Using Multiple Data for Calculating the Maternal Mortality Ratio in Thailand

Worawan Chandoevwit*
Narong Kasitipradith**
Suchat Soranastaporn***
Kriengsak Vacharanukulkieti****
Suwit Wibulpolprasert*****

INTRODUCTION

Thailand was one of the 189 countries that endorsed the United Nations Millennium Declaration, which is aimed at promoting human development and reducing global inequalities. That Declaration contains what are known as the Millennium Development Goals, or MDGs, comprising eight ambitious goals to be achieved by 2015. The goals are to eradicate extreme poverty and hunger; to achieve universal primary education; to promote gender equality and empower women; to reduce child mortality; to improve maternal health; to combat HIV/AIDS, malaria and other diseases; to ensure environmental sustainability; and to develop a global partnership for development.

In order to monitor progress toward achieving the MDGs, each signatory country has to have reliable baseline statistics. For some countries, this requirement is as ambitious as achieving the MDGs.

In Thailand, the statistical system is decentralized. Each public organization conducts its own data-collection system and the production of statistical reports. When the definition of a statistic is unclear or ambiguous, two public organizations can end up with two varying statistics for a single variable. A good example of this is the maternal mortality ratio, or MMR, reported by the Bureau of Health Promotion (BHP) (2006). As shown in Table 1, maternal deaths in 1990 were 36 per 100,000 live births using the BHP statistic and 25 per 100,000 live births using the Bureau of Policy and Strategy (BPS) statistic. In the same year, the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) reported that Thailand had 200 maternal deaths per 100,000 live births.

Using such widely different statistics in the implementation of policy could lead to different emphasis and program direction, or success or failure in achieving MDG to improve maternal health by reducing MMR by three fourths. In this example, we do not know which statistic is factual. What we do know is that each of them provides different targets for the achievement of MDG for improving maternal health (Table 2). If Thailand uses the WHO/UNICEF statistic, the MMR target would be 50. However, in 2000 Thailand's MMR according to WHO/UNICEF was already below 50. In this scene, achieving the MDG target is not an issue: the issue would be why is Thailand's MMR so high? If we use the statistics of either BHP or BPS, the target to be achieved would be very ambitious indeed. To achieve an MMR of 6.25 or 9.0 per 100,000 live births is very difficult for a developing country to do. Moreover, to achieve an MMR of 50 requires a different strategic policy and level of public spending than it does to achieve an MMR of 6.25. Given that Thailand has scarce resources, the country might end up doing things that may not be cost-effective in attempting to achieve this Goal.[1]

* *Senior Research Specialist, Human Resources and Social Development Program, Thailand Development Research Institute.*
** *Deputy Director, Bureau of Policy and Strategy, Ministry of Public Health.*
*** *Director, Central Office for Healthcare Information.*
**** *Director, Phu Kradueng Hospital, Loei.*
***** *Senior Advisor on Disease Control, Office of the Permanent Secretary, Ministry of Public Health.*

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Table 1 Maternal Mortality Ratio Reported by Different Sources

	1990	1995	1997	2000	2002	2004	2005
BHP, MOPH	36.0	16.8	14.2	26.9	22.1	19.8	18.2
BPS, MOPH	25.0	10.7	9.7	13.2	14.7	13.3	12.2
RAMOS[a] method, BHP		44.3	36.5				
WHO/UNICEF	200.0			44.0			

Notes: BHP = Bureau of Health Promotion.
BPS = Bureau of Policy and Strategy.
MOPH = Ministry of Public Health.
[a] The reproductive age mortality studies (RAMOS) method identifies and investigates all deaths of women of reproductive age (15-49 years) using multiple data sources. This method includes interviewing household members and health-care providers; it is considered a complex, costly and time-consuming method.

Source: Bureau of Health Promotion, 2006.

Table 2 Target of Millennium Development Goals for Improving Maternal Health by 2015, Using Different Baselines

	1990	2015 (reduce 1990 level by three quarters)
BHP, MOPH	36.0	9.0
BPS, MOPH	25.0	6.25
WHO/UNICEF	200.0	50.0

Notes: BHP = Bureau of Health Promotion.
BPS = Bureau of Policy and Strategy.
MOPH = Ministry of Public Health.

Getting the true statistics on MMR is very important for policy planning and implementation purposes, not to mention its importance in the context of safe motherhood, which is perceived as a human right. The health of mothers is a major determinant of their children's health. Therefore, in this study, we introduce a new approach for calculating Thailand's MMR, by making use of multiple data sources. It should be mentioned that this approach would not have been possible without the collaboration of the Ministry of Public Health and the Central Office for Health-care Information.

