http://www.medscidiscovery.com
OPEN ACCESS JOURNAL

ISSN: 2148-6832

MSD Medical Science and Discovery
2016; 3(9):325-33

Original Article Doi: 10.17546/msd.18762

Pediction by maternal risk factors and prenatal care of neonatal intensive care of neonatal intensive care admission in a University Hospital, Turkey, a case control study

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Abstract

Objective: To determine socioeconomic characteristics, prenatal care and maternal risk factors and reveal the impact on newborn, in mothers who gave birth .

Material and Method: A case-control study comparing the mothers whose babies were admitted and mothers whose babies were not admitted to neonatal intensive care unit of a University Hospital. The 200 women as a case and 200 women as a control has been chosen among total 958 female patient. A survey form has been filled by the patient to determine socio-economic and prenatal care features and the risk factors. The APNCU index is was used for adequacy of prenatal care. Chi square test, Fisher's exact test and multiple logistic regression analysis are were used for statistical evaluation.

Results: As to prenatal care 94.3 % of the mothers received adequate amount and 95.2 % adequate content. The location of residence (OR:2.72), husband education (OR:1.97), spontaneous abortion in second trimester or preterm birth history (OR:4.27), multiple pregnancy (OR:5.25), bigger or smaller uterine size (OR:26.58), early uterine contraction (OR:2.21), and problems during delivery (OR:2.53) variables were related to be in neonatal intensive care unit.

Conclusion: Factors related to being in intensive care found in this study should be understood and interpreted in all of the steps of health services, and interventions should be executed when necessary.

Keywords: Prenatal care, maternal risks, neonatal intensive care.

Introduction

In clearing up the problems of the high risk newborn to be considered due to the anatomic and physiological differences from the healthy newborn, methods containing special tools and care are required to be used and watched in neonatal intensive care unit (NICU) [1].

Several risks related to the mother are known to increase the risk of babies to be in intensive care [2]. A qualified prenatal care (PNC) service primarily provides to determine and harness the risks endangering pre-pregnancy and during pregnancy in the future mother and therefore provides the prevention of negative results which can occur both in the mother and the newborn [3,4].

Studies done presents that inadequate PNC is related to preterm labor, low birth weight an newborn deaths [5,6].

Besides PNC, interventions during birth and right after that are important and deliveries should be made by health personnel and NICU's should be at least found in certain centers.

It is important to determine the factors affecting the intense care requirement of the newborn in terms of creating effective interventions to be made in this respect in the whole process starting from prenatal period.

This study aims to compare the mothers delivering between January – June 2010 in Hacettepe University Obstetrics and Gynaecology Clinic whose babies were admitted and whose babies were not admitted to NICU and determine the effects of socio-economic factors, prenatal care received risk factors during pregnancy and delivery on the new-born's being in intensive care.

Received 13-07-2016 **Accepted** 1-07-2016 **Available Online** 15-09-2016
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Material and Methods

This study is an analytic one with case/control type comparing the mothers whose babies were admitted and whose babies were not admitted to NICU and researching the factors effective on the admission to NICU. The study is conducted on women who gave birth in Hacettepe University Hospital Gynaecology Clinic between January–June 2010. Because of being a third step hospital, this hospital is the one appealed more by risky pregnancies. In general, the babies born under 2500 gram or before completing the 37th pregnancy week and/or in need of special care are monitored at NICU. In this period 200 women whose babies admitted to NICU were taken as a case group and 200 women whose babies not admitted to NICU were selected by simple random sampling method among total 958 women as a control group.

In total 253 infants of the 210 women in this six-month period were in intensive care. 200 women and 239 babies (33 twins and 3 triplets) of them were enrolled in the study. 200 women and 207 babies (seven twins) were selected from the remaining 748 women by the method of random sampling as the control group. In this way, the study was carried out on 400 mothers, 400 births and 446 newborns. While the dependent variable of the research was babies' hospitalization at NICU, many variables related to the socioeconomic level, PNC status of the mother and risk factors in pregnancy were independent variables.

