

# Vietnamese Infant and Childhood Mortality in Relation to the Vietnam War

## ABSTRACT

**Objectives.** There is obvious potential for war to adversely affect infant and childhood mortality through direct trauma and disruption of the societal infrastructure. This study examined trends in Vietnam through the period of the war.

**Methods.** The 1988 Vietnam Demographic and Health Survey collected data on reproductive history and family planning from 4172 women aged 15 through 49 years in 12 selected provinces of Vietnam. The 13 137 births and 737 deaths to children younger than age 6 reported by the respondents were analyzed.

**Results.** For the country as a whole, infant and childhood mortality dropped by 30% to 80% from the prewar period to the wartime period and was stable thereafter. In provinces in which the war was most intense, mortality did not decline from the prewar period to the wartime period but declined after the war, consistent with an adverse effect during the wartime period.

**Conclusions.** The data are limited by assignment of birth location on the basis of mother's current residence and by inadequate information on areas of war activity. Nonetheless, the data do not indicate a widespread, sizable adverse effect of the war on national infant and childhood mortality in Vietnam but suggest detrimental effects in selected provinces. (*Am J Public Health*. 1993;83:1134-1138)

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### Introduction

The potential for war-related activities to adversely affect the health of infants and children is apparent. Direct casualties through trauma as well as indirect threats to life through loss of one or both parents, inadequate nutrition, and infectious disease from contaminated water supplies might be expected to increase rates of infant and childhood mortality during a war. Only one aspect of the war in Vietnam has received substantial attention with regard to reproductive health, namely the influence of Agent Orange on Americans who served in Vietnam<sup>1</sup> and on the Vietnamese population.<sup>2-4</sup> Detailed studies of other war-related disruptions, such as the Dutch famine of World War II,<sup>5</sup> have found notable adverse effects on birthweight and infant mortality.

To our knowledge, no broad surveys of infant health consequences of the wartime activities in Vietnam have been conducted. Although both the array of exposures and the outcomes available from the recently released 1988 Vietnam Demographic and Health Survey<sup>6</sup> are not very specific or detailed, these data do provide a general description of infant and childhood mortality in relation to the war in Vietnam.

### Methods

The 1988 Vietnam Demographic and Health Survey<sup>6,7</sup> was the first national survey of reproductive health and behavior in that country. According to the 1989 census, the total population of Vietnam was 64.4 million. A national policy supportive of fertility regulation had been in effect since 1963. As part of the effort to control fertility, the National Committee for Pop-

ulation and Family Planning was established in 1984; the Committee commissioned the survey to obtain pertinent information for implementation of this policy.

A sampling approach recommended by the World Fertility Survey was used to design a three-stage probability sample to provide adequately precise estimates for northern and southern regions of the country, for urban and rural areas, and for the country as a whole.<sup>6</sup> Briefly, a list of subdistricts, provinces, and cities served as the sampling frame. Hanoi and Ho Chi Minh City were arbitrarily selected for inclusion, and 10 other provinces were selected by means of sampling fractions proportionate to their size. In the second stage, 151 clusters were selected from within the 12 chosen areas, allocated according to population size. The clusters were allocated as 32 urban and 119 rural; 3 were in the mountain areas, 58 in the north, 40 in central Vietnam, and 50 in the south. In each selected cluster, households were enumerated and probabilities were assigned to obtain a total of 4806 households that contained 4172 ever-married women aged 15 through 49 years for interviews.

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Survey instruments were developed and pretested, and detailed procedures manuals were developed concerning sample selection and interviewing. Training courses were held to standardize data collection procedures across the 12 participating provinces, involving supervisors, editors, and interviewers in each of the provinces. Editing was done both locally and centrally prior to data entry to detect errors, identify needs for additional training of staff, and code open-ended questions.

