

stetrician on duty, the mortality rate was highest in facilities with 4 or more obstetricians, although among preventable deaths, the mortality rate for facilities with only 1 obstetrician was higher than facilities with 2 or more obstetricians (TABLE 6). As the number of obstetricians working at a facility increased, the maternal mortality rate for preventable deaths due to hemor-

rhage decreased: 3.80 for 1 obstetrician per facility; 0.47 for 2 to 3 obstetricians per facility; and 0 for 4 or more obstetricians per facility. National data on staffing patterns of anesthesiologists and availability of laboratory services do not exist and so calculating the maternal mortality rate for these variables was precluded.

The distribution of maternal deaths by facility that rendered treatment during the critical period of preventability revealed a dramatic decrease in the rate per 100 000 going from the smallest to largest facilities—56 for transferring facilities, 26 for nontransferring facilities, and 4 for receiving facilities (TABLE 7). Thus, the preventable maternal death rate was 14 times higher in transferring facilities and 6.5 times higher in nontransferring facilities than in receiving facilities. We also examined the proportion of unpreventable and preventable deaths according to the obstetric and anesthetic staffing and laboratory services during the critical period of preventability. TABLE 8 illustrates a

dramatic decrease in the proportion of preventable deaths as the number of obstetricians on duty during the critical period increased. Although relatively few facilities were staffed with anesthesiologists, the trends for their participation when present were similar, and the proportion of preventable deaths was essentially unchanged when combining the number of obstetricians and anesthesiologists. This suggests that a critical factor is staffing—there were fewer maternal deaths when there were more physicians available to care for the patient. Finally, only a limited number of facilities where maternal deaths occurred provide continuous access to even basic laboratory services. For example, the percentage of facilities with 24-hour availability of 3 test panels were complete blood cell count, 50%; liver function testing, 45%; and coagulation studies, 20%.

COMMENT

Inadequate obstetric and anesthetic services and laboratory facilities are asso-

Table 5. Causes of Maternal Deaths, Japan, 1991-1992*

Deaths Occurring in Medical Facilities (n = 197)	
Hemorrhage	74 (38)
Uterine rupture	14
Atony	11
Placental abruption	10
DIC of unknown etiology	8
Ectopic pregnancy rupture or abortion	8
Secondary to cesarean delivery or hysterectomy	8
Placenta previa	6
Cervical or vaginal lacerations	5
Unknown cause	4
Intracranial hemorrhage	27 (14)
Intracerebral hemorrhage	20
Subarachnoid hemorrhage	7
Hypertensive disorders of pregnancy	17 (9)
Pulmonary edema	11
Hepatic necrosis due to HELLP syndrome	3
Acute fatty liver	2
Other	1
Pulmonary embolism	17 (9)
Amniotic embolism	7 (4)
Other direct causes	19 (10)
Sepsis	5
Anesthesia complications	4
Multiple organ failure due to DIC	4
Hyperemesis gravidarum	3
Spontaneous aspiration of gastric contents	2
Adverse reaction to ritodrine hydrochloride, furosemide, albumin	1
Other indirect causes	19 (10)
Cardiovascular disease	5
Pneumonia	3
Asthma	2
Pancytopenia secondary to viral infection	2
Other	7
Unexplained	17 (9)

Deaths Occurring Outside of Medical Facilities (n = 22)

Postpartum hemorrhage	12
Acute heart failure	4
Ectopic pregnancy	3
Abortion	1
Acute respiratory failure (cause unknown)	1
Subarachnoid hemorrhage	1

*DIC indicates disseminated intravascular coagulation; HELLP, hemolysis, elevated liver enzymes and low platelet count. Percentages (in parentheses) do not sum to 100% because of rounding. Eleven deaths were not included in the analysis because 3 facilities refused participation, 5 had no patient records, and 3 were closed.

Table 6. Mortality Rates for Unpreventable and Preventable Deaths per 100 000 Live Births by the Number of Obstetricians, Japan, 1991-1992

Obstetricians on Duty, No.	Estimated No. of Live Births	Maternal Deaths, No. (Rate*)	Unpreventable Maternal Deaths, No. (Rate*)	Preventable Maternal Deaths, No. (Rate*)	Preventable Maternal Deaths Due to Hemorrhage, No. (Rate*)
0†	25 215	32 (12.7)	30 (11.9)	2 (7.93)	1 (3.97)
1	1 052 613	99 (9.41)	56 (5.32)	43 (4.09)	40 (3.80)
2-3	1 061 143	51 (4.81)	34 (3.2)	17 (1.60)	5 (0.47)
≥4	293 208	48 (16.3)	38 (12.9)	10 (3.41)	0 (0)
Total	2 432 179	230 (9.45)	158 (6.49)	72 (2.96)	46 (1.89)

*Rate is per 100 000 live births.

†This category includes 22 women who died outside a medical facility, 5 who died at home, and 5 who died in a facility with an obstetrician on call from home.

Table 7. Distribution of Maternal Deaths by Facility Type Rendering Treatment During Critical Period of Death Preventability, Japan, 1991-1992*

Variables	Nontransferring	Transferring	Receiving	Total
Total in-hospital maternal deaths, No.	82	104	11	197
Identified preventable maternal deaths treated during the critical period, No.	21	46	5	72
Live births per facility type, 1991-1992, No.	82 347	82 533	121 712	286 592
Rate of preventable maternal deaths per 100 000 population	26	56	4	25
Ratio of preventable deaths rate to receiving facilities rate	6.5	14	1	6.3

*Nontransferring indicates medical facilities where patients were never transferred; transferring, medical facilities that transferred patients to receiving facilities; and receiving, medical facilities where the patients ultimately died after transfer from a transferring facility. Eleven deaths were not included in the analysis because 3 facilities refused participation, 5 had no patient records, and 3 were closed.