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Global Statistics of Perinatal Medicine

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Abstract

Aim: To clarify improvements in maternal and perinatal mortalities in the world.

Methods: Calculation of UNICEF data, quotation of reference and statistical analysis.

Results: Global maternal mortality was slightly improved; along with the increase of countries of maternal mortality lower than 20, while the mean global mortality more than 20 was unchanged, and the highest maternal mortality were 2,000. Maternal mortality was high in high total fertility rate and low when total fertility rate was less than 3. Maternal mortality was high when under 5 mortality was high. Maternal mortality was reported to be significantly lower when the birth space was 36 or more months. Perinatal mortality was reported only in limited countries, while the mortality was closely correlated to maternal mortality. Thus, perinatal mortality was estimated from maternal mortality, where mild improvement was noted in the increase of countries of low estimated mortality, and the peak of estimated perinatal mortality decreased from 130 to 120.

Conclusion: Maternal mortality was slightly improved, but it was unchanged in high mortality countries. The mortality was low in low total fertility rate. Perinatal mortality was estimated from maternal mortality, because they were closely correlated.

Keywords: World; Fetus; Infant; Still birth; Neonatal death; Mother; Maternal Mortality; Perinatal mortality; Total fertility rate; Under 5 mortality

Introduction

There are two markers in the evaluation of perinatal medicine, i.e. they are the maternal mortality rate (maternal death rate per 100,000 births) (X) and perinatal mortality rate (still births and early neonatal death within 1 week in 1,000 births) (Y). The maternal mortality is discussed before perinatal mortality in this paper, because the perinatal mortality closely correlated to maternal mortality [1,2].

Materials and Methods

UNICEF reports maternal mortality in every country of the world, which are cited in Japanese official reports of perinatal statistics, and they were calculated to analyze maternal mortalities in the world in 20 years between 1990 to 2009 [1].

Maternal mortality rate is an important index representing the status of perinatal medicine. Maternal mortality rate is expressing maternal deaths in a year×100,000 divided by total births, where maternal deaths are sum of direct obstetric deaths and indirect obstetric deaths, obstetric deaths of unknown origin, and obstetric tetanus and Human Immunodeficiency Virus disease of pregnancy or until 42 days after the end of pregnancy, from 1995.

Perinatal mortality rate is another important index in the perinatal statistics to estimate the outcomes of fetuses and neonates. Perinatal mortality rate is Perinatal deaths in a year (fetal death after 22 weeks of pregnancy+Early nronatal deaths within a week)×1,000 divided by total births (live births+fetal deaths after 22 weeks of pregnancy), where perinatal mortality is closely correlated to maternal mortalities in Japan [2], therefore, some unreported perinatal mortality was estimated from maternal mortality in this review article. There are two regression equations in the correlation of perinatal mortality after 28 and 22 weeks of pregnancy in this article; where perinatal mortality after 28 weeks of pregnancy is estimated by equations 1 or 2,

$$\text{Log Y (28 weeks)} = 0.7826 \text{ Log X (28 weeks)} + 0.08 \quad (1)$$

$$\text{Y (28 weeks)} = 0.3X + 4.3,\ R = 0.99,\ p < 0.001 \quad (2)$$

Perinatal mortality after 22 weeks of pregnancy is estimated by the equation 3;

$$\text{Y (22 weeks)} = X + 0.96,\ R = 0.98,\ p < 0.001 \quad (3)$$

The equation 3 is used in the cases after 1979, because the official perinatal mortality was calculated after 28 weeks of pregnancy in 1950, and changed to 22 weeks in 1979, because the limits of viability for neonates was in 1950 set at 28 weeks, whereas in 1979, it was set at 22 weeks. In the international comparison of perinatal mortality, the mortality after 28 weeks of pregnancy was utilized.

Results

Global maternal mortality

Decreasing global maternal mortality: The distributions of maternal mortalities of world countries were compared between two periods. According to UNICEF report, it seems that there were more countries with the maternal mortality below 20 in the period between 2007 to 2008 than in the earlier period from 1990 to 1991. There was no clear difference in the countries of maternal mortality of 1,000 or more, but the highest mortality was 2,000 in the earlier periods and 1,800 in the latter (Figure 1).

