when compared to the small and medium size groups, this is observed in the 'E' and 'J' groupings.

Regarding the use of CA and ClA related to MMR, it allowed a detailed view of the municipalities by distributing them in groups, because when analyzing the general situation of the State of Piauí, the large municipalities mask the reality of the smaller municipalities in the state scenario. In this regard, Leal[18] acknowledges that antenatal care coverage is almost universal in Brazil. However, there is a shortage and disparities, especially in small and medium-sized municipalities, regarding coverage and quality of care according to socioeconomic class and place of residence. This probably contributed to the maintenance of high MM rates.

The group "G" is the one that encompasses the most municipalities, so it was found that the largest record of maternal deaths, with eight (17.4%) cases. Among the groups, 'E' obtained the lowest MMR value, with 14.5 per 100,000 LB in 2012. This result is close to that observed in developed countries, such as Canada and the United States, with values, respectively, of 12 and 21 maternal deaths per 100,000 live births.[12] Considering that the analyzed MMR only includes the records associated with hypertensive disorders, it is noteworthy rates presented in other groups are high.

Whereas in 2015 global maternal mortality was around 210 deaths per 100,000 LB. The reduction in MM has been included as targets in the Millennium Development Goals (MDGs) proposed by UN; in Brazil, the target for 2030 is to reduce to 20 deaths per 100,000 LV.[19]

In Table 3, it was possible to analyze the prevailing sociodemographic characteristics in each of the groups, the groups with the most deaths showing characteristics prone to social vulnerability, related to the low education and color/race of these women who died. As a sensitive indicator of social inequality, MM reflects the degree of socioeconomic development in each region. Therefore, the least developed places in the country have high rates of MM.[12]

CONCLUSION

Based on the findings presented, it is confirmed that the study achieved its proposed objective. We observed 46 maternal deaths from hypertension in the state of Piauí, from 2012 to 2016. Most of them were women with 8 to 11 years of schooling, from 30 to 39 years old, brown, and single.

Regarding the ClA that confirms CA, observed the distribution of municipalities in eleven groups, from 'A' to 'K', of which group 'G' had more records of maternal deaths from hypertension (08), group 'I' presented in 2014 the highest value of MMR (948 per 100 thousand LB).

However, the study was limited by the probable underreporting or non-notification of deaths resulting from the pregnancy-puerperal cycle, since the absence of these data results in the lack of investments for actions that qualify care.

Therefore, further investigations are suggested to evaluate both the assistance of health professionals and the (in)completeness of filing death certificates, in order to identify possible failures to intervene.

Thus, it is essential that managers and professionals commit themselves to developing permanent education actions to contribute to the promotion of women's health in the pregnancy-puerperal cycle in various health services, in a decentralized manner, preventing maternal and/or fetal complications and deaths through qualified, humanized and comprehensive care.

ISSN 2175-5361
Oliveira ETA, Cavalcante AEO, Santos LCM et al.

DOI: 10.9789/2175-5361.rpcfo.v12.8970
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Disclosure: The authors claim to have no conflict of interest.