IMPACT OF A TETANUS TOXOID IMMUNIZATION MASS CAMPAIGN ON NEONATAL TETANUS MORTALITY IN ACEH PROVINCE, INDONESIA

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Abstract. Neonatal tetanus mortality declined dramatically in Pidie district (Aceh Province) Indonesia between 1984 and 1987. Baseline and follow-up survey results demonstrated an 85% reduction in neonatal tetanus mortality during this period, from 32.1/1000 live births to 4.9/1000 live births. During 1985 a tetanus toxoid mass campaign was conducted in Pidie district which resulted in 84% of women 10-45 years of age receiving two tetanus toxoid injections. Analysis of the results of the two surveys provides very strong evidence of the impact of the tetanus toxoid mass campaign on neonatal tetanus mortality.

INTRODUCTION

There have been relatively few studies which have measured the impact on neonatal tetanus mortality of tetanus toxoid mass campaigns or even routine tetanus toxoid immunization (Berggren and Berggren, 1971; Berggren, 1974; Berggren *et al,* 1981; Black *et al,* 1980; EPI, 1983, 1988; Rahman *et al,* 1982; Rahman, 1982; Schofield *et al,* 1961). This paper presents the results of a tetanus toxoid mass campaign in Pidie district (Aceh Province) conducted in 1985.

In May 1984, the Aceh Province Health Department (located in Northern Sumatra) with assistance from the USAID Project CHIPPS, conducted a province-wide thirty cluster baseline survey to estimate mortality from neonatal tetanus (NT). The survey revealed a NT mortality rate (NTMR) of 20.9/1000 live births in Aceh Province (Yusuf *et al,* 1986. When this rate was broken down by *Kabuputen* (district), it showed wide variation between districts (range: 1.6/1000 - 35.8/1000). Although these district-specific mortality rates were fairly unstable owing to small sample sizes, there were clearly some districts more heavily burdened than others by higher rates of NT deaths. Since the data also indicated that only 10% of mothers received adequate tetanus toxoid (TT) immunization during routine prenatal care, alternative approaches to this strategy of TT delivery needed consideration. Based on the survey results, provincial Ministry of Health (MOH) officials opted to pilot a mass TT immunization campaign directed at all reproductive age women in Pidie district. This district was among the areas with the highest NTMR (32.1/1000 live births). The mass TT campaign in Pidie district attempted to reach all women 10-45 years with a two-dose tetanus toxoid series given one month apart. This crash program took place in Pidie from September to December 1985, and achieved a two-dose TT coverage in the target population of 84%.

Because the crash program represented a shift of strategy from the national MOH approach of targeting reproductive age women through routine services, and because many financial and human resources were directed toward the campaign, a follow-up survey designed to evaluate the impact of the crash program on T mortality was conducted during August 1987 in Pidie district.

MATERIALS AND METHODS

From the 1980 census a list was made of all villages in Pidie district and their population estimates cumulated. The total population of the 948 villages was 332,518 (out of a total Aceh province population of 2.9 million). Thirty cluster site villages were located as per the standard WHO method (Henderson and Sundaresan, 1982;

Galazka and Stroh, 1986), so that the number of cluster sites in each sub-district was proportional to the population of the sub-district.

Since the initial village in each cluster site frequently did not contain enough households for the survey, additional villages were visited in the same *kemukiman* (cluster of Acehnese villages sharing the same central mosque).

All interviewing was done house-to-house until every house in the village was covered; if no adult member of the household was present, the interviewer proceeded to the next house and did not return. All interviewers were either midwives or nurses, and all were from Aceh province. Supervisors were senior staff from either CDC/Jakarta or CDC/Banda Aceh. The sample size was calculated using the formula $n = t2\ pq/d2$, with $t = 1.96$ or 95% confidence limits; $p =$ the estimate of the expected neonatal tetanus mortality, or 9/1000 live births; $q = p - 1$ and d is the precision desired, or 0.35%, thus $n = 2790$. When divided into thirty clusters, 93 live births were required per cluster.

In each cluster, two interviewers worked door-to-door until they identified 93 infants born in the previous 14 months. They determined if the infant was still alive and asked questions concerning pre-natal care, including whether or not tetanus toxoid had been given. All infants found to be born in the month immediately preceding the survey were eliminated from the survey sample, as they had not been alive long enough to be at risk of dying of neonatal tetanus for the full 28 day risk period. If the infant had died, then additional questions were asked to determine age at death and the probable cause of death. In order for an infant death to be considered as having been caused by neonatal tetanus, it had to meet these criteria:

1. full term pregnancy and "normal size" at birth;
2. suckled/breastfed normally at birth;
3. the first sign of a problem was refusal/inability to suck;
4. followed by rigidity, spasms, trismus, or convulsions;
5. there were no other significant signs or symptoms (such as high fever, diarrhea, cough, etc);
6. death occurred between the 3rd and the 28th day after birth;
7. where infant deaths were thought to be caused by neonatal tetanus, a physician supervisor reinterviewed the household.