Mean maternal mortalities were compared among 1990-1991, 1997-1998 and 2007-2008. Mean maternal mortality was 290.0 ± 348.5

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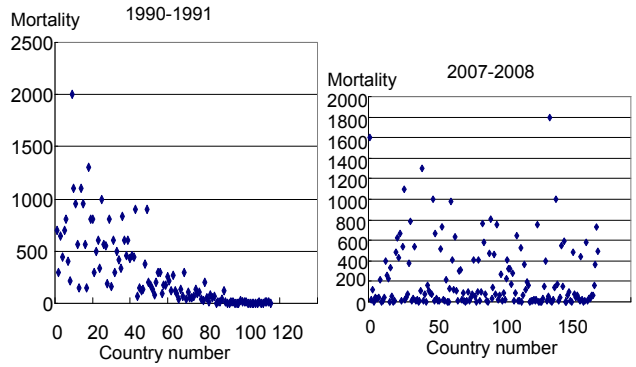

Figure 1: Distributions of maternal mortalities in 190 countries of the world in two period.

Table 1: Global maternal mortalities among 3 periods. The mortality decreased significantly in later periods.

Year	Mean mortally	SD of mortality	Number of countries	Comparison
1990-1991	290	348.3	115	①
1997-1998	195.4	246.2	140	②
2007-2008	212.7	309.8	175	③

P ①-②:0. 08, significant decrease
P ②-③:0.58, no significant difference
P ①-③:0.038, significant decrease

Table 2: Comparison of numbers of countries with maternal mortality >20 in three periods.

Year	Mean mortality in the countries with the mortality >20	Maximal mortality	Number of countries of mortality>20	% (country number of mortality<=20/number of total countries)
1990-1991	304.5 ± 334.2	2,000	121	17.7%(26/147)---①
2007-2008	305.9 ± 334.5	1,600	120	28.6%(48/168)---②
2009-2010	330.3 ± 305.5	1,200	78	22.0%(22/100)

P (①--②)=0.02, significant increase of countries of mortality <=20. Others were not significant difference

(N=115) in 1990-1991, 212.7 ± 309.8 (N=175) in 2007-2008, which was significant reduction. The reduction rate was 1/1.3 (290.0/212.7). There was no significant difference between the mortalities in 1997-1998 and 2007-2008 (Table 1). Therefore, the decreasing maternal mortality rate was mild and similar to the home delivery (1/2.5 in 50 years) in Japan [1].

The highest mortality was 2,000, i.e. 2% of mothers died in 1990-1991. Country number in the Figures is the country order of UNICEF material [1].

The mean maternal mortalities were compared between 1990-1991, 2007-2008 and 2009-2010, excluding the countries when the maternal mortality was 20 or less, to estimate the mortality change in the countries of large maternal mortalities. There was no difference of mean mortality among the three periods (Table 2), but the number of countries with maternal mortality <20 increased in 2007-2008 compared to the period 1990-1991, whereas the mean maternal mortality higher than 20 showed no significant difference.

The case number of maternal mortality less than 20 was significantly more in the second period comparing them to 1990-1991, and the maximal maternal mortality was decreased from 2,000 to 1,200 in the periods. It could be said that global maternal mortality was slightly improved, while the mortality was still high at present in the countries of high maternal mortality.

The maternal mortality significantly reduced when the births were spaced for 36 months or more [3]. Also, the mortality decreased when the total fertility rate reduced, i.e. the mortality is less than 100 if the total fertility rate is lower than 3 (Figure 3). Maternal mortality is reduced if the births are infrequent, expectedly so because of reduction of exposure to the risk of pregnancy and labor. The maternal mortality was significantly decreased between earlier and later periods.

Maternal mortality reduction associated with decreased births: Maternal mortality was reported to be significantly decreased when the birth space was 36 months or more [3]. Maternal mortality significantly increased, when under 5 deaths were frequent (Figure 2) [1].

Maternal mortality was 100 or less, when the total fertility rate was below 3, i.e. maternal mortality reduced if the birth number decreased (Figure 3).

