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Maternal Death and Potential Years of Life Lost (PYLL) in Santa Catarina, Brazil, in 2000 and 2014

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Abstract

Introduction: Indicators of maternal health are often used to evaluate the social development and overall health of a population, as well as the accessibility of health services. Among these indicators, the Potential Years of Life Lost, which is associated with maternal deaths, is useful for the definition of priorities, monitoring, evaluation, and intervention, identifying the highest risk groups. Objective: To analyze the Potential Years of Life Lost by maternal death in Santa Catarina in 2000 and 2014. Method: An Ecological study with exploratory spatial analysis was conducted with data obtained from the Information System on Mortality and Live Births. Results: In the Information System, 35 maternal deaths in the year 2000 were identified and 24 in 2014. The total estimated years of life lost were 845 years in 2000 and 780 years in 2014, dominated by direct obstetric causes. In 2000, women who died lost, on average, 39.8 years of life; and 41.5 years in 2014. Conclusion: The spatial pattern observed in 2000 highlights areas of high risk in different regions of Santa Catarina. The greatest loss of years occurred in younger women, confirming the need to prevent and control maternal mortality and review strategies for compliance with public policies in the State.

Keywords

Maternal Mortality, Potential Years of Life Lost, Causes of Death

1. Introduction

Maternal health indicators, particularly those related to mortality, are used to assess the degree of social development and whether reproductive rights of women are being upheld [1] [2]. In 22 European countries where data are available, the Maternal Mortality Ratio (MMR) was recorded as, on average, 6.3 per 100,000 live births, ranging from 0 to 29.6. The highest MMR was reported in Estonia, with 29.6 per 100,000 live births and the lowest was in Malta with zero. For Austria, Belgium, France and Hungary, the MMR was around the EU average (6.2 per 100,000 live births), while Sweden and Greece had 2.0 maternal deaths per 100,000 live births [4].

Among the causes of maternal deaths, severe bleeding during pregnancy or childbirth occupies the first place. Between 2003 and 2009, hemorrhage, hypertensive disorders and sepsis were responsible for more than half of all maternal deaths worldwide [3]; while pre-existing diseases such as diabetes, AIDS, malaria, and obesity caused 28% of maternal deaths [3] [5].

In Brazil, the reduction of maternal mortality (MM) over the years has slackened. The factors that have contributed to its decline include the improvement in women's education, increased urbanization and changes in the role of women in society, with greater access to the job market, and the reduction in the number of children per woman. In addition to these, there is the expansion of basic health services, with increased coverage of family planning and prenatal services, which have been accompanied by excessive medicalization of pregnancy and child birth contributing to high cesarean section rates, episiotomies and multiple ultrasound examinations [6].

While estimates suggest a decline, over the years, information on maternal mortality in Brazil indicates an under-registration of maternal deaths due to the inadequate completion of registered causes of death [7].

Maternal mortality in Brazil has been directly associated with living conditions, with differences between socioeconomic regions observed [8] [9]. In addition, obstetric complications are the main cause of hospitalization for women of reproductive age, accounting for 26.7% of all admissions in 2008 [6].

The reduction in maternal mortality may be related to underreporting and the low number of investigations into maternal deaths. This is also due to a lack of financial resources, aggravated by inadequate management of the applications to investigate deaths, a discontinuation of relevant programs, inadequate training and management of health workers, and difficulties in securing professionals in regions that are most in need [9] [10].

To reduce mortality rates further, it is necessary to analyze and gain a better understanding of premature mortality. This parameter is very useful for planning and setting priorities in health, monitoring, and evaluating intervention programs and identifying groups of women at greater risk [9].

Premature mortality can be analyzed using the Potential Years of Life Lost (PYLL) indicator. In the calculation of the PYLL, greater weight is attributed to

the deaths of younger people. Thus, its use provides a better comparison in causes of death [11] [12] [13].

Therefore, with the PYLL, deaths occurring premature are quantified, which provides an important social indicator [14]. When a death occurs at a stage of life when greater productivity and creativity can occur, it not only deprives the individual, but the collective society, as a whole.

In the state of Santa Catarina, Southern Brazil, the maternal mortality ratio (MMR) was 43.3/100,000 live births, from 1996 to 2005 [15]. From 1996 to 2002, there were 294 maternal deaths. In this period, the average MMR rose from 44.7 to 71 deaths per 100,000 live births, when the correction factor of 1.83 was applied. This historical series analysis showed that there was no downward trend of the MMR in the period, but an increase in the last two years [16].