HOW TO MEASURE THE MATERNAL MORTALITY RATIO BY THE INTERNATIONAL STANDARD

The MMR implies the risk of death a woman faces once she has become pregnant. The ratio is the number of maternal deaths during a given year per 100,000 live births during the same period, calculated as follows:

$$\frac{\text{Number of maternal deaths}}{\text{Total number of live births}} \times 100{,}000 = \text{MMR}$$

The tenth revision of the International Classification of Diseases (ICD-10) defines a maternal death as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by pregnancy or its management, but not from accidental or incidental causes (WHO 2004, 3). The maternal death can be the result of direct obstetric or indirect obstetric causes. Direct obstetric death includes that resulting from obstetric complications of the pregnant state (pregnancy, labor and the puerperium) from interventions, omissions, or incorrect treatment, or from a chain of events resulting from any of the above: for example, death caused by hemorrhage, sepsis, eclampsia, obstructed labor, unsafe abortion, and the complications of anesthesia. Indirect obstetric death is that resulting from previous existing disease or disease that developed during pregnancy and that was not due to direct obstetric causes (e.g., rheumatic heart disease, congenital heart disease, malaria, AIDS, diabetes, malignant neoplasms, aneurysm, nephritic syndrome and systemic lupus erythematosus (SLE)) but was aggravated by the physiological effects of pregnancy.

Various definitions of the indirect and incidental causes of death across countries make it difficult to compare the prevalence of maternal death internationally. In Thailand, malignant neoplasms used to be treated as an incidental cause of maternal death if the pregnant women were in the age group 45-49 years. Later, all pregnant women who died of malignant neoplasms were grouped under the indirect maternal death category. Incidental death is usually defined as that due to conditions occurring during pregnancy, even though the pregnancy was unlikely to have contributed significantly to the death. Most deaths due to accidents, murder, intentional self-inflicted injury or poisoning, and genocide are considered incidental. To cope with this variation, ICD-10 introduced pregnancy-related death, which is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the cause of death. However, pregnancy-related death has not been used as frequently as maternal death when measuring safe motherhood.

To measure the number of maternal deaths, it is necessary to obtain accurate data from vital registration, including medically certified causes of death. According to WHO (2004), only 60 countries had complete vital registration with good attribution of the cause of death. Another 51 countries reported MMR using other data, such as vital registration with uncertain attribution of the cause of death, direct sisterhood estimates, RAMOS,[2] household surveys and census. There were 62 countries without national data on maternal deaths; WHO, UNICEF and UNFPA used adjusted available country data and a simple logit model to estimate MMR for those countries.

The WHO (2004) estimate of the number of maternal deaths in 2000 was 529,000. The country with the highest estimated number of maternal deaths that year was India (136,000). In terms of MMR, the global estimate was an average of 400 per 100,000 live births. The ratios were highest in Africa and Asia at 830 and 330 per 100,000 live births respectively.

That study showed Thailand as a country with an MMR below 50 per 100,000 (Figure 1). The method used for making the estimate for Thailand was RAMOS, which is considered a costly and time-consuming method. For this reason, it is unlikely for any country to conduct RAMOS effectively every year.