In the collection of the data, primarily the mothers were informed about the research and after taking written consents, a survey form containing questions determining socioeconomic and PNC features as well as the risk factors form prepared by using the list found in Turkish Ministry of Health program was filled in by face-to-face method [7, 8]. Furthermore, delivery records and NICU records were used for the information related to the present statuses of both mothers and newborns.

In PNC evaluation, information such as PNC number of monitoring, on which month it started, by whom and what was done was taken. According to Adequacy of Prenatal Care Utilization (APNCU) index which presents a PNC number by taking the week when PNC started and the week delivery happened into consideration; it was evaluated as ''inadequate'', ''intermediate'', ''adequate'' and ''adequate plus'' [9]. Furthermore, failure to perform any one of weight measurement, blood pressure measurement, and urine and blood examination, ultrasound examination was evaluated as inadequate PNC in qualitative terms.

The data were analysed by entering in Statistical Package for Social Sciences (SPSS) 15.0 program. In order to determine the factors affecting the condition of admission to NICU, Chi square test, Fischer's exact test, student's t-test and as a multivariate analysis, multiple logistic regression analysis was used in statistical evaluations.

Results

When the conditions of those at the intensive care were evaluated, it was clear that 139 infants (58.2%) were below 2500 gram (more than half of them under 2000gram) and 84 infants (42 %) were being born under37 weeks. In contrast, 10 infants from the control group (4.8%) are between 2000 to 2500 g, and 14 infants (7%) are born under 37 weeks. It shows that there is one or more diagnoses that may require intensive care in all the files of the infants at the intensive care. The diagnoses such as miscarriage or premature, IUGR, SGA might be accepted as the greatest diagnosis group with 66.5% in total. Besides, it showed that the diagnoses such as respiratory distress (20%), MSS, KVS, GIS, UGS anomalies (20%) congenital heart disease (6%), blood disorders (3.5%) create significant rates and some other diagnoses were in small numbers.

Some socio-economic features of the babies of mothers participating in the research according to the condition of being in NICU is seen in Table I. When age is considered, 25-35 years old groups form the highest rate in whole group (63 %). There are total 4 women under 18 years old and their babies were in NICU. Mothers over 35 years old, on the other hand, show a higher rate in the group whose babies were in NICU but differences were not found to be statistically significant (p=0,097).

When compared in terms of residing places, it was seen that those who were not in NICU more substantially resided in Ankara city centre. Those residing in a district, village or other cities, on the other hand, are in higher rate in the case group when compared to the other group (p=0,000). No statistically significant difference was found between the groups in terms of women's educational backgrounds and occupations (p=0,818) (p=0,115). When we look at the educational backgrounds of the spouses of the mothers, primary school graduation of the fathers in case group and high school graduation of the fathers in control group is significantly high (p=0,003).

No statistically significant relationship was found between the occupations of the fathers and babies' being in NICU (p=0,121). No significant difference was found between the groups when the annual income per person was compared (p=0,749).

Table 1. Distribution of some socio-economic features of the mothers participating in the research according to the condition of their babies' being in NICU

Condition of being in intensive care unit			
Socio-economic Factors	Cases n=200 %	Controls n=200 %	Statistic (X^2 and p)
Age of the mother			
18 and younger	2,0	0,0	X^2=6,330
19-24	18,0	24,0	p=0,097
25-35	63,5	62,5	
Above 35	16,5	13,5	
Residing place			
Ankara centre	63,0	84,0	X^2=22,642
Districts-Villages and Other cities	37,0	16,0	p=0,000
Educational background			
Primary school	35,5	32,5	X^2=0,401
High school	31,5	33,0	p=0,818
University	33,0	34,5	
Occupation of the mother			
Housewife	67,0	58,0	X^2=5,922
Self-employed	8,5	15,5	p=0,115
Officer	23,0	24,0	
Worker	1,5	2,5	
Educational background of the spouse			
Primary school	29,0	16,5	X^2=11,430
High school	28,0	40,5	p=0,003
University	43,0	43,0	
Occupation of the spouse			
Unemployed	2,0	0,0	X^2=5,812
Self-employed	53,0	60,0	p=0,121
Officer	32,5	30,5	
Worker	12,5	9,5	
Annual income per person (TL)			
≤ 5000	37,5	34,5	X^2=0,577
5000-9999	26,0	29,0	p=0,749
≥ 10000	36,5	36,5	

