



# Evaluation of land transportation of newborns in Türkiye

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## ARTICLE INFO

### Keywords:

Neonatal transport

Neonatal morbidity

Neonatal mortality

Received: May 24, 2022

Accepted: Sep 25, 2022

Available Online: 22.10.2022

DOI:

[10.5455/annalsmedres.2022.05.171](https://doi.org/10.5455/annalsmedres.2022.05.171)

## Abstract

**Aim:** In our country, the number of Neonatal Intensive Care Units (NICUs) and the quality of service has considerably increased during the last two decades. However, improvements in the safe transportation of newborns are not at the same rate, and there are many problems that need to be solved. Appropriate transport conditions should be provided to reduce neonatal mortality and morbidity. In this study, our aim was to present transportation problems in an understandable manner, to reveal solutions proposed by the addressees of these problems, and to reduce transport-related neonatal mortality and morbidity by drawing attention to this issue.

**Materials and Methods:** As a cross-sectional descriptive study, we attempted to reach as many physicians as possible who played a relevant role in neonatal transport and invited them to respond to a Google Forms questionnaire concerning neonatal transport problems, between the 10<sup>th</sup> and 30<sup>th</sup> of April, 2022, and their responses were recorded.

**Results:** A total of 90 participants responded to the questionnaire. Neonatal specialists were the group with the highest response rate of 54.4%. Most of the participants were employed at University Hospitals or Training and Research Hospitals (69.7%). The most frequently used transport system was the on-duty team referred by the emergency call (112) center (84%). The participants reported that they frequently encountered undesirable events during transport, and that the transport team's approach to these events was inadequate. The solution proposal chosen most often was found to be: 'supplying vehicles with equipment similar to those used in NICUs throughout the various regions of our country with respect to population density, and ensuring that personnel employed in these vehicles are only involved in the transportation of newborns'.

**Conclusion:** In our country, improvements in neonatal transport are urgently needed to reduce neonatal mortality and morbidity.



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## Introduction

In our country, the numbers of Neonatal Intensive Care Units (NICUs) and the quality of service have increased greatly during the last two decades. However, improvements in the safe transportation of newborns are not at the same rate, and there are many problems that need to be solved.

Although the transfer of possible high-risk newborns before birth to a center where appropriate follow-up and treatment can be carried out is the best approach, such cases may not always be predictable, and sometimes the best choice for the mother and the baby may be to deliver the baby immediately [1-2]. In such cases, mortality and morbidity of the newborn can be reduced by various

approaches which include stabilizing the newborn, sharing the patient's information accurately and completely with the neonatal specialist or newborn-experienced pediatric specialist (if any) in the center to be transferred, determining the procedures to be performed before the transfer, and providing appropriate care during transport [3].

Our aim was to present transportation problems in an understandable manner, to reveal solutions proposed by the addressees of these problems, and to reduce transport-related neonatal mortality and morbidity by drawing attention to this issue.

## Materials and Methods

This cross-sectional descriptive study was planned as a survey study in a center providing 3rd level Neonatal Intensive Care. Neonatal specialists, pediatricians, neonatology fellowship and pediatric residents who are involved in the transport of newborns were invited to participate in the

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survey by sending an invitation online.

Google Forms was used to prepare the survey, the answers given between the 10<sup>th</sup> and 30<sup>th</sup> of April, 2022 were included in the study and 90 participants completed the questionnaire during this time period.

In order to determine the newborn transport situation in our country and the solution proposals, we asked a total of 14 multiple choice questions and 1 open-ended question for additional solution suggestions if they did not agree with the available proposals (details of the questions are available in the supplementary file).

Statistical analysis was carried out with the SPSS 21 package program. Categorical variables are presented with number (percentage) values.

Our study was approved by the Ethics Committee of the Faculty of Medicine of Karabük University with the decision number 2022/832. The study was conducted in accordance with the Declaration of Helsinki and good clinical practice guidelines.