NEW DATA SOURCES FOR CALCULATING THE MATERNAL MORTALITY RATIO IN THAILAND

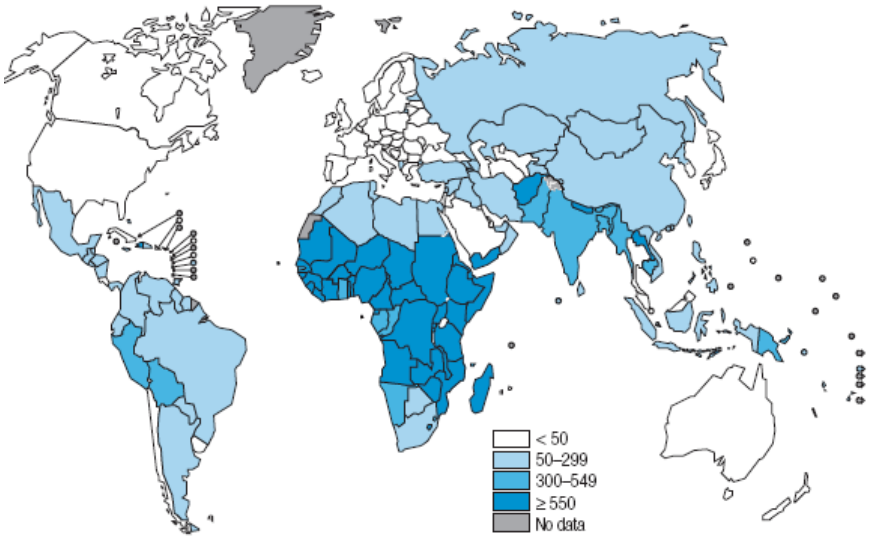
Vital registration in Thailand covers birth, death, marriage, and house registration. Every Thai citizen and household must have an identification number. A newborn child receives a personal identity number (PID) once his/her parent(s) report the birth to the registration office within 15 to 30 days of the birth. For reporting a death, a relative of the dead person must report it to the registration office within 24 hours of the person's death. If a patient dies in the hospital, a physician must issue an official form certifying the death, giving the physician's opinion of the cause of death. In cases when a corpse is found outside a registered house, the person who found the body should report its presence to a police officer or administrative office within 24 hours, but not exceeding seven days. Once a person's death has been reported to an administrative office, the PID of the dead person is coded as "deceased" and it cannot be used by someone else afterwards. Then, a death certificate is issued to the relative concerned. An autopsy is not required following the report of a death.

With technological advances, the reports of births and deaths and the issuance of death certificates have been computerized, which enabled us to use these data sources in order to count the number of mothers. The key basis for defining a maternal death used here is the timing of the death related to pregnancy and the ICD definition of maternal death. We propose two methods for determining the number of maternal deaths. Method 1 searches for the dead mothers who gave live births, while Method 2 searches for the pregnant women who had died without giving live births.

Method 1

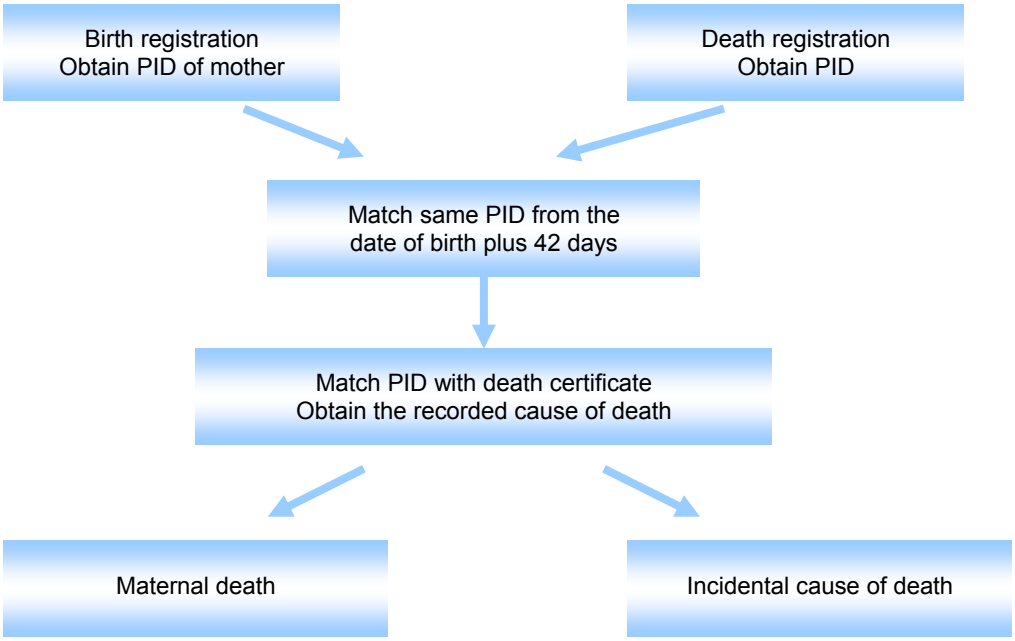
The first step in Method 1 (Figure 2) involved pulling the PID of all mothers, as stated on the birth certificates, in a given period (e.g., a year). Approximately 800,000 births occur each year in Thailand. The second step involved pulling the PID of reproductive-aged dead women. Approximately 30,000 women of reproductive age die each year. We used the PID from two sources as a key matching variable from the two data sets. If PIDs overlapped in the two data sets, we kept the records. Up to this point, we identified the mothers who had died within one year of giving a live birth.

Figure 1 Maternal Mortality Ratio per 100,000 Live Births Worldwide in 2000



Source: WHO (2005).