In this study, the authors analyze the Potential Years of Life Lost by maternal death in Santa Catarina in 2000 and 2014.

2. Methods

This is an ecological study with an exploratory spatial analysis, in which the data of maternal deaths occurring in the state of Santa Catarina, Brazil, in the years 2000 and 2014 are compared, with gross and smoothed rates of PYLL calculated.

The spatial distribution was disaggregated [17] [18] [19]. The instability of the gross rates was corrected to help overcome less populated areas using spatial smoothing by the empirical Bayesian estimator [20]. Thus, municipalities with smaller populations will have a greater correction and cities with larger populations will have little change in their rates [21].

The 2000 and 2014 data analysis also include a comparison of the number of maternal deaths, the maternal mortality ratio (MMR), the total number of maternal PYLL, the mean number of PYLL and the mean age of women at death, with the percentage differences observed across the period. The indicators were grouped by direct and indirect causes of maternal death, as well as unspecified causes, since identifying their causes is essential to defining strategies to target their reduction [3]. Causes were grouped according to the classification of the Tenth Revision of the International Classification of Diseases—ICD 10 [22].

The following variables from the death certificate of women were extracted: age at death between 10 and 49 years [23][1], place of residence in Santa Catarina, and the underlying cause of death. Deaths with the age of the woman and/or place of residence missing were excluded from the analysis.

The maternal mortality records of the Mortality Information System (SIM) and the Information System on Live Births (SINASC) of the Department of Informatics of the Brazilian National Health System (DATASUS) were used to calculate the MMR [24].

The potential years of life lost were calculated for each group studied, using the traditional estimation technique [14]:

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[1]BRASIL. Ministério da Saúde. Gabinete do Ministro. Portaria N˚ 1.119, de 5 de junho de 2008. http://bvsms.saude.gov.br/BVS/SAUDELEGIS/GM/2008/PRT1119_05_06_2008

$$\text{PYLL} = \sum_{i=\text{lower limit}}^{\text{upper limit}} ai \times di$$

where:

ai = the number of years of life remaining up to the upper limit considered, when death occurs between the ages of i and $i = 1$ years;

di = number of deaths occurring between the ages of i and $i + 1$ years, using the adjustment of 0.5 when it is estimated that all deaths occurred in the middle of the year.

The PYLL was calculated for each age group, multiplying the number of deaths by the average number of years of life remaining up to the age of 70 years. Total PYLL was obtained by the sum of the potential years of each age group, for each proposed group: deaths due to direct, indirect and unspecified obstetric causes.

The mean number of PYLLs (PYLL/death) was also calculated to express the average number of years lost per death by a given cause. The number of PYLL for each type of cause was divided by the number of deaths due to this type of cause. The PYLL rate was obtained by the quotient of the total number of PYLL and the population of women of childbearing age (WOCBA) in a given period, multiplied by 100,000. The gross PYLL rate expresses the number of years lost for every 100,000 women of childbearing age.

The units of spatial analysis were the 293 municipalities of the state of Santa Catarina.

3. Results

The total number of maternal deaths in the state of Santa Catarina in 2000 and 2014 was 35 and 24 deaths, respectively. Table 1 shows the data obtained in the descriptive analysis and the PYLL for each group of deaths due to obstetric causes.

At the time interval studied, there were no changes in the ranking of the causes of death, with direct maternal death being the main cause of the loss of PYLL, totaling 845 years in 2000 and 780 years in 2014. Hypertensive disorders, termination of pregnancy, and hemorrhage were the main causes that led to death. The proportion of deaths from unspecified causes fell by 50%, from 8.6% in 2000 to 4.2% in 2014.

The municipalities of Criciúma, Chapecó, and Itajaí (with more than 100,000 inhabitants each) had the highest total number of PYLL in 2000. The same occurred in 2014, particularly in the municipalities of Itajaí, Blumenau, and Joinville (with more than 100,000 inhabitants each) and Caçador with approximately 80,000 inhabitants.

The average age of women at death occurred earlier, from 30.2 years in 2000 to 28.5 years in 2014, considering all groupings of causes. However, deaths from indirect causes occurred at the lower average maternal age of 27 years in 2014.

