## Original article

# Neonatal mortality among hospital delivered babies in Addis Ababa, Ethiopia

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**Abstract**:   A follow up study to determine the magnitude of neonatal mortality and identify its determinants was done on a cohort of babies born at the health institutions in Addis Ababa.  Baseline information on risk behaviour of the mother and child characteristics were recorded just after delivery.   Then, follow up interviews were done on the 7th and 28th day by visiting each neonate/mother at home.  A total of 1334 singleton newborns were included in the study.  The neonatal mortality rate was found to be 71.9 per 1000 live birth with early and late neonatal mortality rates of 50.9 and 20.9 per 1000 live berth, respectively.  Low birth weight and prematurity were associated with a higher risk of neonatal death.  Establishing essential neonatal care facilities at all levels and further study among home deliveries are recommended.  [*Ethiop. J. Health Dev.* 1997;11(3):275-281]

**Introduction**

   Developing countries are known to carry a heavy burden of diseases and death, many folds higher than the developed countries.  This is seen mainly in vulnerable groups such as children and women in the reproductive phase of life; in these groups inadequate nutrition, physiologic demands and lack of resistance make the effects of  diseases  more serious(1,2).

   As health services coverage are low and many births are occurring at home in most developing countries, there is no reliable estimate of neonatal mortality.  Published official statistics usually present a biased image of the public health and in almost every case underestimate the health problems(3,4).  However, hospital-based studies from the developing world have indicated that about half of the infant deaths occur during the neonatal period and estimate neonatal mortality from 20 to 106 per 1000 live birth(5-9).  Generally, hospital-based data tend to over estimate mortality because  of  the  selection factor of over representation of the severely sick children.

   Like many other priority health problems in the developing countries, factors related to the increased risk of neonatal mortality are generally preventable.  Immature maternal reproductive development because of early marriage, high family size, short spacing, single parent and low educational status of the mothers are some of the identified risk factors for low survival of the newborns, all of which have their roots in poverty and inequity( 10-14).

   In addition to the above demographic factors poor nutrition, cigarette smoking, substance use, poor health services during pregnancy and during postpartum, and harmful customs, beliefs and taboos influence neonatal mortality(15-19).  Child factors associated with low survival include low birth weight, birth asphyxia, trauma, and infections such as syphilis, malaria and neonatal tetanus(20-23).Developing countries need to develop preventive strategies to alter this situation.  Useful mesures include placing greater emphasis on identifying and reducing risks before pregnancy, and expansion of basic obstetric services to the majority of the population.  As neonatal morbidity

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and mortality in developing countries could be largely uninfluenced by technological advances only in the field of neonatology, it is very important to put more emphasis on improving nutritional and other basic health requirements of the children(24,25).

## Methods

*Study Area*:  Addis Ababa is the capital city of Ethiopia with an estimated population of 2.4 million.  According to a census conducted in 1984, its population growth rate is 5.1% and the fertility rate was 3.2%(26).  High migration rates from the countryside by people looking for employment opportunities and a better life have contributed to the tremendous increase of the capital's population. Addis Ababa is administratively divided into six zones.

The city has a relatively higher number of health institutions compared to the other parts of the country.  There are 12 hospitals, 14 health centres, about 74 clinics and 24 health posts.  Out of these health institutions 5 of the hospitals, 12 of the health centres and 5 of the clinics  render delivery services.  In the year preceding the study a total of 32,000 deliveries were reported by these health institutions, which is 50-60% of the expected annual deliveries in the city.

*Study design and population*:  The study was conducted on a cohort of newborns delivered in the health institutions of zone 1 and zone 2 in the city of Addis Ababa, Ethiopia.  The two zones were selected because they are the central old parts of the city where population density is high and health institutions exist in adequate number to generate sufficient sample within the time frame of the study. Recruitment for the study was done during November and December, 1994 in all health institutions which were providing delivery service in the two zones.  To avoid the complex interaction of factors and for logistic reasons only single live birth babies whose parents were residents of Addis Ababa were enrolled into the follow-up study.  Stillbirth, multiple deliveries and babies whose parents were not residents of Addis Ababa were excluded from the study.  Assuming a neonatal mortality rate of 10%, with 90% power and 95% certainty, the sample size required for the study was calculated to be 1365.