## Results

A total of 90 individuals participated in our study. Forty-nine (54.4%) were male. Participants were mostly between the ages of 40-50 years (51.1%). The majority of physicians who participated were those working in University Hospitals or Training and Research Hospitals (69.7%). Neonatal specialists responded most frequently with a 54.4% proportion among respondents, while pediatric specialists came in second place with 36.7%. While the participation rate of newborn fellows was in the 3<sup>rd</sup> place with 5.6%, the least participation was among pediatric residents with a rate of 3.3%. The top level of care provided in the NICU of 63.3% of the participants was level 3. The frequency of having a neonatal resuscitation program (NRP) certificate was found to be 92.2%, which is a high rate. The great majority of institutions in which the participants worked had a transport incubator with a ventilator (96.7%). The demographic data of the participants are given in Table 1. The most commonly used referral system was determined as newborn referral with the on-duty 112 team (emergency first responders) coordinated by the 112 Command Centre, with a rate of 84.4%. Among other means of referral, the rate of those who reported that they were performing referral with their own means was 11.1%, the rate of referrals carried out with the trained team from the center accepting the newborn was 3.3%, and there was only 1 participant (1.1%) who reported that referral was performed with private transportation systems.

One-fourth of the participants evaluated the approach of non-physician personnel to problems that may occur during critical neonatal transport as ‘poor’ or ‘very poor’. Only 24.4% of the participants evaluated the adverse event-related approach of the physicians accompanying the critical patients as ‘good’ or ‘very good’. When asked about the incidence of transfer complications, about half answered ‘often’ or ‘very often’ (Table 2). When a complication developed during the transfer, one-third of the participants rated the response of the transportation team as ‘poor’ or ‘very poor’. With regard to responses concerning participants who had admitted newborns referred for hypothermia treatment, 36.7% stated that 50-75% of

**Table 1.** Sociodemographic characteristics.

Parameters	%
<b>Age</b>	
20-30	2.3%
30-40	33.3%
40-50	51.1%
>50	13.3%
<b>Sex</b>	
Female	45.6%
Male	54.4%
<b>Neonatal resuscitation program certificate</b>	
Have	92.2%
Do not have	7.8%
<b>Transport incubator with ventilator</b>	
Have	96.7%
Do not have	3.3%
<b>Institution employed</b>	
Private hospital	18.0%
University hospital or training and research hospital	69.7%
State hospital (including non-educational city hospitals)	6.7%
Maternity and child hospital	5.6%
<b>Expertise level</b>	
Pediatric resident	3.3%
Pediatrician	36.7%
Neonatology fellowship	5.6%
Neonatal specialist	54.4%
<b>The top care level of the neonatal intensive care unit at their center</b>	
1 <sup>st</sup> level	6.7%
2 <sup>nd</sup> level	7.8%
3 <sup>rd</sup> level	63.3%
4 <sup>th</sup> level	22.2%

newborns presented with appropriate body temperature, 31.1% stated that 20-50% of newborns presented with appropriate body temperature, 13.3% stated that 20% of newborns presented with appropriate body temperature, and only 1 participant (1.1%) reported that all hypothermia patients were transferred with appropriate body temperature.

Finally, participants were asked the question, “What do you think the order of priority should be with regard to the following solution proposals for the adequate and safe transport of newborns in our country?”, and it was requested that they rank the 4 options in order of priority. These options were as follows: 1. supplying vehicles with equipment similar to those used in NICUs throughout the various regions of our country with respect to population density, and ensuring that personnel employed in these vehicles are involved in the transportation of newborns, 2. Assigning physicians who are experienced in neonatal in-