The PYLL/death revealed an increase in the average number of years lost

Table 1. Indicators grouped by direct, indirect and unspecified maternal causes of death in 2000 and 2014, Santa Catarina, Brazil.

Year	Direct causes	Indirect causes	Unspecified causes	Total
Maternal deaths				
2000	21	11	3	35
2014	19	4	1	24
% Difference	−9.5	−63.6	−66.7	−31.4
Maternal Mortality Ratio				
2000	22.1	11.6	3.2	36.9
2014	20.4	4.3	1.1	25.7
% Difference	−8.0	−63.0	−66.1	−30.3
Potential Years of Life Lost				
2000	845	430	118	1393
2014	780	173	42	995
% Difference	−7.7	−59.8	−64.4	−28.6
PYLL/Death				
2000	40.2	39.1	39.3	39.8
2014	41.1	43.3	42.0	41.5
% Difference	2.0	10.6	6.8	4.2
Mean age of death				
2000	29.8	30.9	30.7	30.2
2014	28.9	26.8	28	28.5
% Difference	−2.7	−13.5	−8.7	−5.5
PYLL rate				
2000	48.0	24.42	6.70	79.1
2014	37.4	8.29	2.01	47.7
% Difference	−22.2	−66.1	−70.0	−39.8

across all three groupings of causes. In 2000, women lost 39.8 years; while in 2014, there were 41.5 years lost, on average.

The rate of PYLL decreased by 40%, from 79.1 years in 2000 to 47.7 PYLL per 100,000 women of childbearing age in 2014. Direct causes remained the most significant cause of death in the population.

In Figure 1, State maps displaying the Gross PYLL Rate for the years 2000 and 2014 are presented. 268 (91.46%) municipalities were found to have a zero rate. Subsequently, the rate was calculated for only 25 municipalities where maternal deaths occurred in 2000. In 2014, there were 277 (93.89%) municipalities with a zero rate, and 18 with the occurrence of maternal death.