*Data collection and analysis*:  Baseline data and follow-up information were collected using pretested questionnaire.  The questionnaire was prepared in English and later on translated into Amharic for feild use.  Midwives and high school graduates collected the data.  The midwives completed the baseline questionnaire and the high school graduates filled in the follow-up questionnaire at home on the 7th and the 28th day after birth.  A 3-days training was given to everybody involved in the project. The questionnaire was pretested on mothers who delivered during the training period in the health institutions that participated in the study.  Based on the pretest few adjustments were made in the final version of the questionnaire.  Regular checking of data quality was conducted by the research coordinator.  The principal investigator monitored the overall quality and conduct of the study.  Data were entered, stored and analyzed using Epi Info version 5 statistical package.  Multivariate analyses were done using SAS statistical software.

*Ethical considerations*:  Informed consent was obtained from all study participants.  Mothers who volunteered to participate kindly provided a description of their residential area and their house number as well as telephone numbers(either own or neighbour) to facilitate the home visits. Informations were kept confidentially by the principal investigator. Referral was arranged for those neonates who were reported to have been sick during home visits.

## Results

A total of 1606 deliveries took place during the enrolment period, from November 8 to December 22, 1994.  Out of these 180 (11%) were from outside Addis Ababa, 38 were still- births, two were triple deliveries (6 babies) and 25 were twin  deliveries (50 babies), and the remaining were 1334 singleton live births, who were residents of Addis Ababa.  Hence, the analysis was focused on the, 1334 singleton live births.  Of these 693 (51.9%) were male, and 641(48.1%) were female babies.

Of the 1334 mothers 1160 (87%) were married and living in union.  Also the majority (87.4%) of them reported to had at least one ANC consultation during their last pregnancy and 42.1% of

mothers were family planning service users before the last pregnancy.  Cigarette smoking, chat chewing and alcohol consumption, were reported by 21(1.6%), 93(6.9%) and 217(16.2%) of the mothers, respectively, during their last pregnancy.

On the 7th day home visit, of 1334 live singleton babies, 61 were lost to follow-up and 68 neonate were reported to have died.  On the 28th day visit, 10 were lost to follow-up and 28 neonate were reported to have died.  Hence, neonatal mortality rate was 71.9 per 1000 live birth(95% confidence interval: 58.0 to 85.8 per 1000 live births with early and late neonatal mortality rates of 50.9(68/1334) and 23.2(28/1205) per 1000 LB, respectively.

These rates showed that mortality was higher during the very early life of the babies.  The perinatal mortality was 83 per 1000 total births(134/1606).

The distribution of maternal characteristics and neonatal death, and the crude and adjusted odds ratios for the risk factors included in the logistic regression model are shown in the Table 1.  Those babies born from mothers who were non-users of family planning methods were found to be at a higher risk of neonatal death in the multi-variate analysis. Though not statistically significant in the logistic model, babies born from single mothers and low income family were also found to be at a higher risk of neonatal death than babies born from married mothers and high income families.  Also babies born from highly educated mothers and who use ANC services were at a lower risk of dying in the crude analysis compared to the other categories(Table 1).

Table 1:  **Neonatal mortality and related maternal characteristics in Addis Ababa.**