Data were collected on the respondent's background (age, education), reproductive history (all births, survival of offspring), contraception and abortion history, health and breast-feeding histories, marriage, fertility preferences, and employment of father and mother. The response rate was nearly 99% overall, with a narrow range of 98.4% to 98.7% across regions. Seventeen percent of the respondents resided in urban areas and 83% in rural areas. Respondents were approximately evenly divided between north and south. Fifty-three percent of the women had three or more living children. Only 6% were illiterate; 21% were able to read and write but lacked formal schooling. Detailed descriptions of survey methodology and the data collected are provided elsewhere.<sup>6,7</sup>

For the analyses of mortality, the woman's reproductive history was the primary data source. Each woman was asked about the time of each live birth, the sex of the child, whether the child was alive at the time of the survey, and, if deceased, the exact age at death (years, months, and days). This information provided a complete roster of births among women in the survey. Analogous births to women who had moved out of the provinces or who were themselves deceased were thus not available for inclusion.

The risks of neonatal mortality (deaths from birth to 1 month of age), postneonatal mortality (deaths from 1 to 12 months of age), infant mortality (deaths from birth to 12 months of age), and childhood mortality (deaths from 1 to 6 years of age) were calculated by dividing the number of deaths by the number of children who entered the age interval and either died or survived to the end of the interval. Living children who were too young to have entered and survived through an interval were excluded from the calculation of risks for that period. In the case of children younger than 1 year for whom number of months was missing, age was obtained by subtracting the birth date from

Time Period	Neonatal Mortality	Postneonatal Mortality	Infant Mortality	Child Mortality
All periods				
No. dead	257	208	465	272
No. alive	12 837	11 993	11 993	7 943
Total	13 094	12 201	12 458	8 215
Mortality risk per 1000	19.6	17.0	37.3	33.1
Prewar (before 1965)				
No. dead	17	18	35	22
No. alive	594	576	576	554
Total	611	594	611	576
Mortality risk per 1000	27.8	30.3	57.3	38.2
RR, prewar vs wartime	1.3	1.8	1.5	1.3
95% CI	0.8, 2.2	1.1, 3.1	1.1, 2.2	0.8, 2.0
Wartime (1965–1975)				
No. dead	75	58	133	103
No. alive	3 478	3 420	3 420	3 317
Total	3 553	3 478	3 553	3 420
Mortality risk per 1000	21.1	16.7	37.4	30.1
Postwar (1976 and later)				
No. dead	165	132	297	147
No. alive	8 765	7 997	7 997	4 072
Total	8 930	8 129	8 294	4 219
Mortality risk per 1000	18.5	16.2	35.8	34.8
RR, postwar vs wartime	0.9	1.0	1.0	1.2
95% CI	0.7, 1.2	0.7, 1.3	0.9, 1.3	0.7, 1.1

Note. Results have been calculated from data from the 1988 Vietnam Demographic and Health Survey.<sup>6</sup>  
RR = relative risk; CI = confidence interval.

the interview date. Risks were expressed per 1000 infants or children at risk.

The births were assigned to the specific time period in which they occurred, divided into prewar (before 1965), wartime (1965 through 1975), and postwar (1976 or later) periods. The region in which the mother currently resided was assumed to be the location of all births to that mother. Regions were designated as north or south on the basis of the division of the country prior to the war. In the absence of objective information on war intensity by province, a subjective estimate (provided by N.M.T.) was used to divide the country into regions of presumed high, intermediate, and low war activity. The provinces were assigned as follows: high—Nghe Tinh, Binh Tri Thien; intermediate—Hanoi, Ha Bac, Ha Nan Ninh, Phu Khanh; low—Tien Giang, Dong Nai, Hai Hung, Cao Bang, Hau Giang, Ho Chi Minh City. Analyses of mortality were conducted to compare the time trends through the period of the war across regions. An adverse influence of the war might be manifested for the country as a whole but should be exaggerated in the areas of greatest war intensity.

Several sociodemographic factors were examined as potential confounders

in stratified analyses and logistic regression models. The potential for confounding by maternal age is apparent; the prewar births necessarily occurred to younger mothers than wartime births. In addition to maternal age (< 21 years, ≥ 21 years), the infant's sex, mother's education (illiterate or read/write, primary or secondary and above), and birth order (1, 2–4, ≥ 5) were considered. The exponents of the logistic regression coefficients yielded adjusted odds ratios for the variable Year of Birth, with adjustment for the other variables in the model.