Table 2: Distribution of PNC of the mothers which was evaluated with APNCU index, according to the condition of babies' being in NICU

Condition of being in intensive care unit				
Prenatal care with APNCU	Cases n=200 %	Controls n=200 %	Total n=400 %	Statistic (X^2 and p)
Inadequate	2,5	0,5	1,5	X^2=17,629
Intermediate	2,0	6,5	4,3	p=0,001
Adequate	13,5	25,5	19,5	
Adequate plus	82,0	67,5	74,8	

The mean number of prenatal visit was 14.04±5.90 in case group, and 14.42±4.68 in control group and there is no significant difference between the groups (p=0,219) and the whole group was seen to be substantially monitored by a specialist physician. Mean number of antenatal visit by a specialist physician is 13.14±5.83 in the case group, and 13.90±4.24 in control group. There were only 3 women who received antenatal care less than 4, in whole group. Results obtained according to APNCU index for PNC has been given in Table II.

Accordingly it is seen that 'adequate plus' PNC is received in the large part of the group. While ''Inadequate'' and ''Adequate Plus'' monitoring is higher in case group, ''Intermediate" or ''Adequate'' monitoring is higher in control group when compared to the other group (p=0,001). When PNC content is evaluated in 3 persons weight, in 3 persons blood pressure, in 3 persons blood count, in 14 persons urine and in 1 person USG examinations were not performed in the whole group and total 19 persons to whom one of these tests were not applied. In this sense, qualitatively inadequate PNC ratio is 5, 5 % in case group and 4 % in control group (p=0,481).

Those which are determined to be statistically significant in bivariate analysis in the distribution among the risks determined in the histories and present pregnancies of mothers participating in the research according the condition of their babies' being in NICU are shown in Table III. When personal risk factors of the mothers are evaluated, having received infertility treatment was found in a higher ratio in intensive care group (p=0,002). Number of deliveries being 5 or greater (p=0,000) in relation to their previous obstetrical histories, stillbirth or neonatal death (p=0,005), spontaneous abortion in 2nd trimester or preterm labor (p=0,000) was found statistically significantly high in those who are in NICU.

When present pregnancies of mothers are evaluated, changes in fetal movements, gestational hypertension, multiple pregnancy, polyhydramnios or oligohydramnios, small/big uterus according to week, early membrane rupture, early contractions, urinary infection and preeclampsia was found significantly high in mothers whose babies are in intensive care when compared to the other group. Important fetal problem (IUGR, SGA, congenital heart disease, congenital anomalies etc) suspected by USG during pregnancy was found to be significantly high in those whose babies are in NICU (p=0,000).

Having a problem during delivery was found to be higher in mothers whose babies were in NICU (p=0,003).

Among the factors not given in the table but researched about previous pregnancies, no statistically significant difference was found between frequent delivery, small or big babies according to the gestational age, baby with a fetal malformation, habitual 1st trimester abortion, gestational hypertension, placenta retention or postnatal bleeding, Rh isoimmunisation or hydrops fetalis and intervened delivery and to be in intensive care.

Likewise, among the risks researched in relation to their existing pregnancies, anaemia, excessive/low weight gain, shortness of height, hyperemesis gravidarum, vaginal bleeding cervical failure, presentation disorder, fetal head's inability to settle in primigravid in the 40th week, existence of gestational diabetes, genital infection and chronic disease was not found related to being in NICU.

Multivariate Analysis (Logistic Regression Analysis) Results:

With bivariate analyses risks, which are considered important, do not much include each other and are numerically adequate were examined with logistic regression analyses.

Accordingly, residing place, educational background of the spouse, infertility treatment, number of deliveries $\geqslant$ 5, stillbirth in the previous delivery or neonatal death, spontaneous abortion in 2nd trimester or preterm labor in the previous pregnancy, gestational hypertension, multiple pregnancy, polyhydramnios or oligohydramnios, small/big uterus according to week, early contractions, urinary infection, preeclampsia and problem during birth variables were taken to logistic regression analysis and results related to the factors which are found effective are shown in Table IV.