**Table 2.** Responses to the questions.

Questions	Responses	%
Which referral system do you use when referring critically ill patients a NICU which is at a higher level or the same level as yours, for various reasons?	The on-duty team of the 112 Command Centre that day	84.4%
	Trained team at the center that accepts the newborn	3.3%
	Special transport systems	1.1%
	Our own means	11.1%
If you accept newborns for the purpose of hypothermia treatment, what is the approximate rate of transfer to you with appropriate body temperature?	100%	1.1%
	75-100%	17.8%
	50-75%	36.7%
	20-50%	31.1%
At what rate do you observe hypothermia, hypotension, cardiac arrest, respiratory failure, hypoglycemia, hypocalcemia, fluid overload, or other complications in newborns you have transferred or have been transferred to you?	Never	0.0%
	Rarely	51.1%
	Frequently	43.3%
	Very frequently	5.6%
How do you evaluate the success of the approach of non-physician personnel who accompany the critically-ill patients that are being transferred to a NICU at a higher level or the same level as yours, for various reasons, with respect to the adversities that may occur during newborn transport (establishing vascular access, ensuring the safety of the baby, perfusor settings, oxygen tube replacement, 1/10 thousand adrenaline preparation, emergency drug use, resuscitation, etc.)?	Very good	3.4%
	Good	24.7%
	Moderate	49.4%
	Poor	21.3%
How do you evaluate the success of the approach of physicians who accompany the critically-ill patients that are being transferred to a NICU at a higher level or the same level as yours, for various reasons, regarding the negativities that may occur during newborn transport (team management, intubation, thoracic tube insertion, establishing vascular access, regulation of ventilator parameters, emergency drug use, resuscitation, etc.)?	Very good	2.2%
	Good	22.2%
	Moderate	46.7%
	Poor	24.4%
	Very poor	4.4%

tensive care and have NRP certificates for newborn transport, 3. Providing 1-month NICU internship after training to all 112 personnel in all provinces, 4. Putting the newborn transport curriculum in Medical Faculties and supporting it with practical training.

When we requested participants to specify additional suggestions other than those that had been put forth, the following suggestions were noted:

1. It is necessary to raise awareness of not only pediatricians but also gynecologists and obstetricians on this issue, and it is necessary to ensure that deliveries unsuitable for their center should be carried out in appropriate centers.
2. There should be at least one neonatal specialist in almost every province in order to reduce transportation time and possible risks. There are provinces where there are no newborn specialists, and this increases the number or transportation time of transports.
3. There should exist 112 teams whose only duty is to transport neonates, and transport teams coordinated by the provincial 112 control center should be present in big hospitals. In all developed countries, the transfers of newborn patients are carried out by experienced transport teams from the receiving center. Table 2 includes the questions and responses from the participants.

## Discussion

To our knowledge, this is the first study in the literature in which the opinions of participants who experience problems related to newborn transport in our country are obtained and possible solutions are discussed. This study showed that neonatal transport problems are at an alarming level in our country. The main problems we identified were: the transfer of newborns with transport teams that had insufficient training and experience, the transfer of most newborns with the on-duty 112 team(s), and the frequent development of clinical complications during transfers and the inadequacy of interventions in these babies.

It was determined that the development of many undesirable events such as hypothermia, hypoglycemia and circulatory disorder decreased compared to previous years by improving the transportation conditions of newborns in Diyarbakır in 2008, for instance, by increasing the rate of transportation by ambulance and utilization of transport incubators [4].

Among the studies published by clinics in our country, the study conducted in Izmir Dr. Behçet Uz Hospital in 2004 emphasized that the stabilization of newborns before and during transport was not ensured, communication was insufficient before transport, and transport personnel and ambulance equipment were insufficient [5].

A study conducted in South Africa found that the probability of developing an undesirable event during the transport of newborns was at least 75% [6].

In our study, when the transport team was evaluated by the participants, the success of approaching adverse events during the transfer highlighted the inadequacy of both physician and non-physician personnel (total of 'good' and 'very good' responses: 24.4% for physicians and 28.1% for non-physician staff).

Unfortunately, there is no study investigating the frequency of complications during transportation in our country, but nearly half of the participants (48.9%) in our study stated that they had encountered complications 'frequently' or 'very frequently' during transport.