## Results

Table 1 presents the overall risks of neonatal, postneonatal, infant, and childhood mortality for all provinces. More than 13 000 live births were included in the survey; there were 737 deaths of children younger than age 6. Dividing births into prewar, wartime, and postwar periods (Table 1) shows a decrease in mortality rates from the prewar period to the wartime period (relative risks [RRs] of 1.3 to 1.8); the decrease is most apparent for postneonatal mortality and least apparent for neonatal and childhood mortality. A comparison of wartime and postwar mor-

TABLE 2—Adjusted Odds Ratios (ORs) and Confidence Intervals (CIs) for Demographic Factors in Infant and Childhood Mortality

	Neonatal Mortality		Postneonatal Mortality		Infant Mortality		Childhood Mortality	
	Adjusted OR	95% CI	Adjusted OR	95% CI	Adjusted OR	95% CI	Adjusted OR	95% CI
Sex								
Male	1.0	...	1.0	...	1.0	...	1.0	...
Female	0.9	0.6, 1.1	0.7	0.5, 0.8	0.8	0.6, 0.9	0.9	0.6, 1.1
Mother's age at birth								
≥21 y	1.0	...	1.0	...	1.0	...	1.0	...
<21 y	1.3	0.8, 2.0	1.1	0.6, 1.7	1.2	0.8, 1.6	1.7	1.0, 2.5
Mother's education								
Primary or higher	1.0	...	1.0	...	1.0	...	1.0	...
Illiterate/read and write	1.2	0.8, 1.5	1.4	1.0, 1.8	1.2	1.0, 1.5	0.9	0.7, 1.2
Birth order								
1	1.0	...	1.0	...	1.0	...	1.0	...
2-4	1.0	0.7, 1.3	0.8	0.5, 1.1	0.9	0.7, 1.1	2.3	1.6, 3.3
5+	1.7	1.1, 2.5	1.8	1.1, 2.6	1.8	1.3, 2.3	3.1	2.0, 4.7
Year of birth								
Before 1965	1.3	0.7, 2.2	1.8	1.0, 3.2	1.5	1.0, 2.3	1.4	0.8, 2.2
1965-1975	1.0	...	1.0	...	1.0	...	1.0	...
1976 or later	0.9	0.6, 1.1	1.0	0.7, 1.3	1.0	0.7, 1.1	1.1	0.8, 1.4

Note. Results have been calculated from data from the 1988 Vietnam Demographic and Health Survey.<sup>8</sup> Adjustment was by logistic regression for other variables in the table.

tality indicates that there was little or no decline (RRs of 0.9 to 1.0). Wartime declines were sustained but enhanced very little after the war.

Demographic determinants were examined in combination with time period through logistic regression modeling, as shown in Table 2. Males, children born to mothers younger than 21 years, children of less educated mothers, and children of birth order 5 or higher were at increased risk of mortality at all ages. However, adjusting simultaneously for all these factors left the pattern by time period unaffected: mortality was markedly higher in the prewar period, fell during wartime, and then remained at that level through the postwar period.

Possible heterogeneity in the patterns by geographic area was examined by dividing the country into north and south regions (the intensity of the war was notably greater in the south) and by estimated level of war intensity on a province-by-province basis (Table 3). As would be expected, the precision of the estimates is markedly diminished, but adjusted odds ratios indicate that the south experienced a greater reduction in mortality during and after the war years than did the north. This pattern was apparent for mortality at all ages but was especially strong for infant mortality, which showed little decrease

over time in the north and a sizable decrease (odds ratios of 0.4 to 0.6) in the south.

Stratifying the provinces into high, intermediate, and low war intensity yielded a suggestive differential in pattern by time period. The low- and intermediate-intensity provinces demonstrated the same trends as those observed nationally: markedly higher prewar than wartime mortality, followed by an absence of decline in the postwar period. The prewar-to-wartime drop was most marked for the intermediate-intensity provinces. In contrast, the high-intensity area showed a different pattern (on the basis of very small numbers of prewar births). Based on only one or two deaths per stratum, the prewar mortality rates were actually lower than the wartime rates (RRs of 0.6 to 0.9). Furthermore, in these provinces alone, infant mortality and its subsets declined following the war to levels 30% lower than wartime levels, although childhood mortality increased by the same proportion.