The gross PYLL rates that stood out for the high values in the year 2000 were municipalities with a small population: Bela Vista do Toldo, Nova Itaberaba,
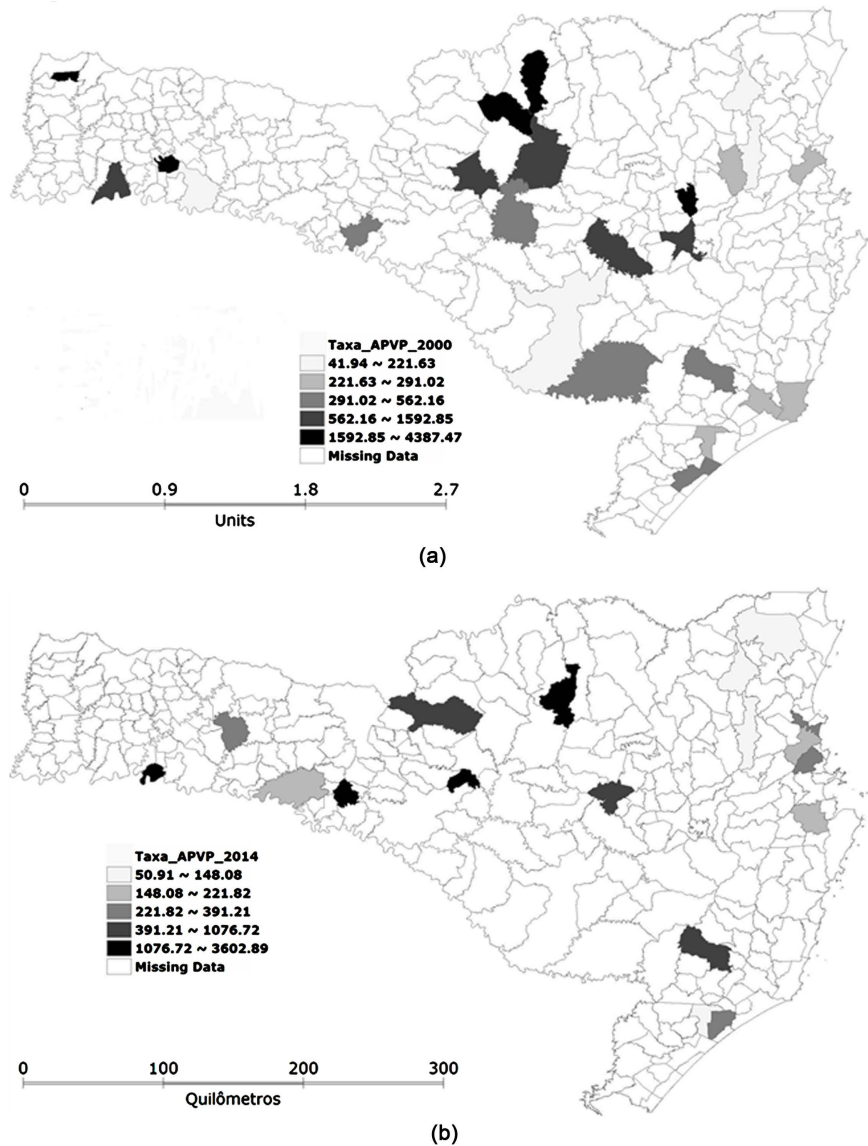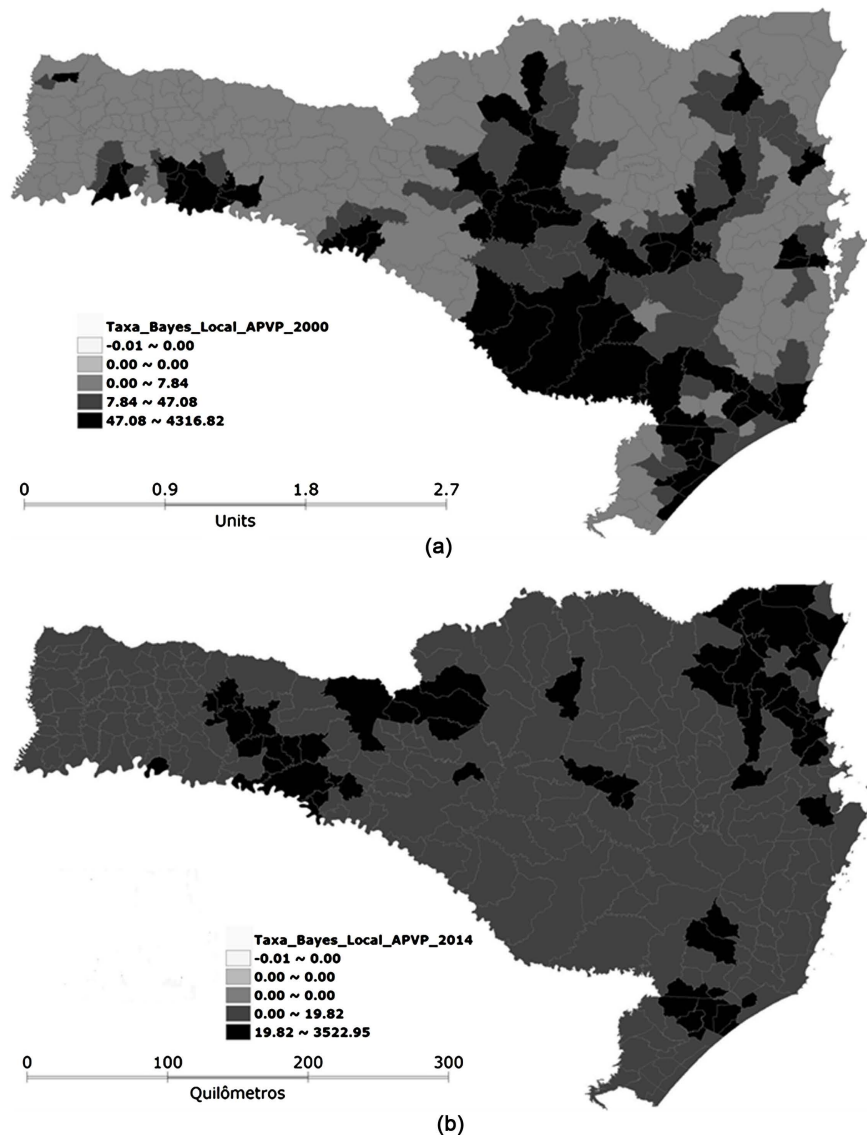
Figure 1. Spatial distribution of PYLL rates for maternal deaths in women of childbearing age in 2000 (a) and 2014 (b), Santa Catarina.

Guarujá do Sul, Timbó Grande, and Lontras. In 2014, the municipalities of Caxambu do Sul, Ouro, Monte Castelo and Monte Carlo also maintained high values.