Maternal mortality=4.7×(deaths under 5 years)-41.9, R=0.89, p<0.01

Global perinatal mortality: Perinatal mortality is defined as the stillbirths and early neonatal deaths in a week after birth after 22 weeks in Japan since 1979. It was defined after 28 weeks of pregnancy in 1950, when the perinatal mortality was introduced into Japan. Since there

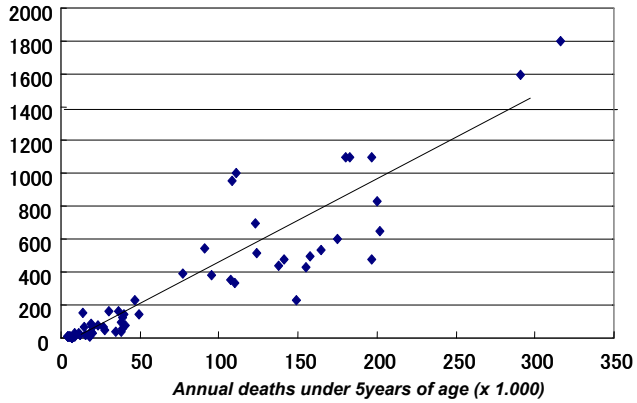

Figure 2: Maternal mortality increased when deaths under 5 years were high in 1985-2003 calculated from UNICEF data [1].

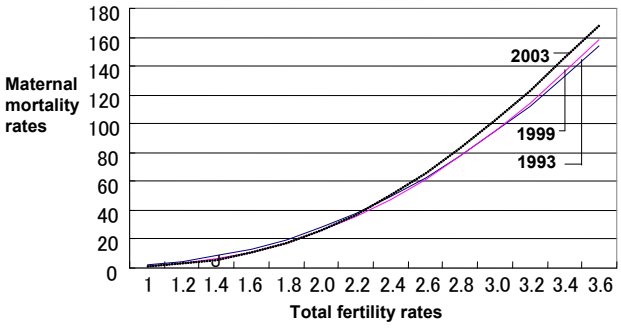

Figure 3: Maternal mortality rate (Y axis) of a country was higher than 100 when the total fertility rate (X axis) was more than 3 in the world. The regression curves were obtained by the processing of UNICEF data [1]. Regression equation in 2003: $Y=-2.48X^2+5.31X+0.04$, where Y=Log maternal mortality, X=Log total fertility rate, $R^2=0.8$, p<0.001. J: Maternal mortality in Japan in 2008.

Table 3: Comparison of estimated perinatal mortality and true perinatal mortality of developed countries in 2008 [1].

Country	Maternal mortality	Perinatal mortality after 28 gestational weeks	Reported true perinatal mortality after 28 weeks	Estimation error (%)
USA	13	5.2	6.8	16
Denmark	10	7.3	6.6	9.6
Germany	8	6.7	5.5	18
Hungary	17	7.4	7.8	5
Italy	7	6.4	5.1	20
Netherland	7	6.4	6.0	6
Sweden	5	4.3	4.3	0
UK	7	6.4	8.5	24

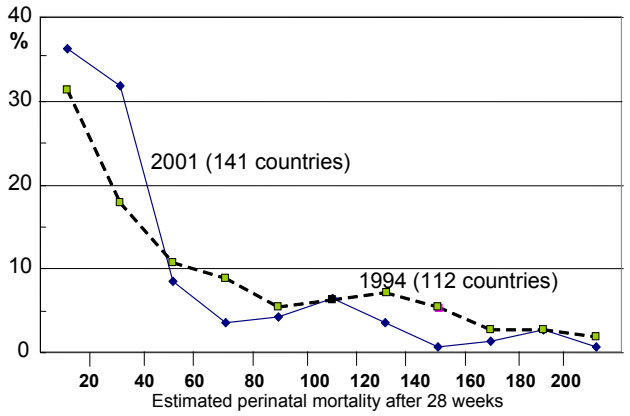

Figure 4: The world perinatal mortalities after 28 weeks of pregnancy estimated from UNICEF maternal mortalities in 1994 and 2001, where perinatal mortality after 28 weeks=maternal mortality×0.30+4.30. The perinatal mortalities were mildly improved, because the countries (%) of 40 or less perinatal mortality increased and the perinatal mortality peaks shifted from 130 to 120.

was no report of perinatal mortality in most country in the UNICEF material, the perinatal mortality was estimated in this article from the maternal mortalities of Table 1 because of the close correlation between maternal and perinatal mortalities in Japan [2]. According to the Equation 2 and Figure 4, global perinatal mortality after 28 weeks in 3 periods are estimated to be:

1990-1991: 290.0×0.3+4.3=91.30

1997-1998: 195.4×0.3+4.3=62.92

2007-2008: 212.7×0.3+4.3=68.11

The estimated perinatal mortality in 2007-2008 was lower than 1990-1991.