Accordingly, babies' risk of being in intensive care increased 2,72 times in those living in a city other than Ankara, another district or village, 1,97 times in those whose spouse's educational background is primary school graduation when compared to those whose spouse's educational background is university graduation, 4,27 times in those who had spontaneous abortion in 2nd trimester or preterm labor in the previous pregnancies, 5,25 times in those with multiple pregnancy.

26,58 times risk increase was seen in those with small or big uterus according to pregnancy week, 2,21 times risk increase in those with early contraction, 2,53 times risk increase in those with problems during delivery.

Table 3: Distribution of the risks determined in the histories and present pregnancies of the mothers according to the condition of babies' being in NICU (Those which are statistically significant)

Condition of being in intensive care unit			
Risks in the histories	Cases n=200%	Controls n=200	Statistic (X^2 and p)
Infertility treatment			
Yes	20,0	9,0	X^2=9,760
No	80,0	91,0	p=0,002
Number of deliveries ≥5			
Yes	6,5	0,0	X^2=13,437
No	93,5	100,0	p=0,000
Stillbirth or neonatal death			
Yes	16,0	7,0	X^2=7,959
No	84,0	93,0	p=0,005
Spontaneous 2nd trimester abort/preterm labor			
Yes	18,0	5,0	X^2=16,605
No	82,0	95,0	p=0,000
Risks in the present pregnancies			
Changes in fetal movements			
Yes	4,5	0,5	p=0,020*
No	95,5	99,5	
Gestational hypertension			
Yes	12,5	5,0	X^2=7,045
No	87,5	95,0	p=0,008
Multiple pregnancy			
Yes	18,0	3,5	X^2=21,914
No	82,0	96,5	p=0,000
Polyhydramnios or oligohydramnios			
Yes	18,0	11,0	X^2=3,952
No	82,0	89,0	p=0,047
Small/big uterus according to the gestational week			
Yes	16,0	1,0	X^2=28,930
No	84,0	99,0	p=0,000
Early membrane rupture			
Yes	14,5	2,0	X^2=20,642
No	85,5	98,0	p=0,000
Early contractions			
Yes	35,5	15,5	X^2=21,055
No	64,5	84,5	p=0,000
Urinary infection			
Yes	29,5	19,5	X^2=5,406
No	70,5	80,5	p=0,020
Preeclampsia			
Yes	9,0	1,5	X^2=11,308
No	91,0	98,5	p=0,001
Problems of the baby during pregnancy**			
Yes	34,5	*4,0*	X^2=59,845
No	65,5	*96,0*	p=0,000
Problem during birth***			
Yes	18,0	*8,0*	X^2=8,842
No	82,0	*92,0*	p=0,003

*: Fischer's exact test
**: Small for gestational age, intra-uterine growth retardation, congenital anomalies etc.
***: Early membrane rupture, cord entanglement, cord prolapse, pres

Table 4. Results related to the factors which are found to be effective to be in NICU in logistic regression analysis

Risk Factors	Beta	Standard Error	p	Odds Ratio (OR)	95% Confidence Interval for OR	
					Lower Limit	Upper Limit
Residing Place						
Ankara-Centre						
Other Cities/district-village	1,003	0,275	0,000	2,726	1,591	4,668
Education of the spouse						
University			0,011			
Primary school	0,681	0,301	0,024	1,976	1,094	3,567
High school	0,251	0,273	0,357	0,778	0,455	1,328
Spontaneous abortion in 2nd trimester or preterm birth history						
No						
Yes	1,453	0,404	0,000	4,276	1,936	9,445
Pregnancy status						
Single						
Multiple	1,659	0,464	0,000	5,255	2,117	13,043
Uterus according to the week						
Normal						
Small/big uterus	3,280	0,759	0,000	26,583	6,003	117,710
Early contractions						
No						
Yes	0,796	0,285	0,005	2,218	1,268	3,880
Problems during birth						
No						
Yes	0,930	0,360	0,010	2,534	1,252	5,128

Discussion

When the relationship between the socio-economic features and babies' being in NICU is evaluated (Table I), it is remarkable that there are total 4 mothers under 18 years old which is the risky age group in the age distribution of mothers and their babies are all in intensive care. Women older than 35 years old were more in number in this group but no statistically significant differences were seen between the groups in terms of age distribution.