Figure 2 Method 1: Mothers Who Died after Giving a Live Birth



Note: Using this matching method enables only the determination of the number of now dead mothers who gave a live birth.

The next step was to delete the records whose date of death was beyond 42 days of the date of birth of the women's newborns. To determine the causes of death, the PID was used to match with records in the death certificate data set. The final step was to investigate the causes of death carefully to separate the incidental causes of death from maternal death. In this study, we did not separate direct and indirect causes of death since that would have required extra assessment by experts and careful investigation. However, separating the incidental cause was straightforward as the ICD definition is clear.

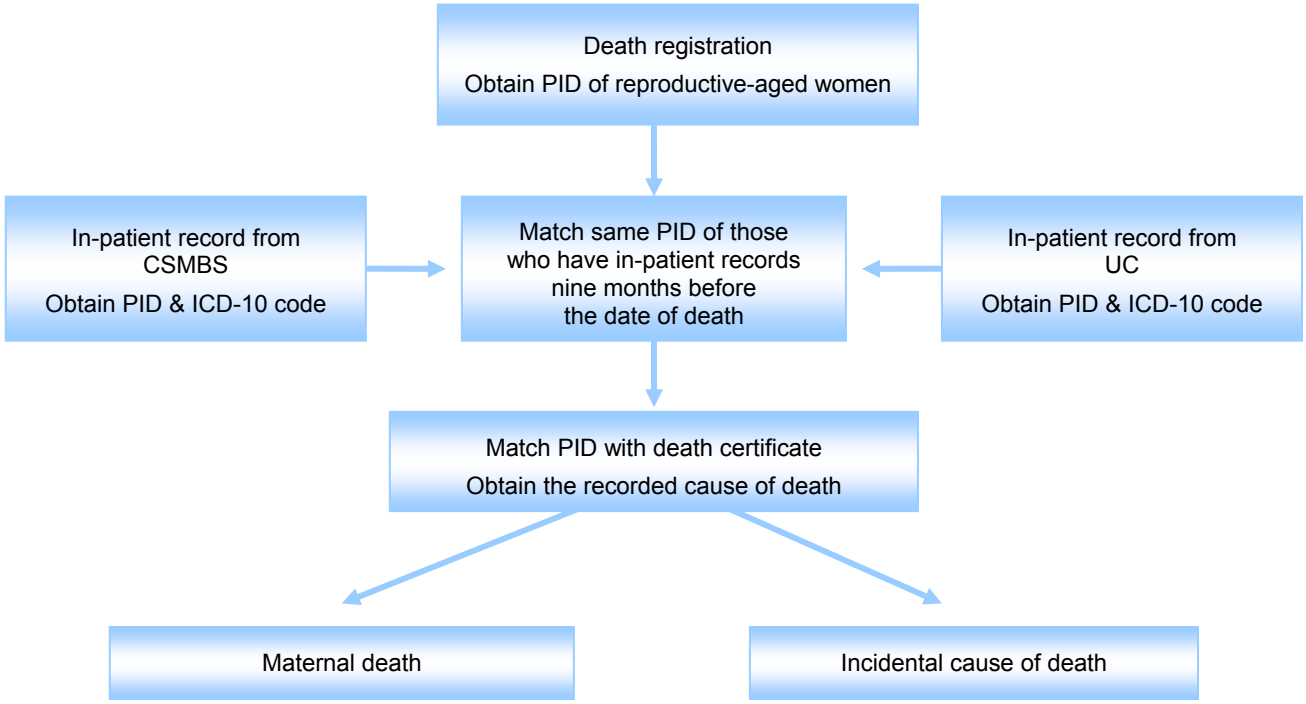
Method 2

Method 1 covers only the death of women who successfully gave live birth. It misses pregnant women whose pregnancy was terminated as a result of stillbirth, and neonatal death.[3] Although it is difficult to determine the number of women who died without giving a live birth, there is a way to deduce some proportion of that number.

Method 2 uses in-patient data of two health-care schemes. Currently, Thailand has three main public health-care systems: the Civil Servant Medical Benefit Scheme (CSMBS), the Social Security Scheme (SSS), and the Universal Health-care Coverage Scheme (UC). The first-named scheme covers approximately 5.6 million civil servants and their dependants (approximately 9% of the country's total population). The second scheme covers approximately 8.8 million private employees in the non-agricultural sector (approximately 14% of the population). The third scheme covers all who are not covered by the first two schemes, or approximately 77 percent of the population. Because of the payment mechanism of the CSMBS and UC schemes, that is, the diagnosis-related groups (DRGs), all in-patient records in public hospitals have been computerized. Method 2, therefore, uses the DRG data set, which is composed of data on 21 million admissions between 2004 and 2006, in order to determine the number of pregnant women who had died without giving live birth.