Ashokcoomar and Naidoo (2016), in their study which aimed to investigate transfer delays of newborns between health facilities and adverse events encountered during newborn transfer, found that 29 (24.2%) of the 120 transferred patients were critically-ill newborns, and serious adverse events developed in 10 (8.3%) newborns, including one (0.8%) death. All of the remaining nine patients with adverse events had developed life-threatening complications such as deterioration in respiratory and cardiac functions, hypothermia, and cardiorespiratory arrest.

Inappropriate pre-transplant preparation, lack of stabilization before transfer, and lack of available healthcare professionals with advanced life support training were found to be among the causes of neonatal death [7].

In developed countries, teams that provide newborn transport consist of trained and experienced personnel in this field. For example, newborn transports in Canada are predominantly carried out by private hospital-based neonatal transport teams [8]; whereas, in the United Kingdom, neonatal transport is mainly organized by unit-based neonatal transport teams and central transport services [9].

However, in our country, as most of our participants (84.4%) stated, newborn transfer is usually carried out by the on-duty 112 team. These teams also carry out the transport of children and adults, generally consisting of people who have not received any training in neonatal resuscitation or the approach to adverse events that may develop during transport. It has been suggested by our participants that 112 teams whose only duty is neonatal transport and have received relevant training should be employed, and that there should be a transport team (coordinated by 112) in large hospitals.

In a retrospective study conducted by the neonatal transport teams of the Zurich University Children's Hospital in Switzerland to evaluate neonatal transport activities, the high rate of emergency transfers demonstrated the need for an efficient neonatal transport system available 24 hours a day all-year-round and the need for dedicated neonatal transport teams composed of members trained in neonatal transport who are experts in handling neonatal emergencies. They also emphasized that national guidelines on newborn transport standards and quality criteria should be established in Switzerland in order to devise necessary criteria and improve the quality of transport [10].

Provision of vehicles with equipment similar to those used in NICUs throughout the various regions of our country with respect to population density, and ensuring that personnel employed in these vehicles are only involved in the transportation of newborns was the most recommended

solution among our participants. In our country, newborn ambulances are currently actively used in the provinces of İzmir and Adana [11].

Assignment of physicians who are experienced in neonatal intensive care and have NRP certificates into neonatal transport was the second most frequently recommended option. The third most frequent suggestion was to provide 112 personnel with a 1-month NICU internship after training. The other solutions proposed by our participants were as follows: 'incorporating newborn transport-related training into the curriculum in Medical Faculties and supporting it with practical training', 'assigning at least one neonatal specialist in almost every province with respect to transportation time and possible risks', and 'raising awareness not only of pediatricians but also of gynecologists and obstetricians for the transfer of risky births, and ensuring that the births of these patients are carried out in centers with appropriate NICUs'.

The efficacy of hypothermia treatment in hypoxic ischemic encephalopathy decreases over time. It is recommended to initiate this treatment particularly within the first 6 hours. This is why appropriate-temperature transfer gains importance for babies transferred for hypothermia treatment [12]. In our study, the participants reported a high rate of inappropriate-temperature transfer among patients who were referred for hypothermia (44.4% of the participants stated that less than half of the patients were transferred with appropriate body temperature).

## Conclusion

In our country, improvements in neonatal transport are urgently needed to reduce neonatal mortality and morbidity. For this purpose, the primary emphasis of our study has been that it is necessary to carry out newborn transport with newborn ambulances in which trained and experienced personnel are present, similar to the practices in developed countries.

## Limitations

It is difficult to identify and reach this small population, as there are thousands of employees in the 112 system and the number of people assigned to transport newborn babies among these employees is quite low. Therefore, 112 employees were not included in the study. Air transport was not evaluated in this study because it was performed at a relatively low rate.

## Acknowledgements

We would like to thank all our colleagues who participated and spared their valuable time.

## Ethics approval

Our study was approved by the Ethics Committee of the Faculty of Medicine of Karabuk University with the decision number 2022/832.

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