In **Figure 1**, a spatial pattern can be observed in 2000 in the municipalities of the Alto Vale do Rio do Peixe (Curitibanos, Fraiburgo, Santa Cecília, Timbó Grande and Lontras); while in the year 2014, a random distribution of rates was identified.

The PYLL rates smoothed by the local Bayesian method demonstrate a regional pattern for 2000 and 2014. After spatial smoothing, the municipalities no longer presented zero values, as they incorporated in their estimated rates the underlying pattern of the region in which they are inserted. **Figure 2** shows the smoothed rates, ranging from 7.84 to 4.316.82 PYLL/100,000 women of

Figure 2. Spatial distribution of local Bayesian rates of PYLL for maternal deaths in women of childbearing age in 2000 (a) and 2014 (b), Santa Catarina.

childbearing age in 2000 and from 19.82 to 3.522.95 PYLL/100,000 in 2014. The spatial pattern in 2000 is highlighted by the increase in areas with a high risk of PYLL in different regions of the State.

4. Discussion

The results reported herein show that, in Santa Catarina, there was a reduction in maternal mortality between 2000 and 2014, which was lower than estimates presented in a previous Brazilian study [2]. Despite the downward trend in the period 1990-2011, the results indicate that the MMR values in Brazil are still high, being 3 to 4 times higher than estimates reported in comparable developed countries at the beginning of the 2010 decade.

Reducing maternal mortality is a policy commitment in Brazil, given that its

government endorsed an agreement to target its reduction and in so doing, the objectives of the Millennium Development Goals and subsequent Sustainable Development Goals. Therefore, maternal and child health indicators should be analyzed through government actions to promote social and economic development [6].

The reduction of MM observed in the state of Santa Catarina requires further research in the form of surveys and time series analysis, for an in-depth assessment and further investigations. Among these investigations there is the life history of women and the occurrence of diseases that may adversely impact on their health in the pre-conception period and may not receive adequate attention, with adequate diagnosis and ongoing treatment before, during and after gestation. It is also necessary to consider whether maternal deaths are associated with a low demand for health services by women leading up to death, a low capacity of health services in the 293 municipalities in the State, a low quality of health records and minimal investigation into the cause of death in women of child bearing age.

It should be noted that the Death Certificate, in Brazil, is completed by a doctor who often did not care for or treat the woman during pregnancy, which may be a determining factor in the lack of recognition of the antecedent causes leading to death [25]. In addition, the quality of clinical data and diagnoses recorded in medical-hospital charts and maternity records does not necessarily match the physician's statement n the death certificate [26]. Although, it is recognized that the quality and validity of mortality data depends primarily on the quality and accuracy of the death certificate [13].

Ongoing efforts to qualify birth registries, and thus increase reliable data on pregnancy-related mortality, with the use of household surveys and censuses should be encouraged and, thus, improve global indicators of maternal mortality. It is also necessary to monitor female mortality from all causes to help track maternal mortality [27].

Despite the coverage of the health services, maternal deaths, related to the prenatal, childbirth and postpartum period, did experience a reduction (9.5%) in the time period studied. The causes of death (hypertensive disorder, termination of pregnancy and hemorrhage) continued to be observed. These causes are considered to be avoidable through adequate attention to women during pregnancy and the puerperal period. This situation demonstrates the need for a review and appropriate changes to the schedule and model of prenatal care and delivery offered in the State. The prevalence of direct obstetric causes, represented by arterial hypertension and hemorrhage, followed by puerperal infection and termination of pregnancy has also been identified in other Brazilian States [28] [29].

In order to reduce maternal morbidity and mortality, well-structured maternity services must be ensured, with the implementation of planned interventions, based on scientific evidence and applied in practice by health institutions and regulatory agencies, by trained and competent health care professionals [30] [31].

Every maternal death must be understood as a failure of the health system and as a violation of human rights [2]. The potential years of life lost identified in this study demonstrates that women are dying younger of maternal causes. In Brazil, from 2000 to 2009, a higher frequency of maternal deaths was identified in the age group 20 - 29 years (41.85%), followed by the age range between 30 and 39 years [32]. The average age of maternal death in the State of Santa Catarina follows the same trend reported in the country, that is, women are dying prematurely, thus increasing the PYLL.