## Discussion

Contrary to what might be expected, the secular trends toward reduced infant mortality were most apparent nationally during the wartime period, and those changes were maintained rather than en-

hanced after the war. This pattern was not confounded by the measured demographic risk factors (mother's age and education, child's sex and birth order) and was stronger in the south than in the north. Only within the stratum of provinces believed to be most intensely affected by the war were the results supportive of a measurable adverse effect of the war on infant and childhood mortality.

A number of limitations must be noted that affect our ability to draw conclusions about an absence of more global adverse effects of the war. Given the timing of the data collection, only long-term survivors of the war could be included in the survey. The exclusion of mortality among orphans, whose mothers were not available for interview, may well underestimate the impact of the war on infant and child health.

It is impossible to know what trends would have emerged in the absence of the disruption of the war, that is, how much infant and childhood mortality would have otherwise dropped. The estimated relative risks of 1.3 to 1.8 for prewar vs wartime mortality might have been even more striking under more favorable circumstances.

The inability to define with much precision those individuals most likely to suffer adverse effects of the war precludes the conclusion that no subgroup suffered marked adverse effects. In fact, although the suggestive results for the high-war-intensity provinces is consistent with such effects. The infants and children in the very specific locations of greatest war intensity may well have suffered notable increases in mortality that were not discernible in the data that were available. Births were assigned to locations on the basis of the mother's residence at the time of the survey, not on the basis of her residence at the time of the birth. Women may well have moved since the war, either within Vietnam or into or out of the country. Depending on the reproductive health history of such migrants, the patterns we observed could be biased in any direction. If such movement into and out of areas was unrelated to infant and child survival, then the relative risks would be diluted toward no association by nondifferential misclassification.<sup>8</sup>

Use of the broad time periods of prewar, wartime, and postwar may further dilute any true associations. The evolution of the war may well have caused some war-related harm prior to 1965, and the inconsistent intensity of the war would have resulted in heterogeneity during the



TABLE 3—Infant and Childhood Mortality Risks, by Time Period and Province

	Neonatal Mortality	Postneonatal Mortality	Infant Mortality	Child Mortality
<b>North</b>				
Prewar (before 1965)				
Number of deaths	7	5	12	4
Mortality risk per 1000	26.4	19.4	45.3	15.8
RR, prewar vs wartime	1.2	1.7	1.4	0.7
95% CI	0.5, 2.7	0.6, 4.6	0.7, 2.6	0.3, 2.0
Wartime (1965–1975)				
Number of deaths	36	18	54	35
Mortality risk per 1000	22.0	11.3	33.0	22.1
Postwar (1976 and later)				
Number of deaths	91	62	153	81
Mortality risk per 1000	18.2	13.6	33.0	36.1
RR, postwar vs wartime	0.8	1.2	1.0	1.6
95% CI	0.6, 1.2	0.7, 2.0	0.7, 1.4	1.1, 2.4
<b>South</b>				
Prewar (before 1965)				
Number of deaths	10	13	23	18
Mortality risk per 1000	28.9	38.7	66.5	55.7
RR, prewar vs wartime	1.4	1.8	1.6	1.5
95% CI	0.7, 2.8	1.0, 3.4	1.0, 2.6	0.9, 2.5
Wartime (1965–1975)				
Number of deaths	39	40	79	68
Mortality risk per 1000	20.3	21.3	41.2	37.0
Postwar (1976 and later)				
Number of deaths	74	70	144	66
Mortality risk per 1000	18.8	19.6	39.4	33.5
RR, postwar vs wartime	0.9	0.9	1.0	0.9
95% CI	0.6, 1.4	0.6, 1.4	0.7, 1.3	0.6, 1.3
<b>Low-intensity provinces</b>				
Prewar (before 1965)				
Number of deaths	11	12	23	20
Mortality risk per 1000	29.6	33.3	62.0	57.5
RR, prewar vs wartime	1.4	1.8	1.5	1.5
95% CI	0.7, 2.6	0.9, 3.4	1.0, 2.4	0.9, 2.5
Wartime (1965–1975)				
Number of deaths	43	36	79	70
Mortality risk per 1000	22.0	18.8	40.3	37.3
Postwar (1976 and later)				
Number of deaths	87	85	172	90
Mortality risk per 1000	18.8	20.3	40.3	41.4
RR, postwar vs wartime	0.9	1.1	1.0	1.1
95% CI	0.6, 1.2	0.7, 1.6	0.8, 1.3	0.8, 1.5
<b>Intermediate-intensity provinces</b>				
Prewar (before 1965)				
Number of deaths	5	5	10	1
Mortality risk per 1000	30.7	31.6	61.3	6.5
RR, prewar vs wartime	1.5	2.4	1.8	0.2
95% CI	0.6, 4.1	0.9, 6.4	0.9, 3.7	0.0, 2.0
Wartime (1965–1975)				
Number of deaths	21	14	35	22
Mortality risk per 1000	19.7	13.4	32.8	21.3
Postwar (1976 and later)				
Number of deaths	53	31	84	35
Mortality risk per 1000	20.4	13.0	34.4	28.0
RR, postwar vs wartime	1.0	1.0	1.0	1.3
95% CI	0.6, 1.7	0.5, 1.8	0.7, 1.6	0.8, 2.2
<b>High-intensity provinces</b>				
Prewar (before 1965)				
Number of deaths	1	1	2	1
Mortality risk per 1000	13.0	13.2	26.0	13.3
RR, prewar vs wartime	0.6	0.9	0.7	0.6
95% CI	0.1, 4.7	0.1, 6.8	0.2, 3.1	0.1, 4.7
Wartime (1965–1975)				
Number of deaths	11	8	19	11
Mortality risk per 1000	20.8	15.4	35.9	21.6
Postwar (1976 and later)				
Number of deaths	25	16	41	22
Mortality risk per 1000	14.6	10.3	25.9	27.7
RR, postwar vs wartime	0.7	0.7	0.7	1.3
95% CI	0.3, 1.4	0.3, 1.5	0.4, 1.2	0.6, 2.6