In our study, the first step of Method 2 (Figure 3) was to obtain the PID of dead reproductive-aged women from the death registration. The second step was to match each PID from the first step with the DRG records between the date of death and 270 days before the date of death (58,270 women with 193,579 admissions in the period 2004-2006). There were no in-patient records in this DRG data set for approximately 35 percent of the reproductive-aged dead women in the period 2004-2006.[4] The in-patient records were kept if their ICD-10 codes contained the code O00-O99 (pregnancy, childbirth, and the puerperium). This step produced a list of dead women who were in-patients under the CSMBS or UC schemes and were pregnant within a period of nine months prior to their death (1,650 women with 3,513 admissions). The last step was to verify whether those deaths were maternal deaths.

Figure 3 Method 2: Women Ending Pregnancy with Stillbirth or Neonatal Death



The last step of Method 2 is rather time-consuming because each in-patient record contains many ICD-10 codes. We had to search each in-patient record with any of the following codes: S00-S99, T00-T79, T90-T98 (injury and poisoning of external causes), V01-X59 (accident), X60-X84 (intentional self-harm), X85-Y09 (assault), or Y10-Y36 (event of undetermined intent and legal intervention and operation of war). They were labeled as death caused by some incident and thus excluded from the maternal deaths.

The remaining records were not all maternal deaths. Those who died before the discharge date, on the discharge date, or within 42 days after the last discharge date were classified as maternal deaths (A in Figure 4). Of those who died after 42 days but within nine months of the discharge date (B in Figure 4), we did not know whether they were maternal deaths. As a result, we did not include them in the MMR formula.

Table 3 shows the final result of both methods. It shows that Method 1 contributes about half of the picture while Method 2 can do a better job. Using both methods, we determined that the number of maternal deaths in 2004 and 2006 were 362 and 330 respectively. In applying the previously mentioned formula, these figures produce MMRs of 44.5 and 41.6 per 100,000 live births for those years. However, the lower figure for 2005 is a little suspicious to us; thus, further investigation on the death record for 2005 should be carried out.

This new method is expected to cover most maternal deaths. The missing deaths are pregnant women under the SSO scheme whose pregnancy resulted in stillbirth or neonatal death. We also miss pregnant women who had no in-patient record in the UC and CSMBS schemes or had records but died between 42 days and nine months after the discharge date (again B in Figure 4). These missing deaths may be missed as well using an approach, such as RAMOS, since they disappeared from the public health-care system. To make an ad hoc adjustment, we may multiply the MMR in Table 3 by 1.5, the multiplier used to adjust the MMR using the vital statistics found in WHO (2004).

Figure 4 Timing of Maternal Deaths

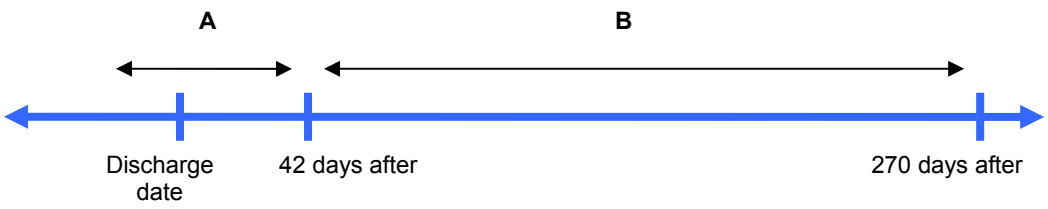


Table 3 Maternal Mortality Ratio Using New Approach

	2004	2005	2006
No. of deaths: women aged 15-49	32,658	29,398	27,934
No. of live births	813,069	809,485	793,623
Method 1			
Maternal deaths	182	126[1]	185
Incidental causes of death	15	6	18
Method 2			
Maternal deaths	286	249	250
Incidental causes of death	9	8	19
Overlapping of Method 1 and Method 2			
Maternal deaths	106	72	105
Incidental causes of death	8	5	12
Summary (Method 1 + Method 2 – Overlapping)			
Maternal deaths	362	303	330
Classified by health-care scheme			
- UC	269	241	235
- CSMBS	17	8	15
- Others[2]	76	54	80
Incidental causes of deaths	16	9	25
Pregnancy-related deaths	378	312	355
MMR (per 100,000 live births)	**44.5**	**37.4**	**41.6**
Pregnant in-patients who died within 9 months after being discharged from the hospital (B in Figure 4)[3]	110	246	174

Notes: [1] This figure is suspicious. We checked to ensure that there was no error in data processing. We found that 100 percent of these deaths happened in the hospital in 2005. However, in 2004 and 2006, approximately 65 and 80 percent respectively of the numbers on the same row happened in the hospital.
[2] Others include the deaths without in-patient records under UC or CSMBS.
[3] These deaths are not included in calculating the MMR.