|  | Population | Death number(%) | Crude OR(95%CI) | Adjusted OR(95%CI) |
|---|---|---|---|---|
| Maternal age |  |  |  |  |
| 15-19 | 125 | 9 (7.2) | 1.00 | 1.00 |
| 20-24 | 362 | 29 (8.0) | 1.13(0.54,2.38) | 1.18(0.48,2.95) |
| 25-29 | 382 | 21 (5.5) | 0.76(0.34,1.70) | 1.12(0.41,3.07) |
| 30-34 | 236 | 22 (9.3) | 2.11(0.72,6.20) | 2.11(0.72,6.20) |
| 35+ | 158 | 15 (9.5) | 1.37(0.58,3.23) | 1.60(0.47,5.50) |
| Marital status |  |  |  |  |
| Married | 1104 | 70 ( 6.3) 1.00 | 1.00 |  |
| Others | 159 | 26 (16.4) 2.92(1.80,4.74 | 1.30(0.61,2.80) |  |
| Income |  |  |  |  |
| 0-100 | 279 | 37 (13.2)1.00 | 1.00 |  |
| 01-250 | 277 | 25 (10.5)0.65(0.38,1.11) | 0.99(0.49,1.99) |  |
| 251-600 | 453 | 22 ( 4.9)0.33(0.19,0.57) | 0.57(0.27,1,19) |  |
| 601+ | 254 | 12 ( 4.7)0.32(0.17,0.64) | 0.48(0.18,1.27) |  |
| Maternal education |  |  |  |  |
| Illiterate | 202 | 24 (11.9)1.00 | 1.00 |  |
| 1-8 grade | 476 | 33 ( 6.9)0.56(0.32,0.97) | 0.80(0.40,1.59) |  |
| 9-12 grade | 499 | 35 ( 7.0)0.56(0.32,0.97) | 0.85(0.40,1.79) |  |
| 12+ | 86 | 4 ( 4.7) | 0.36(0.12,1.07) | 0.62(0.15,2.58) |
| ANC during last pregnancy |  |  |  |  |
| Used | 1105 | 70 ( 6.3)1.00 | 1.00 |  |
| Not used | 158 | 26 (16.5)2.90(1.78,4.69) | 1.66(0.87,3.17) |  |
| Family planning service |  |  |  |  |
| Non-user | 736 | 66 (9.0) | 1.00 | 1.00 |
| User | 527 | 30(5.7) | 0.61(0.39,0.96) | 0.50(0.29,0.87) |

Table 2: **Selected Maternal Behaviour and Neonatal Mortality in Addis Ababa.**

| Maternal Behaviour | Population | Death No.(%) | Crude OR(95%CI) | Adjusted OR(95%CI) |
|---|---|---|---|---|
| Cigarette smoking | | | | |
| Yes | 19 | 6 (31.5) | 5.92(1.95,17.20) | 1.22(0.33,4.39) |
| No | 1244 | 90 (7.2) | 1.00 | 1.00 |
| Chat chewing | | | | |
| Yes | 85 | 15 (17.6) | 2.90(1.52,5.48) | 0.87(0.39,1.95) |
| No | 117 | 81 ( 7.4) | 1.00 | 1.00 |
| Alcohol consumption | | | | |
| Yes | 209 | 21 (10.0) | 1.46(0.05,2.49) | 0.81(0.80,1.49) |
| No | 1054 | 75  (7.1) | 1.00 | |

In this study the logistic regrassion analysis did not show significant association between cigarette smoking, chat chewing and alcohol consumption, and neonatal mortality(Table 2). Among the child characteristics studied gestational age and birth weight were shown to be good predictors of neonatal survival. Term and normal weight babies had a significantly lower risk of dying: adjusted odds ratios were 0.33(95% CI, 0.19-0.59) and 0.06(95% CI, 0.04-0.12) for term and normal weight babies respectively(Table 3).

**Discussion**

The neonatal mortality rate observed in this study is consistent with previous estimates (5,9). However, a slight overestimation may have occurred because of the selection of hospital delivered babies in which high risk mothers could be over-represented. According to the findings of this study, neonatal mortality may account for 65% of the infant mortality in this country, if one considers the official national infant mortality rate of 110/1000 live births(26). The observation of a significantly higher  risk of neonatal mortality  among the low birth weight and preterm babies is also in conformity with previous reports from the developing countries(4,6,12).

Though not statistically significant in the logistic analysis, the difference observed in the crude analysis between the illiterate and the highly educated mothers was remarkable, that is, babies born from highly educated mothers were  at a lower risk of mortality than babies born from illiterate mothers. Maternal education is believed to be one way of reducing mortality during infancy, since it provides the mother with the necessary skill for child care(15).