Note. Results have been calculated from data from the 1988 Vietnam Demographic and Health Survey.<sup>6</sup> RR = relative risk; CI = confidence interval.

period classified as “wartime.” Generalization across relatively broad time intervals may also have diluted any adverse effects limited to particular places and times.

Finally, the limited precision of many of the estimates should be acknowledged, especially for the high-war-intensity provinces. Even with a large national survey that is adequate for assessment of present fertility and related behavior, analyses of such rare events as mortality, which is further divided by time period and location, yield some statistically unstable estimates.

Subject to all these caveats, it appears that there was no large, widespread adverse effect of the war on infant and childhood mortality in Vietnam but possibly an influence more limited to the provinces most intensely involved in the war. Perhaps in a largely rural nation in which the provision of such essentials as food, water, and clothing is decentralized, the devastation of the infrastructure (manufacturing, transportation, etc.) is actually less harmful to survival than it would be in a more developed country. There may have been very little “ripple effect” of war-related destruction beyond the immediately affected areas, so that averages even for a heavily affected province might not show up dramatically in aggregate figures.

Even if these results are valid, they should not be generalized to other wars or even to the potential effect of the war in Vietnam on other indices of child health, such as physical or psychological morbidity. Additional evaluation is needed, subject to the challenges of historical research, of more precisely defined areas of war activity and on other health parameters of infants and children born during war. □

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The journal *Health Education Research: Theory and Practice* is soliciting submissions for a theme issue on measurement in health education and health promotion, to be published in 1994. It will focus on quantitative and qualitative measurement in health education and health promotion research or practice. Examples of topics suitable for this issue include, but are not limited to: (a) conceptual discussions of measurement-related issues as they apply to health education or health promotion, theory, research, and practice; (b) the challenges of operationalizing variables stemming from theories that inform health behavior and health education research and practice; (c) examples of innovative solutions to measurement problems; (d) presentations of new instruments or methods for measuring variables of broad interest in health education and health promotion; (e) critical examinations of measurement procedures or instruments widely used in health education; (f) comparisons of qualitative and quantitative measurement approaches; (g) innovations in measurement theory with particular bearing on health education theory, research, and practice or on health promotion; and (h) integrative reviews of measurement issues or approaches in health behavior or health education.

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