# IMPACT OF PRENATAL CARE ON PERINATAL MORTALITY

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**Abstract.** This study aimed to estimate the perinatal mortality rate (PMR) in Ho Chi Minh City, Vietnam, and to assess the association between perinatal death (PD) and prenatal care (PC). During January 1st to December 31st, 1992, among 4,809 births ascertained from 22 communes randomly selected in two areas, urban and rural, of Ho Chi Minh City, 48 still births and 66 early neonatal deaths were recorded, resulting in a weighted PMR of 25 (95% confidence interval: 20-29) per thousand. Major causes of PD were prematurity 33%, congenital malformation 15%, perinatal asphyxia 12%, perinatal infection 11%, birth injury 4%, others 8% and unknown 16%. From the whole sample, a nested case-control study was conducted on 103 cases (all the mothers whose infants died) and 309 controls (selected among the mothers of surviving infants) to assess the relationship between PD and prenatal care (PC). During unconditional logistic regression, starting prenatal care (PC) within the 1st trimester was associated with a lower risk of PD, giving an odds ratio of 0.11 (95% CI: 0.02-0.61), whereas having 4 to 8 visits gave an odds ration of 0.15 (95% CI: 0.03-0.67). It is concluded that early onset of prenatal care and having four to eight visits provide significant protection against perinatal mortality.

## INTRODUCTION

Perinatal mortality rate (PMR) is a good indicator of the medical care offered to pregnant women, their delivery and their newborn because of its sensitivity to changes over relatively short periods (Bakketeig and Hoffman, 1985;). PMR is easy to ascertain since perinatal death is a dichotomous event and the post-natal fraction is short. Determinants of perinatal mortality (PM), such as sociodemographic, environmental and behavioral factors, as evaluated by several previous studies are however subject to controversies (Poland *et al*, 1987, 1990; Caunes *et al*, 1990; Guendelman, 1990; Nguyen *et al*, 1991; Malik and Mir, 1992). Regarding prenatal care (PC), one of the most significant determinants of PM, the con-tribution of PC to the overall reduction of PM varies considerably in different settings due to the inconsistency in its quality and intensity (Ryan *et al*, 1980; Shear *et al*, 1983; Flynn, 1985; Insler *et al*, 1986; Nagey, 1989; Nesbitt *et al*, 1990).

With a PMR estimated as 50/1,000 in 1985, Vietnam is among Asian countries having highest perinatal mortality rate. Few data on PM have been published recently, however the situation in Ho Chi Minh City appears to be improved, with approximately 80% of pregnant women seeking prenatal care at a government or a private facility (Cuong and Thieu, 1991). Our study was conducted to analyze the situation of PM in Ho Chi Minh City, as well as to confirm the association between PM and PC that would be useful for further planning, provision of health resources, and improvement of services.

## MATERIALS AND METHODS

### Design

This was a two-part study: 1) a one-year retrospective survey to describe the perinatal mortality in Ho Chi Minh City, and 2) a nested case-control study to assess the association between perinatal death (PD) and prenatal care (PC). Cases were defined as women whose pregnancy resulted in perinatal wastage, and controls, those whose infants survived the first week of life.

### Population

Female residents of 22 randomly selected communes of the city, aged 15-49, who gave birth during the period from January 1st to December 31th 1992 were selected. In the nested case-control, all potential cases were to be recruited, then 3 controls for each case, matched by residence and date of delivery, were selected accordingly. A sample size of 101 cases was sufficient to obtain a 90% chance to detect a significant association between PD and PC with an odds ratio (OR) of 0.5, at 5% significance level for one-sided testing.

### Sampling

The city population was divided into 250 communes of nearly equal size, stratified as 168 urban and 68 rural. An urban: rural allocation ratio of 4.5 : 1 was used to select 18 urban and 4 rural communes. This allocation ratio, not proportional to size, was determined after taking into consideration the differences in variances of mortality rate and in costs to obtain an observation between two areas.

### Sources of data

The birth registry was used to ascertain live and still births as 99% of pregnant women in Ho Chi Minh City delivered in either a hospital or a health center. Early neonatal deaths (END) were identified using death registry in Infant hospitals and Neonatology department of Obstetric and Gynecology hospitals, since most of END occurred in hospitals. Data for the case-controls, including socioeconomic factors, past obstetric history, data on the index pregnancy particularly seeking prenatal care (PC) behavior, and details on the infant, were collected during home interviews. Quality control of data was made by randomly selecting and visiting 2% of the subjects to verify the reliability of data.