CONCLUSIONS AND POLICY REMARKS

Maternal mortality is an indicator of disparity and inequity between men and women. It implies the place of women in society and women's opportunity with regard to health-care access and economic activity. Societies with a high MMR may well have a high infant mortality rate; conditions in such societies may also lead to family and social disorder as well. Therefore, getting statistics on MMR that reflect the true situation in Thailand will support the formulation of effective policies for promoting access to, and good quality of, health care, improved social prospects, and human rights.

In this study, we used multiple data sources to calculate Thailand's MMR. This approach can also be applied to calculate other statistics, such as the infant mortality rate (IMR). The major benefit of using this approach is the ability to draw out policy implications from the data. Some examples which are not related directly to this study but are implied from the data are as follows.

- The occurrence of death among pregnant women is higher than among those giving live birth, i.e., the number obtained from Method 2 is higher than that from Method 1. Many of the women died as a result of illegal abortion. While public health policy is needed to deal with this problem, we cannot deny that social policy is urgently required to deal with unwanted pregnancy.
- The average age that maternal death occurred in the period 2004-2006 is 31. Because about 6.3 percent of the maternal deaths occurred in the teenage age group, more and effective education on pregnancy should be provided to youth.
- Many maternal deaths are among HIV-positive women and are preventable. Following-up the cause of death in detail can provide information that will help in taking the right action for reducing the risk of losing life.
- Data from birth and death certificates indicate that about half the mothers who successfully committed suicide did so within 10 days of giving birth. In all such cases, the women chose either hanging or drinking pesticide. Their infants and society have lost a great deal from such incidents, which are preventable.

- It has been alleged that people under the CSMBS scheme get better quality medical treatment than those under non-CSMBS schemes. The number of eligible people under CSMBS was 5.6 million in 2006. The number of people not covered by CSMBS was approximately 56.4 million, which is 10 times higher than the number covered by CSMBS. In 2006, the number of maternal deaths among women covered by CSMBS was 15, while that of their non-CSMBS counterparts was 315. This indicates that maternal deaths among non-CSMBS women were 21 times higher than among those covered by CSMBS. Even though there might be some other factors at work, we think that something has to be done to improve the equity of health-care quality among Thais.

Many more policy implications can be drawn from the data if we investigate the causes of death in detail, a step that should be done after calculating MMR. From our initial investigation of maternal death, we recommend that health, economic and social interventions across organizations be implemented simultaneously in order to reduce maternal deaths. In attacking this issue, horizontal cooperation will achieve interventions more effectively, as we have learned from this study, that is, multi-organization cooperation could improve understanding of the issue, reduce the knowledge gap across organizations and produce a more cost-effective way of doing the same thing.

ENDNOTES

[1] Thailand has admitted that the MMR target of 9 per 100,000 live births is too ambitious (NESDB 2004, 30). According to WHO/UNICEF and the United Nations Population Fund (UNFPA), the following countries and territories with good death registration and good attribution of cause of deaths have MMRs of 9 or lower (figures in parentheses are maternal deaths per 100,000 live births): Australia (8), Austria (4), Canada (6), Croatia (8), Czech Republic (9), Denmark (5), Finland (6), Germany (8), Greece (9), Iceland (0), Ireland (5), Italy (5), Kuwait (5), New Zealand (7), Portugal (5), Qatar (7), Slovakia (3), Spain (4), Sweden (2), and Switzerland (7) (WHO 2004, 23-24).

[2] See footnote [a] in Table 1.

[3] A stillbirth is defined as the death of a fetus at any time after the twentieth week of pregnancy. Neonatal death is the death of a live-born infant within 28 days of its birth.

[4] The 35 percent cohort could include the following: those who died outside public hospitals or in private hospitals, those who were under the SSS, or those who paid for their medical care as an out-of-pocket expense.

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