Infant deaths thought to be due to other causes were not visited by supervisors; no efforts were made to clearly define cause of death in non-tetanus deaths.

RESULTS

In the follow-up survey in Pidie District in 1987, a total of 2,637 infants born in the 13 month period of eligibility were identified by visits to 12,877 households. Thirteen infants had died from neonatal tetanus. The neonatal tetanus mortality rate (NTMR) for Pidie district was calculated as 4.9/1000 live births (LB), with 95% confidence limits (CL) of ±2.6/1000 LB.

A total of 124 infant deaths were identified during the survey period, for an infant mortality rate of 80.7/1000 LB. A total of 77 infant deaths occurred in the first month for a neonatal mortality rate (from all causes) of 29.2/1000 LB. The non-tetanus neonatal mortality rate was 24.3/1000 LB. Thus neonatal tetanus represented 16.7% of the total neonatal mortality rate.

The relationship between the number of tetanus toxoid doses a mother received during the Pidie TT Crash Program in 1985 and neonatal tetanus experience in 1986-1987 is shown in Table 1. The NTMR was six times greater among women who got no TT vaccine than among those who received the two dose series.

Table 2 compares mortality rates found during the two surveys (1984 vs. 1987). In Pidie district the Neonatal Tetanus Mortality Rate fell from 32.1/1000 live births (95% confidence limit 18.6 - 45.6/1000) in 1984 to 4.9/1000 live births (95% confidence limit 2.3-7.5/1000) in 1987. At the same time the neonatal mortality rates fell in Pidie from 59.5/1000 to 29.2/1000. The fraction of the neonatal mortality rate owing to causes *other* than tetanus actually increased slightly, from 27.4/1000 (CL 14.9 - 39.9/1000) to 29.2/1000 (CL 18.8 - 39.6/1000), though this increase was not statistically significant.

The age distribution of mothers in the survey is shown in Table 3. The rates for both neonatal

Table 1

Tetanus toxoid doses received during the 1985 crash program and neonatal tetanus mortality rates. Pidie District, August 1987.

No. of TT doses crash program Sept.-Dec. 85	Live births	% of live births	Neonatal tetanus deaths	Neonatal tetanus mortality rate per 1000/LB
None	646	24.5	8	12.4
One	488	18.5	2	4.1
Two	1503	57.0	3	2.0
Totals	2637	100.0	13	4.9

Table 2

Mortality rates compared: Aceh Province 1984 and Pidie District 1984 and 1987.

Mortality rates	Aceh Province May 1984 n = 4836	Pidie District May 1984 n = 655	Pidie District August 1987 n = 2637
Neonatal tetanus mortality rate (NTMR)	20.9/1000 95% CL ± 4.0/1000 (16.9-24.9/1000)	32.1/1000 95% CL ± 13.5/1000 (18.6-45.6/1000)	4.9/1000 95% CL ± 2.6/1000 (2.3-7.5/1,000)
Neonatal mortality rate (NMR)	38.9/1000 ± 5.4/1000	59.5/1000 ± 18.1/1000	29.2/1000 ± 6.4/1000
Non-Tetanus neonatal mortality rate	18.0/1000 95% CL ± 3.7/1000	27.4/1000 ± 12.5/1000	29.2/1000 ± 10.4/1000
Infant mortality rate	110/1000		80.7/1000

tetanus deaths and total neonatal deaths were highest among women over 39 years. Comparing the number of years of school attended by mothers and the number of antenatal care visits shows a definite linear relationship; 32.7% in the no schooling group had two or more visits compared to 93.1% in the group who attended senior high school.

Almost 63% of the survey population had some form of prenatal care on at least two occasions. Almost two thirds (64.9%) of prenatal care was provided by government-trained midwives in Pidie district (24% at government health centers and 40% in private practice), as shown in Table 4.

The survey found that 78.3% of all live births were attended by trained birth attendants (Table 5). This group experienced a neonatal tetanus mortality rate of 3.9/1000 LB. Those attended by untrained persons experienced a NTMR of 8.7/1000 LB.

