



## **Survival Rate of Low and Very Low Birth Weight Neonates in an Iranian Community**

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### **Abstract**

**Background:** This study aimed to assess the incidence and survival rates of neonates weighing less than 2500g for duration of the first 28 days in an Iranian community.

**Methods:** In this prospective longitudinal study, all neonates with birth weight less than 2500g were selected from the list of all neonates born in the only public-sector referral hospital, for a six months period. The weight of neonates at birth along with some demographic variables was recorded on a checklist. A cohort of neonates with birth weight less than 2500g were followed for 28 days. Mortality within 28 days of birth was used as end point. Continuous variables were summarized using mean and 95% confidence intervals, while categorical variables were presented as ratios and percentages.

**Results:** About 1750 neonates were born of which 168 neonates with birth weights less than 2500g were recorded giving a proportion of 9.6%. Of 168 neonates, 21 (12.5%) had very low birth weights (VLBW) (birth weights<1500g). Survival rates for the groups of LBW (1500<birth weights<2500g) and VLBW neonates were 98.4% and 66.6%, respectively. Regression analysis showed birth weight has, unsurprisingly, the most effect ( $\beta=0.501$ ) on the survival rate among variables studied in this research.

**Conclusion:** The survival rate among VLBW births in our study is dramatically low (66.6%). Not only attempts must be made to reduce the incidence and prevalence of this problem but also we need to work on the related factors of neonates' survival rate in this community.

**Keywords:** Low birth weights, Survival rate, Neonates, Iran

### **Introduction**

Up to 22.5% of neonates are born with low birth weight (LBW), worldwide (1) and the effect of LBW on individuals' health in forthcoming years is also documented (2-5). This means, in some communities, remarkable proportion (about a quarter) of infants at birth need special medical care to catch their normal growth up.

Advances in prenatal and neonatal care have increased the survival of both extremely low birth weight (6) and very-low-birth-weight infants (VLBW) (7), in many populations in particular developed communities. However, still a lack of

investigation exists even in some developed countries to address survival of very low birth weight infants (8).

Many factors are responsible for the birth of neonates with low birth weight. In a recent study conducted to measure the prevalence and risk factors of LBW in an Iranian community in southern areas of the country, the overall prevalence of LBW was 11.8% (95% CI: 9.9%-13.7%), similar for boys and girls (11.1% and 12.6% respectively). In this study, LBW was significantly associated with mother's ethnic ori-

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gin, birth interval < 3 years, twin birth, no use of supplements during pregnancy, prenatal care visits, no education, younger age and presence of maternal disease (9). On the other hand, the negative effect of LBW on cognitive, behavioral status, health status, and even academic achievement of LBW infants in forthcoming years of their life has been known (10). These results show the broad spectrum of factors which can affect (and be affected by) the weight of neonates at birth (11). No doubt that these factors differ from one to another community affected by economic, social and cultural settings. These differences make it necessary to study more effective factors in a given community.

As long as attempts are being made to control determinant factors for reducing the incidence of low birth weight in communities, efforts are also important to improve the survival rates of neonates born with birth weight less than 2500g (12). However, Wilson-Costello and colleagues concluded from their investigation that the improved survival rates of extremely low birth weight (ELBW) infants in the 1990s was accompanied with an increased risk of significant neurodevelopment impairment (6).

In our study we sought to assess the incidence and survival rates of infants weighing less than 2500g for duration of 28 days in an Iranian community, Southeast of Iran.

## Material and Methods

This was a prospective longitudinal study. All neonates who were born in the main Maternal Hospital of Rafsanjan (Niknafs Hospital), the only public-sector referral hospital, affiliated (12) to the Rafsanjan University of Medical Sciences, for a six months period between 1<sup>st</sup> January 2007 and 30<sup>th</sup> Jun 2007 were checked and all neonates with birth weight less than 2500g were recruited for the study. Neonates were LBW if their birth weight was less than 2500g (including VLBW and ELBW).

To understand the mortality or survival of recruited infants, all LBW (<2500g) neonates born in the hospitals were recorded and followed through health centers of the county. All people living in the county are registered in health centers. Health centre physicians were invited to help with the process of data collection. Trained physicians were requested to answer the items on the study checklist using maternal medical files as well as interviewing mothers. Pregnancy and delivery data were collected soon after birth. The weight of neonates at birth were recorded on the checklist as well as some demographic variables such as gender, birth order, mother's age, mother's educational status, mother's job and living place (urban/rural). Trained physicians also weighted neonates at birth and recorded the data on the checklist. Scales used for weighting neonates were all calibrated before each time use.

Those neonates with birth weight less than 2500g were followed for their neonatal duration (until 28<sup>th</sup> day of their life) wherever they have been; in hospital or at home. Therefore, there was a cohort of neonates with birth weight less than 2500g including those who were admitted to the neonatal intensive care unit of the hospital and were followed up for 28 days. In order to be in the cohort, a neonate had to have a gestational age of more than 25 weeks, and be free of congenital anomalies. Mortality within 28 days of birth was used as end point.