### Statistical methods

Data were analyzed with the design effect (caused by cluster sampling) and the weighting factors (due to non-propotional to size stratified sampling) taken into consideration. Unpaired *t*-test or Mann Whitney *U* test, and chi-squared or Fisher's exact test, were used for the comparison between groups with respect to continuous and categorical data, respectively. Associations between PD and other variables were assessed by the odds ratios (ORs) and their 95% confidence interval given by conditional and unconditional logistic regression under the control of Hosmer-Lemeshow goodness-of-fit test, whereas design effect was controlled during multivariate analysis using Huber standard error. STATA statistical package was used for data analysis.

## RESULTS

During the study year, 48 stillbirths and 66 early neonatal deaths (END) were ascertained from a total of 4,809 births in 22 communes. From different mortality rates in urban (21/1,000) and rural (34/1,000) areas, the weighted PMR was estimated at 25 (95% confidence interval 20-29) per 1,000. Mortality rates for different birth weight groups, 1,000-1,499, 1,500-1,999, 2,000-2,499, 2,500-3,999, and ≥ 4,000 grams, were 730, 250, 27, 10, and 20 per 1,000 births, respectively.

Among the major causes of death, prematurity accounted for 33% of perinatal deaths (PD), the rest being congenital malformations, perinatal asphyxia, perinatal infections, birth injuries, others and unknown, 15, 12, 11, 4, 8, and 16%, respectively. No evidence of seasonal variation in perinatal mortality was found.

Maternal ages were similar between the PD group and the non-PD group: 28.2 versus 27.9 years, and parity was the same (1.9) in both groups. PD was not associated with mode of delivery: mortality rates in normal, vacuum, forceps and cesarean deliveries were 2.0, 1.6, 3.5 and 6.5%, respectively. For males and females, mortality rates were 2.3 and 2.4%, respectively.

In the nested case-controls, 103 cases were selected from 114 PD after excluding 11 migrants, and 309 controls were selected accordingly. No difference was found between case series and 11 migrants, and between control series and non-selected subjects of non-PD group, in terms of age, parity, mode of delivery, infant's sex and birth weight. None of the potential mothers refused interview.

During univariate analysis, age at marriage, marital and employment status, smoking habit, husband's occupation, previous IUD use, condom use and surgical sterilization were not related to PD. Positive associations were found between PD and fewer years of formal education, hard working

Table 1

Distribution of sociodemographic characteristics among cases and controls.

| | Cases (n = 103) | Controls (n = 309) | p-value |
|---|---|---|---|
| **Area:** | | | NS[a] |
| Urban | 77 (74.8) | 231 (74.8) | |
| Rural | 26 (25.2) | 78 (25.2) | |
| **Age at marriage** (mean, SD) | 22.7 (3.70) | 22.0 (3.54) | NS[e] |
| **Marital status:** | | | NS[c] |
| Married | 100 (97.1) | 294 (95.1) | |
| Divorced | 1 (1.0) | 9 (2.9) | |
| Widowed | 2 (1.9) | 6 (1.9) | |
| **Years of education** (mean, SD) | 4.6 (3.21) | 6.3 (2.99) | 0.001[d] |
| **Educational level:** | | | < 0.001[b] |
| Illiterate | 7 (6.8) | 8 (2.6) | |
| 1st degree | 52 (50.5) | 90 (29.1) | |
| Higher than 1st degree | 44 (42.7) | 211 (68.3) | |
| **Employment status:** | | | NS[a] |
| Employed | 24 (23.3) | 104 (33.7) | |
| Non employed | 79 (76.7) | 205 (66.3) | |
| **Work done during pregnancy:** | | | < 0.001[c] |
| None | 4 (3.9) | 28 (9.1) | |
| Sedentary job | 84 (81.6) | 272 (88.0) | |
| Active job | 15 (14.6) | 9 (2.9) | |
| **Smoking habit:** | | | NS[c] |
| None smoker | 99 (96.1) | 293 (94.8) | |
| Ex-smoker | 2 (1.9) | 3 (1.0) | |
| Smoker | 2 (1.9) | 13 (4.2) | |
| **Husband's employment status:** | | | NS[a] |
| Employed | 62 (60.2) | 210 (68.0) | |
| Non employed | 41 (39.8) | 99 (32.0) | |
| **Husband's smoking habit:** | | | < 0.001[c] |
| Non smoker | 13 (12.6) | 96 (31.1) | |
| Ex-smoker | 3 (2.9) | 9 (2.9) | |
| Smoker | 87 (84.5) | 204 (66.0) | |
| **Number of cigarettes/day:** | (n = 87) | (n = 204) | < 0.001[c] |
| < 10 | 7 (8.0) | 76 (37.3) | |
| 10-20 | 63 (72.4) | 109 (53.4) | |
| > 20 | 17 (19.5) | 19 (9.3) | |
| **Economic level:** | | | < 0.001[b] |
| Low | 60 (58.2) | 94 (30.5) | |
| Middle | 40 (38.9) | 175 (56.6) | |
| High | 3 (2.9) | 40 (12.9) | |