The accuracy of estimation was confirmed by the comparison of estimated and actual perinatal mortalities after 28 weeks of pregnancy in European countries (Table 3).

Country numbers (%) every estimated perinatal mortality from maternal mortality were compared in 1994 and 2001 (Figure 4). Mild improvement was noted in the increase of countries of lower mortalities than 40, and the peak shift from 130 to 120 (Figure 4).

Comments

Although the mean maternal mortality showed significant reduction in global statistics, it depends on the increase of the countries of lower maternal mortality under 20. The mean maternal mortality higher than 20 is not decreased, showing no improvement of maternal mortality in most of high mortality countries. It will be suggested that countries of higher maternal mortality than 20 are requested to reduce maternal mortality by the progress of medicine, not only obstetrics, but also general medicine against various general risks in general health, increasing the support of medical care. The merit of medicine and medical care is shown in the article "Progress of perinatal medicine in Japan" in the special issue. Literacy is another problem in the progress of perinatal care, not only in understanding the support of medicine and medical care, but also for the requirement of pregnant women to the medicine and administration. Self supporting will develop by reading the maternal–child note distributed to the women in some countries.

Expanding birth space more than 36 month [3], and reducing the total fertility rate will achieve the reduction of maternal mortality, while the strategy would be associated with oral contraceptives. The medical care of the general population will be mandatory to improve the health status of mother and child in all countries.

Medical care of pregnant and intrapartum women should be improved by such strategies as the diagnosis of early pregnancy, followed by repeated visits to obstetric care institutions, blood pressure control, early detection of preeclampsia, followed by its treatment and obstetric care in pregnancy and labor, including ultrasound diagnosis and external fetal heart rate monitoring will improve statuses of mother and child.

The primary problem to manage perinatal mortality was no official report of perinatal mortality in many countries. The strong hope of author is annual official perinatal mortality report in every country in the world. Since the perinatal mortality is closely correlated maternal mortality [2], estimated perinatal mortality from maternal mortality was studied, and some improvement of perinatal statuses in the increase of countries of lower perinatal mortality than 20. Perinatal studies require true statistics of perinatal mortality in all countries in the world.

The pediatric improvement is compared with global under 5 mortality (Table 4 and Figure 5). It was shown that under 5 mortality was improved in the mortality reduction rate for about 1/1.8 in 20 years in the world, which was clarified by the annual report of every country. The decrease of perinatal mortality was reported by some countries but

Table 4: Global under 5 mortality rate [1], The mortality was lower in 2010 than 1990.

Year	1990	2010
Number of countries	129	129
Mean mortality	70.80*	39.78*
SD	57.40	43.41
Maximal mortality	311	180

*P<0.001, significant reduction

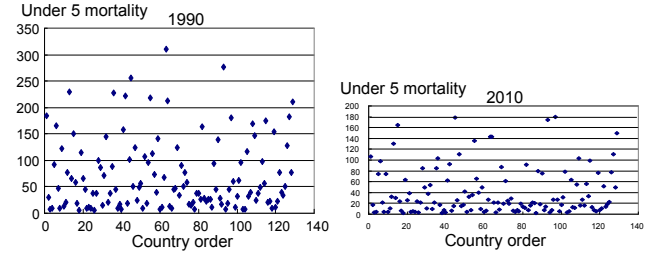

Figure 5: Global under 5 mortality rate was lower in 2010 than 1990 [1]. Country: Order of countries in the table of UNICEF material [1].

not of all countries, and the supports of medicine and medical care was reported in Japan, but the survey should be done in all countries, like as pediatric care in under 5 and under 1 infants in annual global reports.

Conclusion

Global maternal mortality was improved by increasing the number of countries with the mortality lower than 20, but the mean global mortality more than 20 was not decreased, and the highest maternal mortality was 2,000. Maternal mortality was higher if high total fertility rate, and the mortality was lower than 100 when the total fertility rate was lower than 3. Maternal mortality was high when the under 5 mortality was high. It was reported that maternal mortality was significantly low when the births space was 36 or more months. Perinatal mortality rates are published in limited countries, where the mortality was closely correlated to maternal mortality, and the mortality was estimated from maternal mortality, where mild improvement was noted in the increase of countries with the estimated perinatal mortality was lower than 40, and the peak of estimated perinatal mortality decreased from 130 to 120.

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