Studies have also reported an association between the risk of premature death and the socioeconomic characteristics of the place of residence [33]. Therefore, the PYLL calculation provides an overview of premature deaths in a population and is also an important component in identifying diseases and areas that require greater attention from health policy makers when dealing mostly with preventable deaths [13] [34].

The absolute numbers of PYLLs were concentrated in more densely populated municipalities, confirming the premise that areas of higher population density have higher PYLL values when compared to areas of smaller population density, justifying the need to calculate and analyze PYLL rates.

The rate of PYLL decreased by 40%, from 79.1 to 47.7 PYLL/100,000 women of childbearing age in the study period. The proportion of deaths that occurred due to direct obstetric causes highlights the potential for preventing maternal deaths and reflects the high socioeconomic cost, which is in line with the assertion that maternal mortality is mostly preventable and represents a violation of human rights [2] [6] [7].

Among the limitations of this study is the exclusive use of PYLL, as non-fatal cases, even with high frequency, are not represented, since only the cause-of-death statistics were used. In addition, the quality of mortality data was not controlled, as the secondary data was accessed and was susceptible to the completion of the death certificate by the reporting physician. It is also important to consider the possibility of incorrect and/or incomplete death certificates, as the physician may not attribute the importance of the woman's condition in the period leading to the time of death; indicated infields 43 and 44 of the death certificate, as well as the non-completion of the time interval between childbirth and death, if relevant. There may also be errors in data entry, with coders assigning the basic cause of death [6] [9] [25] [26].

In comparing the years studied, maternal deaths in Santa Catarina have occurred in younger women, increasing the potential years of life lost. In addition, the high variability in the data calculated by the PYLL rate, with high standard deviations, indicates that new analyses should be carried out, especially with a historical case series, in order to identify regional differences.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Melo, C.M., Aquino, T.I.S., Soares, M.Q. and Bevilacqua, P.D. (2017) Death Surveillance as an Indicator of the Quality of Health Care for Women and Children. *Ciência & Saúde Coletiva*, **22**, 3457-3465.
https://doi.org/10.1590/1413-812320172210.19652017

[2] Szwarcwald, C.V., Escalante, J.J.C., Rabello Neto, D.L., Souza Jr., P.R.B. and Victora, C.G. (2014) Estimation of Maternal Mortality Rates in Brazil, 2008-2011. *Cadernos de Saúde Pública*, **30**, S71-S83. https://doi.org/10.1590/0102-311X00125313

[3] Say, L., Chou, D., Gemmill, A., Tunçalp, O., Moller, A.B., Daniels, J., *et al.* (2014) Global Causes of Maternal Death: A WHO Systematic Analysis. *The Lancet Global Health*, **2**, e323-e333. https://doi.org/10.1016/S2214-109X(14)70227-X

[4] Bouvier-Colle, M.H., Mohangoo, A.D., Gissler, M., Novak-Antolic, Z., Vutuc, C., Szamotulska, K., *et al.* (2012) What about the Mothers? An Analysis of Maternal Mortality and Morbidity in Perinatal Health Surveillance Systems in Europe. *BJOG*, **119**, 880-889; discussion 890. https://doi.org/10.1111/j.1471-0528.2012.03330.x

[5] Souza, M.L., Laurenti, R., Knobel, R., Monticelli, M., Brüggemann, O.M. and Drake, E. (2013) Maternal Mortality Due to Hemorrhage in Brazil. *Revista Latino-Americana de Enfermagem*, **21**, 711-718.
https://doi.org/10.1590/S0104-11692013000300009

[6] Victora, C.G., Aquino, E.M., Carmo Leal, M., Monteiro, C.A., Barros, F.C. and Szwarcwald, C.L. (2011) Maternal and Child Health in Brazil: Progress and Challenges. *Lancet*, **377**, 1863-1876. https://doi.org/10.1016/S0140-6736(11)60138-4

[7] Silva, B.G., Lima, N.P., Silva, S.G., Antúnez, S.F., Seerig, L.M., Restrepo-Méndez, M.C., *et al.* (2016) Maternal Mortality in Brazil from 2001 to 2012: Time Trends and Regional Differences. *Revista Brasileira de Epidemiologia*, **19**, 484-493.
https://doi.org/10.1590/1980-5497201600030002

[8] Viana, R.C., Novaes, M.R.C.G. and Calderon, I.M.P. (2011) Maternal Mortality: An Update Approach. *ComunCiêncSaúde*, **22**, S141-S152.
http://bvsms.saude.gov.br/bvs/artigos/mortalidade_materna.pdf