Data are n (%)
[a] : Chi-squared p-value
[b] : Chi-squared for trend p-value
[c] : Fisher exact p-value
[d] : Mann Whitney p-value
[e] : *T*-test on log-transformed data

during pregnancy, heavy smoking of the husband, lower economic level, non-use of oral or injectable contraceptive (DMPA), previous abortion, previous PD, short interval between the previous 2 deliveries, and complication during pregnancy and labor (Tables 1, 2, 3). Percentages of seeking prenatal care (PC) among cases and controls were 43% and 75%, respectively. Prenatal care was protective to PD when started during the first trimester. No dose-response relationship was found between PD and number of visits, since protective effect of PC was obtained merely when a woman sought 4-8 visits during her pregnancy. The main reason for seeking PC was the perception of its benefit, whereas non-seeking PC was mainly due to lack of time (Table 4).

Table 2

Distribution of obstetric past history.

| | Cases (n = 103) | Controls (n = 309) | p-value |
|---|---|---|---|
| Parity (mean, SD) | 1.88 (1.42) | 1.97 (1.14) | NS[c] |
| Primipara | 50 (48.5) | 137 (44.3) | NS[a] |
| Ever practiced contraception | 62 (60.2) | 175 (56.6) | NS[a] |
| Ever used oral contraceptive | 18 (17.5) | 93 (30.1) | 0.014[b] |
| Ever used DMPA | 2 (1.9) | 35 (11.3) | 0.002[b] |
| Ever used IUD | 24 (23.3) | 51 (16.5) | NS[b] |
| Ever used condom | 10 (9.7) | 24 (7.8) | NS[b] |
| Surgically sterilized | 0 (0.0) | 10 (3.2) | NS[b] |
| Previous abortion | 18 (17.5) | 13 (4.6) | < 0.001[b] |
| Previous perinatal death | 18 (17.5) | 27 (8.7) | 0.014[b] |
| Previous preterm delivery | 21 (20.4) | 43 (13.9) | NS[b] |

Data are n (%)
[a] : Chi-squared p-value
[b] : Fisher exact p-value
[c] : Mann Whitney p-value

Table 3

Data on the index pregnancy.

| | Cases (n = 103) | Controls (n = 309) | p-value |
|---|---|---|---|
| Interval between the last two deliveries: | | | < 0.001[a] |
| Primipara | 50 (48.5) | 137 (44.3) | |
| ≤ 2 years | 48 (46.6) | 52 (16.8) | |
| > 2 years | 5 (4.9) | 120 (38.8) | |
| Complication/pregnancy | 71 (68.9) | 90 (29.1) | < 0.001[a] |
| Antepartum hemorrhage | 33 (32.0) | 44 (14.2) | < 0.001[b] |
| Hypertension | 28 (27.2) | 46 (14.9) | 0.007[b] |
| Hospitalization/pregnancy | 3 (2.9) | 2 (0.6) | NS[b] |
| Complication/labor | 79 (76.7) | 64 (20.7) | < 0.001[a] |

Data are n (%)
[a] : Chi-squared p-value
[b] : Fisher exact p-value

Table 4

Data on prenatal care (PC).

| | Cases (n = 103) | Controls (n = 309) | p-value |
|---|---|---|---|
| **Ever sought PC** | 44 (42.7) | 233 (75.4) | < 0.001[a] |
| **Starting PC during:** | | | < 0.001[b] |
| No PC | 59 (57.3) | 76 (24.6) | |
| 1st trimester | 6 (5.8) | 185 (59.9) | |
| 2nd trimester | 35 (34.0) | 44 (14.2) | |
| 3rd trimester | 3 (2.9) | 4 (1.3) | |
| **Number of prenatal visits** | 3.95 (2.47) | 5.48 (1.87) | 0.001[c] |
| **PC intensity:** | | | 0.001[b] |
| No PC | 59 (57.3) | 76 (24.6) | |
| 1-3 visits | 29 (28.3) | 36 (11.6) | |
| 4-8 visits | 9 (8.7) | 186 (60.2) | |
| > 8 visits | 6 (5.8) | 11 (3.6) | |
| **Reason for PC:** | (n = 44) | (n =233) | NS[b] |
| Perceived benefit | 29 (65.9) | 140 (60.1) | |
| Husband's advice | 13 (29.5) | 84 (36.1) | |
| Family's advice | 2 (4.5) | 8 (3.8) | |
| **Reason not to have sought PC** | (n = 59) | (n =76) | NS[b] |
| No benefit | 0 (0.0) | 2 (2.6) | |
| No time | 52 (88.1) | 52 (68.4) | |
| No money | 6 (10.2) | 19 (25.0) | |
| Not allowed by the husband | 1 (1.7) | 3 (3.9) | |