The effect of marital status on newborn survival is believed to have been over- shadowed in this study since the majority of the mothers were married.  The effect of family income and maternal age on neonatal survival noted with other studies were not also obvious in this study.  This might be due to the imprecise reporting of these variables either because of genuine ignorance or taboos related with these variables.  Both variables are socially sensitive in the Ethiopian context.  This observation was also made by Kloos(27).

In this study babies born from mothers who were family planning users were found to be at a lower risk of neonatal mortality than those born from non-users, which is consistent with other studies too(27). Unlike other studies antenatal care (ANC) attendance showed no statistically significant association.  This may be due to the fact that no consideration was given to the number of visits made.  Obviously, only one visit may not make any difference.

Although cigarette smoking, chat chewing and alcohol consumption by pregnant women were indicated to influence neonatal mortality in other studies(18,19), it was not obvious in this study. The reason for that could be the lack of information on the amount and duration of their use as well as the small number of mothers who reported using these substances.    Losses to follow-up were small, only 71(5.3%) of cohort member were lost on the follow-up visits.  When considering the complexity  of  doing a  follow-up study in a

Table 3: **Newborn characteristics and neonatal mortality in Addis Ababa.**

| | Population | Death number(%) | Crude OR(95%CI) | Adjusted OR(95%CI) |
|---|---|---|---|---|
| Sex | | | | |
| Male | 656 | 51(7.8) | 1.00 | 1.00 |
| Female | 607 | 45(7.4) | 0.95(0.63,1.45) | 0.74(0.46,1.22) |
| Gestational age | | | | |
| (in weeks) | | | | |
| 28-37 | 223 | 35(15.6)1.00 | 1.00 | |
| >37 | 1040 | 61( 5.9) | 0.34(0.22,0.52) | 0.33(0.19,0.59) |
| Birth weight | | | | |
| (in grams) | | | | |
| <2500 | 112 | 49(43.8)1.00 | 1.00 | |
| ≥2500 | 1151 | 47(4.1) | 0.06(0.03,0.09) | 0.06(0.04,0.12) |
| Birth order | | | | |
| 1st | 527 | 42(8.0) | 1.00 | 1.00 |
| 2nd-4th | 514 | 39(7.9) | 0.95(0.60,1.50) | 0.54(0.81,2.88) |
| 5th + | 222 | 15(6.8) | 0.84(0.46,1.55) | 0.71(0.28,1.82) |

large urban setting like Addis Ababa, where locating houses is extremely difficult to a stranger, the loss was negligible and it could not have any significant effect on the findings of the study.
However, if we take all the lost as alive or as dead, the neonatal mortality ranges from 7.1 to 12.4/1000 live births.  This provides the worst and the best scenarios.

   Though the use of new borns delivered in health institutions could be regarded as the weakness of this study, the other alternative of including home deliveries was practically impossible for obvious logistic reasons.  However, the study gained its strength for successfully following the babies at home, which was very important since in developing countries a significant proportion of deaths occur outside health care facilities.  Hence, the selection procedure may limit the generalizability of the findings but not the validity.  To make further generalizability of the findings we recommend a similar study among home delivered babies.  A fairly high sample size was used to minimize the role of chance.  Bias was also minimized by using  uniform inclusion criteria and achieving high follow-up rates.  Reliability was maintained by prior training of supervisors and interviewers, by using pretested questionnaire, and by regular supervision.   Multivariate analysis was utilized for control of confounding.

   In conclusion, the major risk factors identified for increased risk of neonatal mortality in this study, low birth weight and prematurity, seem universal in the developing countries and these factors are deeply rooted in poverty and social inequalities.  Therefore, a logical strategy to reduce neonatal mortality at the moment could be to improve and/or expand neonatal care facilities and access to such services while exploring for long-lasting solutions through economic and social development.  In Addis Ababa, equipping all health institutions to provide the essential neonatal care and education of mothers to use such services deserve due consideration(28).  Currently the Ethio-Swedish Children's Hospital is the only centre capable of providing such service in Addis Ababa.  It has to be noted that unless we are able to bring down such very high risk of child mortality starting from the early time of life, we can not be successful in our global efforts to regulate fertility and to promote safe motherhood.

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