[9] Morse, M.L., Fonseca, S.C., Barbosa, M.D., Calil, M.B. and Eyer, F.P. (2011) [Maternal Mortality in Brazil: What Has the Scientific Literature Shown in the Last 30 Years?]. *Cadernos de Saúde Pública*, **27**, 623-638.
http://www.scielo.br/pdf/csp/v27n4/02.pdf
https://doi.org/10.1590/S0102-311X2011000400002

[10] Reis, L.G.C., Pepe, V.L.E. and Caetano, R. (2011) Safe Motherhood in Brazil: The Long Road to the Realization of a Right. *Physis: Revista de Saúde Coletiva*, **21**, 1139-1160. https://doi.org/10.1590/S0103-73312011000300020

[11] Maniecka-Bryła, I., Bryła, M., Bryła, P. and Pikala, M. (2015) The Burden of Premature Mortality in Poland Analysed with the Use of Standard Expected Years of Life Lost. *BMC Public Health*, **15**, 101. https://doi.org/10.1186/s12889-015-1487-x

[12] Plass, D., Chau, P.Y.K., Thach, T.Q., Jahn, H.J., Lai, P.C., Wong, C.M., *et al.* (2013)

Quantifying the Burden of Disease Due to Premature Mortality in Hong Kong Using Standard Expected Years of Life Lost. *BMC Public Health*, **13**, 863.
https://doi.org/10.1186/1471-2458-13-863

[13] Gènova-Maleras, R., Catalá-López, F., Larrea-Baz, N.F., Álvarez-Martín, E. and Morant-Ginestar, C. (2011) The Burden of Premature Mortality in Spain Using Standard Expected Years of Life Lost: A Population-Based Study. *BMC Public Health*, **11**, 787. https://doi.org/10.1186/1471-2458-11-787

[14] Romeder, J.M. and Mcwhinnie, J.R. (1978) The Development of Potential Years of Life Lost as an Indicator of Premature Mortality. *Revue d'Epidémiologie et de Santé Publique*, **26**, 97-115.
https://www.researchgate.net/profile/Eiko_Takahashi/publication/225750155_Years_of_potential_life_lost_as_the_indicator_of_premature_mortality_in_occupational_medicine/links/0912f5081ef5e8ef1c000000/Years-of-potential-life-lost-as-the-indicator-of-premature-mortality-in-occupational-medicine.pdf

[15] Saviato, B., Knobel, R., Moraes, C.A. and Tonon, D. (2008) Maternal Death Due to Hypertension in the State of Santa Catarina. *Arquivos Catarinenses de Medicina*, **37**, 16-19. http://www.acm.org.br/revista/pdf/artigos/604.pdf

[16] Peixoto, H.C.G., Martins, H.E.L., Gregório, V.R.P. and Knobel, R. (2006) Profile of Maternal Delivery-Related Death in Santa Catarina. *Enfermeria Global*, No. 8, 1-11.
http://revistas.um.es/eglobal/article/viewFile/326/434

[17] Carvalho, M.S. and Souza-Santos, R. (2005) Analysis of Spatial Data in Public Health: Methods, Problems, and Perspectives. *Cadernos de Saúde Pública*, **21**, 361-378. https://doi.org/10.1590/S0102-311X2005000200003

[18] Santos, S.M. and Noronha, C.P. (2001) Mortality Spatial Patterns and Socioeconomic Differences in the City of Rio de Janeiro. *Cadernos de Saúde Pública*, **17**, 1099-1110. https://doi.org/10.1590/S0102-311X2001000500012

[19] Elliott, P. and Wartenberg, D. (2004) Spatial Epidemiology: Current Approaches and Future Challenges. *Environmental Health Perspectives*, **112**, 998-1006.
https://doi.org/10.1289/ehp.6735

[20] van de Schoot, R., Kaplan, D., Denissen, J., Asendorpf, J.B., Neyer, F.J. and van Aken, M.A.G. (2014) A Gentle Introduction to Bayesian Analysis: Applications to Developmental Research. *Child Development*, **85**, 842-860.
https://doi.org/10.1111/cdev.12169