Data are n (%) or mean (standard deviation) as appropriate.
[a] : Chi-squared p-value
[b] : Fisher exact p-value
[c] : Mann Whitney p-value

Effects of trimester of starting PC and number of visits were adjusted for the variables significantly associated with PD in univariate analysis. Starting PC during the first trimester reduced the odds of PD by 9 folds: OR = 0.11, 95% CI = 0.02-0.61, however starting PC during the second trimester was not significantly associated with PD: OR = 1.80, 95% CI = 0.58-5.54. Having 4 to 8 prenatal visits reduced the odds of PD by nearly 7 folds: OR = 0.15, 95% CI = 0.03-0.67, whereas the association between PD and a number of < 4 or > 8 visits was not significant (Tables 5).

## DISCUSSION

Consistent with previous studies, perinatal death was strongly associated with prenatal care (PC) from our findings. The groups of lowest risk of PD consisted of those mothers who had the first visit during their first trimester of pregnancy, or who had a total of 4 to 8 visits. Nagey (1989) explained the association between early onset of PC and reduction in perinatal mortality by the management of psychological stress and the technical support of pregnancy dating. In fact, medical, nutritional advices, advice concerning activity and other patient education are supposed to provide the pregnant woman with sufficient measures to stabilize the ongoing process and to reduce the chance of any abnormality. In high risk pregnancies, early onset of PC might enhance the detection of fetal abnormalities, provide, appropriate counselling and spe-

Table 5

Crude and adjusted odds ratios[a] for the association between perinatal death (PD) and PC.

| | Crude OR | 95% CI | Adjusted OR | 95% CI |
|---|---|---|---|---|
| **Trimester of starting PC:** | | | | |
| No PC | 1 | | 1 | |
| 1st trimester | 0.04 | 0.02-0.11 | 0.11 | 0.02-0.61 |
| 2nd trimester | 1.02 | 0.56-1.86 | 1.80 | 0.58-5.54 |
| 3rd trimester | 0.97 | 0.14-5.95 | (dropped[b]) | |
| **PC intensity:** | | | | |
| No PC | 1 | | 1 | |
| 1-3 visits | 1.04 | 0.55-1.96 | 1.73 | 0.36-8.21 |
| 4-8 visits | 0.06 | 0.03-0.14 | 0.15 | 0.03-0.67 |
| > 8 visits | 0.69 | 0.22-2.21 | 2.43 | 0.37-16.0 |

[a] : Adjusted for economic score, birth interval, amount of husband's smoking, history of previous preterm delivery, history of previous abortion.
[b] : dropped due to collinearity with history of previous abortion.

cific medical management, as well as consideration of delivery in a tertiary center where the neonatal intensive care is available. Regarding PC intensity, a prospective study by Insler *et al* (1986) on 6,908 deliveries in Israel demonstrated that number of visits was inversely proportional to perinatal mortality. Ryan *et al* (1980), when analyzing more than 3,000 records of deliveries in Tennessee, US, 1979, found that prematurity and perinatal mortality rates decreased when the number of prenatal visits increased. It was noted from our data that mothers having 1-3 visits had a non significantly higher risk, since those who sought less visits were more likely to have a delayed onset of PC when a complication had occurred: in fact 45% of the subjects in this group had a complicated pregnancy. Similarly higher risks of PD, although not significant, among those who sought an excessive number of visits, were mostly due to a serious complication or disease during their pregnancy rather than to PC itself, should be regarded as not satisfactory. Our data revealed that among those who had not sought PC, very few were unaware of its benefits. Few subjects did not access PC for financial reasons, since perinatal health services are mostly free of charge in our setting. Main reason for not attending a prenatal clinic was lack of time, but this might imply a negative attitude to PC. Therefore from a client viewpoint, the provision of perinatal health care needs to be improved to increase the utility of services.

From our perinatal mortality survey, variations of PD by month of the year and time in day did not exist, in contrast to a previous report (Bakketeig and Hoffman, 1985). Maternal age and parity in our data were not associated with PD, consistent with others' findings (Buckell and Wood, 1985; Fauveau *et al*, 1990; Yosef *et al*, 1992). Perinatal mortality is strongly determined by birth weight, although its variation by birth weight group was not completely linear. Therefore to reduce perinatal mortality, preterm delivery must be prevented and properly controlled. There have been reports that two thirds of preterm deliveries are preventable (Murray and Bernfield, 1988; Nguyen, 1991).

In conclusion, prenatal care is most beneficial if started during the first trimester of pregnancy with a suitable number of visits. The current 75% coverage of prenatal care, and a PMR of 25/1,000 are both unsatisfactory. Perinatal mortality could be reduced by an effective control and prevention of preterm deliveries as a result of an improvement of perinatal health promotion and services.

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