This condition can be originating from the study group's not being numerically so high. Adolescent pregnancies and advanced age pregnancies are known to have results such as miscarriage/stillbirth or risky neonatal [10].

When the residing places of the mothers are evaluated, it was seen that those whose babies were in NICU resided in a place other than Ankara city centre in a higher rate when compared to the other group (p=0,000). This difference was found significant in logistic regression analysis as well (OR:2,72).

This can demonstrate the fact that socioeconomic factors are effective on being in intensive care. However, referral of risky considered patients living in the regions other than Ankara to the University Hospital in which the study was made can also be effective on this result.

No statistically significant difference was found between the groups in terms of educational backgrounds of the mothers (p=0,818). When compared to Turkey Demographic and Health Survey 2008 (TDHS-2008) data, educational backgrounds of women in the research group were seen to be better than Turkey-wide [10]. When the occupations of mothers were evaluated, it was seen that they were largely housewives and no significant difference was seen between the groups in terms of occupations (p=0,115). As in Turkey-wide, the ratio of working women in the research group is also not in adequate level [10].

The relationships between the educationals backgrounds of the spouses of mothers and being in intensive care are statistically significant (p=0,003).

The educational level of fathers is higher in control group. This was determined as an important factor at the end of multiple analyses, too (OR: 1,97). Factors related to the father were found effective in similar studies in Turkey [11]. In our study group, fathers' educational level was higher when compared to mothers and it can be said that it has an effect on the social status and health results of the family. No statistically significant relationship was found between the occupations of fathers and babies' being in NICU. However, it is meaningful that there are total 4 unemployed fathers and their babies are all in intensive care. There is no significant difference in terms of income between the groups (p=0,749). On this result, economic levels of the patients making application to this hospital being close to each other and difficulties in taking income information can be effective.

The mean number of prenatal visits in the research group was close to each other and is about 14 and quite high in each group. This result is affected by the fact that our research was executed in an urban region and on those who gave birth in the University Hospital. WHO have suggested four monitoring based routine approaches for the large part of women as the new model of PNC and additional controls to those with special risks. This approach was introduced and used in several countries [12,13]. However, new 4 control PNC approach is not adequate in high risk pregnancies and multiple pregnancies. Number of prenatal visits is quite high in our study and less than 4 was seen only in 3 persons within the group.

PNC is generally known to be related to preterm labor, low birth weight, fetal death and neonatal death [5,6,14,15]. However, number of PNC evaluated in several studies is different from each other and numbers greater than 4 can be suggested according to results [15]. The process during PNC visits and status of the pregnant woman allows giving more correct decision for this number.

In a study done on those giving birth in a University Hospital in Ankara in 1996, average number of PNC are found as 8,7 and this is a lower average according to our study [16]. This shows that the number of PNC in Turkey, at least in urban region increased in time. However, although a large number of control ratios are required in complicated pregnancies, it also makes one think about whether the sources are effectively used in other circumstances.

When quantitative adequateness of PNC is evaluated according to APNCU index, it is seen that a large part of the group received adequate plus PNC (Table II). The sum of those who received adequate and adequate plus PNC is 94, 3% in the whole group. This result was found lower in a study executed on-site in Turkey with the same index [11]. Almost all of those who received inadequate PNC (which are few) are in intensive care unit. Those who received ''intermediate'' and ''adequate'' PNC is higher in the control group and ''adequate plus'' PNC is higher in the case group.

These differences between the groups are statistically significant (p=0,001). The results obtained in our study have shown that those monitored in ''inadequate'' level as well as risky pregnant women are determined and monitored more, and thus those who are monitored ''adequate plus'' are in the higher ratio in the group which is in NICU.

It was seen that pregnant women in the study group were substantially controlled by specialist physician. In TDHS 2008 data, it was seen that PNC was taken 90% from the physician, and specialist and practitioner ratios were not specified. The high rate of received PNC by the specialist physician in our study shows that primary care health services are not sufficiently used.