Data were analyzed using SPSS. Continuous variables were summarized using mean and 95% confidence intervals, while categorical variables were presented as ratios and percentages.

Cross-tabulations of categorical variables with survival were produced and statistical associations between these categorical variables and survival outcome were measured using Chi-Square test. Normally distributed continuous variables were compared using the independent *t*-test and the Mann-Whitney U test was used to compare discrete variables and those continuous variables that were not normally distributed. Those variables which were supposed to have

interaction effect on neonates' survival were entered into a multiple regression model.

## Results

Totally, 1750 neonates were born of which 168 neonates with birth weights less than 2500g were recorded giving a proportion of 9.6% of all births. Of 168 neonates with birth weights less than 2500g, 21 (12.5%) had birth weights less than 1500 gr as VLBW. One hundred forty seven neonates were recorded with a birth weight between 1500-2500 grams (LBW).

The frequency distribution of neonates with birth weights less than 2500g based on their weights and gender is presented in Table 1.

Mean birth weights of boys and girls were  $2089.1 \pm 445.9$  (Min= 750, Max= 2490) and  $2063.8 \pm 456.3$  (Min= 590, Max=2490), respectively. There was no significant difference between the mean weights of boys and girls.

Survival rate of neonates with birth weights less than 2500g for the first 28 days of their life (neonatal life) was 94.6%. In other words, more than 5% of neonates with birth weights less than 2500g were deceased before the end of their neonatal life.

Table 2 shows the proportion of those who were alive at the end of their neonatal life in the two groups of boys and girls. There was no significant difference between the proportion of those who were alive at the end of their neonatal life among boys and girls.

Table 3 shows the proportion of those who were alive at the end of their neonatal life in the two groups of neonates with LBW and VLBW. As the table shows, 33.3% ( $n=7$ , 95%CI= 53.4%-13.2%) of VLBW neonates were deceased before the end of their neonatal life. Whereas this proportion among LBW neonates was 1.6%

( $n=2$ , 95%CI= 0-3.63%) which was significantly smaller than this proportion among VLBW neonates (Chi Square=37.0,  $df=1$ ,  $P<0.001$ ). In other words, survival rates for the groups of LBW and VLBW neonates were 98.4% and 66.6%, respectively.

Mann Whitney U test showed that mean weight of neonates who were deceased during their neonatal life ( $1126.7 \pm 431.1$ ) was significantly lower than this mean for neonates who were not deceased ( $2127.2 \pm 389.5$ ) in this duration ( $Z=4.4$ ,  $P<0.001$ ).

Mother age, mothers' job and mothers living place were also compared between the two groups of alive and deceased neonates. There was no significant difference between the mean of mothers age of alive ( $27.6 \pm 5.5$  years) and deceased ( $28.1 \pm 6.3$  years) neonates.

Living place and the job of mothers of neonates with birth weights less than 2500g in the two groups of alive and deceased neonates are presented in Table 4. There was no significant difference of living place and mothers' job between the two groups of alive and deceased neonates.

Regression analysis showed that neonates birth weight has, unsurprisingly, the most effect ( $\beta=0.501$ ) on the survival rate of neonates among variables studied in this research. The model showed that 0.511 of the variations in survival rate depends on neonates' weight, whereas only 0.117 of survival variations depended on the other variables (i.e. Mother age, mother's job, mothers living place, mother's education status, birth order and neonates gender). The odds ratio for death among neonates with birth weight <1500 grams was 4.1 (95% CI 1.2 to 13.9) compared to neonates with birth weight between 1500 and 2500g.

**Table 1:** The frequency distribution of neonates with birth weights less than 2500g based on their weights and gender

Weights*	Boy n (%)	Girl n (%)	Total n (%)
LBW	57 (87.7)	90 (87.4)	147 (87.5)
VLBW	8 (12.3)	13 (12.6)	21 (12.5)
Total	65(100)	103 (100)	168 (100)

\*- LBW: Birth weights between 1499 and 2500g., VLBW: Birth weights less than 1500g

**Table 2:** The frequency distribution of neonates with birth weights less than 2500g based on their survival and gender

Alive	Boy n (%)	Girl n (%)	Total n (%)
Yes	61 ( 93.8)	98 (95.1)	159 (94.6)
No	4 (6.2)	5 (4.9)	9 (5.4)
Total	65 (100)	103 (100)	168 (100)

**Table 3:** The frequency distribution of neonates with birth weights less than 2500g based on their survival and the level of their birth weights

Weights*	Alive n (%)	Deceased n (%)	Total n (%)
LBW	145 (98.6)	2 (1.6)	147 (100)
VLBW	14 (66.6)	7 (33.3)	21 (100)
Total	159 (94.6)	103 (5.4)	168 (100)