[21] Silva, S.L., Fachel, J.M., Kato, S.K. and Bassanesi, S.L. (2011) Patterns of Variation in the Infant Mortality Rate in Rio Grande do Sul State, Brazil: Comparison of Empirical Bayesian and Fully Bayesian Approaches. *Cadernos de Saúde Pública*, **27**, 1423-1432. https://doi.org/10.1590/S0102-311X2011000700017

[22] World Health Organization (WHO) (2018) The 11th Revision of the International Classification of Diseases (ICD-11) Is Due by 2018! World Health Organization, Geneva. http://www.who.int/classifications/icd/revision/en/

[23] Ribeiro, C.M., Costa, A.J.L., Cascão, A.M., Cavalcanti, M.L.T. and Kale, P.L. (2012) Strategy for the Selection and Investigation of Deaths of Women of Reproductive Age. *Revista Brasileira de Epidemiologia*, **15**, 725-736.
https://doi.org/10.1590/S1415-790X2012000400005

[24] Ministério da Saúde (BR) (2016) Datasus, Informações em Saúde. Brasília.
http://www.datasus.gov.br/DATASUS/index.php/index.php?area=0205

[25] Laurenti, R., de Mello Jorge, M.H. and Gotlieb, S.L. (2008) Underlying Cause-of-Death Mortality Statistics: Considering the Reliability of Data. *Revista Panamericana de Salud Pública*, **23**, 349-356.

http://www.scielosp.org/pdf/rpsp/v23n5/a07v23n5.pdf

[26] Laurenti, R., Jorge, M.H.P.M. and Gotlieb, S.L.D. (2000) Maternal Deaths and Mortality Due to a Maternal Underlying Cause of Death. *Epidemiologia e Serviços de Saúde*, **17**, 283-292. http://scielo.iec.pa.gov.br/pdf/ess/v17n4/v17n4a05.pdf

[27] Hogan, M.C., Foreman, K.J., Naghavi, M., Ahn, S.Y., Wang, M., Makela, S.M., *et al.* (2010) Maternal Mortality for 181 Countries, 1980-2008: A Systematic Analysis of Progress towards Millennium Development Goal 5. *The Lancet*, **375**, 1609-1623. https://doi.org/10.1016/S0140-6736(10)60518-1

[28] Moura, E.R.F., Ponte, M.S.R., Silva, R.M. and Lopes, M.V.O. (2007) Maternal Mortality in Ceará-Brazil (1998-2002): Retrospective Study. *Cogitare Enfermagem*, **12**, 44-51. http://www.redalyc.org/pdf/4836/483648982006.pdf

[29] Martins, A.C.S. and Silva, L.S. (2018) Epidemiological Profile of Maternal Mortality. *Revista Brasileira de Enfermagem*, **71**, 677-683. https://doi.org/10.1590/0034-7167-2017-0624

[30] Cecatti, J.G. and Parpinelli, M.A. (2011) Maternal Health in Brazil: Priorities and Challenges. *Cadernos de Saúde Pública*, **27**, 1256. https://doi.org/10.1590/S0102-311X2011000700001

[31] David, E., Machungo, F., Zanconato, G., Cavaliere, E., Fiosse, S., Sululu, C., *et al.* (2014) Maternal near Miss and Maternal Deaths in Mozambique: A Cross-Sectional, Region-Wide Study of 635 Consecutive Cases Assisted in Health Facilities of Maputo Province. *BMC Pregnancy and Childbirth*, **14**, 401. https://doi.org/10.1186/s12884-014-0401-3

[32] Ferraz, L. and Bordignon, M. (2012) Maternal Mortality in Brazil: A Reality in Need of Improvement. *Revista Baiana de Saúde Pública*, **36**, 527-538. http://files.bvs.br/upload/S/0100-0233/2012/v36n2/a3253.pdf

[33] Duarte, E.C., Garcia, L.P., Freitas, L.R.S., Mansano, N.H., Monteiro, R.A. and Ramalho, W.M. (2012) Ecological Association between Characteristics of the Municipalities and the Risk of Homicide in Adult Males Aged 20 to 39 in Brazil: 1999-2010. *Ciência & Saúde Coletiva*, **17**, 2259-2268.

[34] Penner, D., Pinheiro, P. and Krämer, A. (2010) Measuring the Burden of Disease Due to Premature Mortality Using Standard Expected Years of Life Lost (SEYLL) in North Rhine-Westphalia, a Federal State of Germany, in 2005. *Journal of Public Health*, **18**, 319-325. https://doi.org/10.1007/s10389-010-0322-1