When PNC's content was evaluated, it was seen that the number of persons to whom "inadequate'' monitoring was made in qualitative terms was very low and so significant difference could be found between the groups in this respect (p=0,481). This result is an expected condition in our study group whose number of visits is very high and it is higher than the performance rates of the examinations in TDHS 2008 data [4].

As seen in Table III, having received infertility treatment is higher in those who are in NICU when compared to the other group (p=0,002). As a result of the infertility treatment which is gradually widespread today, multiple pregnancy rates increase and in multiple pregnancies low birth weight and other problems increase intensive care requirement. Among the risks related to the previous birth histories of mothers; number of births being 5 or greater, stillbirth or neonatal death, spontaneous 2nd trimester abortion or preterm labor is higher in those whose babies are in NICU.Existence of spontaneous 2nd trimester abortion or preterm labor history is also one of the factors remaining effective as a result of logistic regression analysis (OR=4, 2) (See Table IV).

When the risks which are determined in the current pregnancies of mothers (Table III) are evaluated, changes in fetal movements, gestational hypertension, multiple pregnancy, polyhydramnios or oligohydramnios, small/big uterus according to the week, early membrane rupture, early contractions, urinary infection and preeclampsia was significantly high in mothers whose babies are in NICU. The possibility of staying in intensive care unit is higher for the babies whose mothers have such risky conditions in their pregnancies. These relationships were shown in several studies [2,17].

Multiple pregnancies which are found to be significant in logistic regression analysis as well (OR=5, 25) increased with the spread of infertility treatment and they are high risk pregnancies due to their fetal and

maternal complications. Multiple pregnancies which are the most important factor found to be related to intensive care in the USA constitute 14% of neonatal deaths and increase perinatal mortality 10 times [2,18].

Since the existence of big or small uterus according to the week, which is one of the risk factors found significant (OR=28,5) in logistic regression analysis, reflects fetal growth and conditions related to amnion liquid, it can be a good indication of NICU requirement of the baby. Early membrane rupture is one of the most important preterm labor reasons and one of the factors affecting the babies' being in NICU and it has also taken place within the title of problems during birth in our study. Early contraction is also a condition increasing preterm labor risk. This factor was evaluated with logistic regression analysis and found significant (OR=2, 2). Conditions such as urinary infection and preeclampsia are also the factors resulting in prematurity [19, 20].

While the existence of a fetal problem as a result of USG examinations made in pregnancy is 34, 5% in the cases and it is only 4% in the controls (p=0,000). This result also demonstrates the fact that giving birth in a hospital with NICU is of vital importance if there is a problem detected in the baby during pregnancy.

A statistically significant relationship was found between having a problem during delivery in those participating in the research and the babies' being in NICU (p=0,003). This factor was also found to be significant in logistic regression analysis, (OR=2, 5), (See Table IV). In the study, the majority of the ones under the title of problems during the delivery consisted of EMR, and there were also problems such as cord entanglement, cord prolapsed and presentation anomaly.

Problems such as cord entanglement, cord prolapse, early membran rupture, presentation anomaly makes delivery difficult and increases the intensive care requirements of the babies.

Conclusion

In conclusion, in our study, being in NICU was found to be related to some socio-economic factors. Although PNC ratio is generally high, the approach of bringing qualitative PNC service to all parts of the community maintains its importance. Since PNC was inadequate within primary health care services, its integration to the first step should be made, specialist support should be given when necessary. And PNC visits more than required in pregnant women should be reviewed in terms of effective use of sources. Risks determined in the previous pregnancies and during control of mothers are extremely important, factors related to being in intensive care found in our study should be understood and interpreted in all of the steps of health services, and interventions should be executed when necessary. When a problem occurs during pregnancies, the intensive care requirement of the baby should be substantially foreseen, access should be provided to suitable delivery conditions and NICU.

Conflict of Interest: The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical issues: All Authors declare that originality of research/article etc... and ethical approval of research, and responsibilities of research against local ethics commission are under the authors responsibilities. The study was completed due to defined rules by the Local Ethics Commission guidelines and audits.

Aknowledgement: None

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