\*- LBW: Birth weights between 1499 and 2500g., VLBW: Birth weights less than 1500g

**Table 4:** The frequency distribution of neonates with birth weights less than 2500g based on their survival, living place and mothers' job

Survival	Residency		Mother's job		Total n (%)
	Urban n (%)	Rural n (%)	Working n (%)	Not working n %	
Alive	77 (92.8)	82 (96.5)	128 (44.1)	31 (96.9)	159 (94.6)
Deceased	6 (7.2)	3 (3.5)	8 (5.9)	1 (3.1)	9 (5.4)
Total	83 (100)	85 (100)	136 (100)	32 (100)	168 (100)

## Discussion

The results showed that the incidence of LBW and VLBW births in the study community is one of the highest incidence rates comparing to some developing (13, 14) and developed (15, 16) countries, worldwide. Although Incidence rate of birth weights less than 2500g in our study (9.6%) is lower than what is reported by Roudbari and colleagues (11.8%) for a Southern province of Iran (Zahedan) (9), the difference is not statistically significant. Delivery of births with weight less than 2500g is a major problem for a big proportion of all communities (1). Not only attempts must be made to reduce the incidence and prevalence of this problem but also we need to work on the survival rates of infants with this deficit. For this purpose, the related factors of survival rate among human communities should be studied.

This research provides neonatal survival rates in an Iranian community in southeast, Iran. The overall neonatal survival rate was 94.6% for neonates who were born with birth weights less than 2500g. Although this survival rate seems reasonable but the survival rate among VLBW births in our study is dramatically low (66.6%) compared to what is reported by others (17).

Seven out of 21 VLBW neonates were deceased before the 28<sup>th</sup> day of their life. Comparing to the survival rate of VLBW infants in some other Asian countries, the survival rate among our neonates is less than what is reported for Taiwan (1998, 78.4%), Thailand (2003, 81%), Turkey (2002, 84%) and Malaysia (2003, 81.6%) (17). However, according to what is reported by this author and colleagues, the survival rate of VLBW neonates in India (63%, year of publication=2008) is less than this survival rate obtained in our study. In comparison with what is reported earlier (17) (73%), the survival rate of VLBW infants born in the location of our study is lower than the global average. This result indicates that resources should be channeled in order to improve survival of VLBW infants in

our community in Southeast, Iran. The importance of existence of some services such as mechanical ventilation is highlighted (18). Mean birth weight of VLBW infants in our study was  $1099 \pm 265.3$  (range, 590-1460) which is less than this mean reported by Tsou in Taiwan (mean birth weight= 1133g, (range, 368-1,500) (7). The overall survival rate of the VLBW infants in Tsou study was 76.2% (7) which is higher than this rate calculated in our study (66.6%, 2010). Although, it could be assumed that this discrepancy is due to lower mean birth weight among neonates born in our region comparing to this mean among Taiwan Infants, it is not possible to ignore the role of health care systems in this difference. More investigation is needed to detect the possible effect of both known and unknown variables in this region.

The results of multivariate logistic regression in our study showed that among variables entered into the model included birth weight, neonate's gender, birth order; mother's living place, mothers' age and mothers' job, birth weight was the most effective factor to determine the survival rate. Gestational age was not included in the model as it was highly correlated with birth weight. None of the remaining variables showed significant effect on neonates' mortality in our study. Neonates' gender, which was one of the predictors of neonates' survival rate in Ballot and colleague study, was not significant predictor in our study (17).

Although more than 50% ( $R=0.511$ ) of mortality variation was defined by birth weight on neonates, only about 10% ( $R= 0.117$ ) of this variation was related to other variables. This result shows that there must be some other variables affecting the mortality of neonates in our research. These variables are studied by others in a broad spectrum (1, 19-21). For instance the effect of gestation period, APGAR score, risk factors for mortality related to antenatal care, labor and delivery on neonates mortality are shown by

Ballot and Colleagues (17). Further, Horbar and colleagues showed significant effect of prenatal care, cesarean section, multiple births, antenatal steroids on mortality of neonates (22).

Therefore, although the survival rate of VLBW and LBW infants in our study is not dramatically different from these rates in other developing countries, based on the results reported by others, prenatal and neonatal care and neonatal resuscitation programs are needed to be emphasized to improve the outcome of infants with birth weight less than 2500g, furthermore.

In order to improve the survival rate of both LBW and VLBW neonates in the community, effective variables should be recognized. Some of these variables might be specific for different communities depending on social norms and socio-economic status as well as culture and even religious. Some factors have direct effect on survival rate and some are indirectly related to mortality of neonates. Total effect of these variables could be explained in a model of web of causation. Accurate inspect on the role of these factors in determining of neonates survival would help health systems with developing effective methods for improving neonates survival rate which is vitally needed in many communities including in our study region. A continuing audit of these measures should also be encouraged.

## Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc) have been completely observed by the authors.

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