The split between antiseptic versus traditional treatment for the umbilical stump was 56% and 41% respectively. The antiseptic category included mainly alcohol or sulfa; the traditional category

Table 3

Age of mother and neonatal tetanus deaths, Pidie District, 1987.

Age of mother	Total live births	Neonatal tetanus deaths	Neonatal tetanus mortality rate	Neonatal deaths	Infant deaths
< 20	228	1	4.4/1000	9	13
20-29	1435	6	4.2/1000	39	62
30-39	767	2	2.6/1000	15	30
> 39	127	4	31.5/1000	12	16
Unknown	80	0	0.0	2	3
Totals	2637	13	4.9	77	124

Table 4

Antenatal care provider and neonatal tetanus deaths, Pidie District, 1987.

Antenatal care	Live births	One visit		Two or more visit	
		#	NT deaths	#	NT deaths
Hospital	65	4	-	61	1
Health center	635	80	2	554	2
Private doctor	52	6	-	46	-
Private midwife	1078	98	-	980	5
Untrained TBA	23	6	-	1	-
None	785	-	-	-	3
Totals	2637	194	2	1658	11

Table 5

Birth attendant and neonatal tetanus deaths, Pidie District, 1987.

Birth attendant	Live births	Neonatal tetanus deaths	Neonatal tetanus mortality rate	
Doctor	37	0	0.0/1000	3.9/1000 for trained birth attendants
Trained midwife	635	2	3.1/1000	
Trained TBA	1393	6	4.3/1000	
Untrained TBA	49	1	20.4/1000	8.7/1000 for untrained birth attendants
Others	523	4	7.6/1000	

was dominated by *abu dapur,* the Acehnese designation for kitchen ash from a wood fire. The crude birth rate estimate from the survey sample was 43.1/1000 population.

DISCUSSION

Two surveys of neonatal tetanus mortality in Pidie district (Aceh Province) were carried out in 1984 and 1987. In 1985 a tetanus toxoid immunization crash program was implemented in Pidie district. The estimate of neonatal tetanus mortality fell from 32.1/1000 live births to 4.9/1000 live births, a decline of nearly 85% in three years. We believe that this major decline in the neonatal tetanus mortality rate was a result of the TT crash program in Pidie district. The Pidie crash program was possibly not the only change that influenced the decline in NT mortality, but it played an essential role. We realize that the 1984 survey results for Pidie district were based on only a fraction (13.5%) of the total sample population, and thus these data are not strictly comparable to the follow-up survey data in 1987. (That is, the second survey was designed as a district-wide sample, while the first survey covered all of Aceh Province). However, the sample size in Pidie in 1984 was large enough so that the 95% confidence interval for neonatal tetanus mortality ranged from 18.6 to 45.6/1000 live births. In the follow-up survey, the 95% confidence interval for NT mortality ranged from 2.3 to 7.5/1000. Thus, even the lower limit of the 1984 survey (18.6/1000) is 148% higher than the upper limit (7.5/1000) recorded in the 1987 survey. In this context the 85% decline in neonatal tetanus mortality in Pidie district was indeed significant. Several other factors support the idea of the TT crash program's impact on the downward trend in neonatal tetanus mortality:

1. Although a reduction of 85% in the NTMR was observed between 1984 and 1987 in Pidie district, the neonatal mortality attributable to causes other than tetanus remained unchanged (Table 2.) Thus the change in neonatal mortality estimate between the two time periods is accounted for entirely by tetanus.
2. The risk of a neonatal tetanus death to a mother who reported that she received no TT from the mass campaign was six times greater than the risk to mother immunized with the two-dose series during the mass campaign.
3. Other factors which may have directly affected the rate of NT deaths also remained largely unchanged between the two sample periods. Example: the proportion of deliveries assisted by either a trained or untrained TBA or other non-medical persons was 78% in 1984 and 74.5% in 1987. There were no formal training programs held for TBAs in Pidie district between 1984 and 1987.

In both surveys, neonatal tetanus mortality rates were three times higher in infants of women who used traditional rather than antiseptic dressing on the umbilical stump. The proportion of women reporting behaviors falling into these two categories was the same in both survey populations. There was no increase in the proportion of women who received the two-dose TT series during routine prenatal care in Pidie district between the 1984 and 1987 surveys. Over 90% of women who received two prenatal consultations either did not receive or did not know if they received tetanus toxoid. This suggests that improvements, if any, in the routine prenatal programs did not account for much of the neonatal tetanus mortality reduction.

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