



ORIGINAL ARTICLE

# Hospital survival upon discharge of ill-neonates transported by ground or air ambulance to a tertiary center<sup>☆</sup>



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## KEYWORDS

Ambulance;  
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## Abstract

**Objective:** To evaluate the differences in hospital survival between modes of transport to a tertiary center in Colombia for critically ill neonates.

**Methods:** Observational study of seriously ill neonates transported via air or ground, who required medical care at a center providing highly complex services. Data on sociodemographic, clinical, the Transport Risk Index of Physiologic Stability (TRIPS), and mode of transport were collected. Patients were described, followed by a bivariate analysis with condition (live or dead) at time of discharge as the dependent variable. A multiple Poisson regression with robust variance model was used to adjust associations.

**Results:** A total of 176 neonates were transported by ambulance (10.22% by air) over six months. The transport distances were longer by air (median: 237.5 km) than by ground (median: 11.3 km). Mortality was higher among neonates transported by air (33.33%) than by ground (7.79%). No differences in survival were found between the two groups when adjusted by the multiple model. An interaction between mode of transport and distance was observed. Live hospital discharge was found to be associated with clinical severity upon admittance, birth weight, hemorrhaging during the third trimester, and serum potassium levels when admitted.

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**PALAVRAS-CHAVE**

Ambulância;  
Terrestre;  
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TRIPS

**Conclusions:** Mode of transport was not associated with the outcome. In Colombia, access to medical services through air transport is a good option for neonates in critical condition. Further studies would determine the optimum distance (time of transportation) to obtain good clinical outcomes according type of ambulance.

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### Sobrevida hospitalar após a alta de neonatos doentes transportados por ambulância terrestre ou aérea para um centro terciário

#### Resumo

**Objetivo:** Avaliar as diferenças na sobrevivida hospitalar entre os modos de transporte para um centro terciário na Colômbia para neonatos gravemente doentes.

**Métodos:** Estudo observacional de neonatos gravemente doentes transportados por ar ou terra que precisam de cuidados médicos em um centro que oferece serviços altamente complexos. Foram coletados dados sociodemográficos, clínicos, sobre o Índice de Risco da Estabilidade Fisiológica no Transporte (TRIPS) e o meio de transporte. Os pacientes foram descritos e submetidos a uma análise bivariada, com a condição (vivo ou morto) no momento da alta sendo a variável dependente. Uma regressão múltipla de Poisson com modelo de variância robusta foi utilizada para ajustar as associações.

**Resultados:** Um total de 176 neonatos foram transportados por ambulância (10,22% pelo ar) ao longo de seis meses. As distâncias foram maiores pelo ar (mediana: 237,5 km) que por terra (mediana: 11,3 km). A mortalidade foi mais alta entre neonatos transportados pelo ar (33,33%) que por terra (7,79%). Não foram encontradas diferenças na sobrevivida entre os dois grupos após o ajuste com o modelo múltiplo. Foi observada uma interação entre o meio de transporte e a distância. A alta hospitalar com vida foi associada à gravidade clínica na internação, ao peso ao nascer, à hemorragia durante o terceiro trimestre e aos níveis de potássio sérico na internação.

**Conclusões:** O meio de transporte não foi associado ao resultado. Na Colômbia, o acesso a serviços médicos por transporte aéreo é uma boa opção para neonatos em condições críticas. Estudos adicionais determinariam a distância ideal (tempo de transporte) para obter bons resultados clínicos de acordo com o tipo de ambulância.

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## Introduction

Transportation is an important factor to ensure quality medical care for neonatal patients who do not have the opportunity to obtain optimal care or whose pathology is complex.<sup>1</sup> This is because the infrastructure required to treat these patients is not always available in the areas where they are born. For a health system, effective ambulance services (ground and air) may provide a means to improve access to health services. It is important, because according to Campbell et al., access to clinical care and its effectiveness are the factors related to the quality of services.<sup>2</sup>

Worldwide, ambulance transport is the first line of response for inter-hospital referrals of critical patients. Many of these patients are transported by ground, while medical air transport services have been used for critical patients who require immediate care or when geographic difficulties limit access by ground.<sup>3</sup> Several studies regarding air transport have been conducted in developed countries – primarily in the United States, Canada, and Europe – nevertheless, evidence about this topic is scarce in developing countries.<sup>4</sup> In these countries, social difficulties are

related to large inequities in health services. Additionally, geographic characteristics could limit the provision of health services, including primary care.<sup>5</sup>

To address these problems with geographic accessibility, countries such as the United States have developed policies directed toward efforts to improve access and eliminate disparities in health care, with efficiency as the priority.<sup>6</sup> Examples like this are not suitable for Colombia. In this country, three mountain ranges run through country, making the distances between the regions longer than in other nations when traveled by ground. In addition, a recent study of roadway conditions in Colombia reported the existence of 128,000 km of roads in the country (75% paved), only 35% of which were found to be in good condition.<sup>7</sup> Furthermore, during the rainy season roadways are frequently blocked by landslides and floods. It was especially problematic during 2010 and 2011 when La Niña caused a great deal of deterioration in roadway infrastructure,<sup>8</sup> making it difficult to transport some patients who required specialized medical care at more complex hospitals. All these reasons favor the option of air transportation. In health services, the air transportation of patients to main cities (Bogotá and Medellín) is relatively

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