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# Factors Impacting Length of Treatment and Length of Hospital Stay in Neonatal Abstinence Syndrome

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## Abstract

**Background:** Neonatal Opiate Withdrawal Syndrome (NOWS) has been a concern in the United States, with an incidence of 20 cases per 1000 live births. Most research on NOWS uses length of stay (LOS) in the hospital or length of pharmacological treatment (LOT) as outcome measures for treatment effectiveness. However, LOS does not account for other factors impacting neonatal care, such as other medical or social confounders. LOT may be a more precise measure to evaluate treatment effectiveness but does not account for possible need to continue close, in-hospital monitoring of withdrawal symptoms. Therefore, the aim of our research is to evaluate LOT and LOS, assessing what factors prolong hospital stay after completing pharmacological treatment for NOWS.

**Objective:** To evaluate factors that contribute to the difference between LOT and LOS.

**Methods:** A retrospective medical chart review of all neonates born to mothers with evidence of substance use/abuse from 2011 – 2017 at a tertiary care center was conducted by using EPIC EHR system. Neonates over 35 weeks gestational age with in-utero opioid exposure and no other major congenital anomalies, who received pharmacological treatment for NOWS were included. Demographic data as well as outcome data related to the difference between LOT and LOS was analyzed using multivariate analysis. Prolonged hospital stay is considered for LOS-LOT greater than 48 hours.

**Results:** 229 neonates were included in the study with median LOT 22 days and median LOS 29 days. Of the 62% who had prolonged hospital stay after cessation of pharmacological treatment for NOWS, 43% were due to a hold placed by child protection service. There was a correlation in increased time between LOT and LOS and maternal age ( $p=0.001$ ), as well as receiving treatment in the NICU ( $p=0.005$ ). There is a trend towards a shorter stay in neonates with higher birth weight ( $p=0.05$ ) and gestational age ( $p=0.08$ ). Maternal polysubstance use did not statistically increase the stay ( $p=0.929$ ). Prolonged stay had no effect on readmission within 30 days ( $p=0.882$ ). Mean LOS and LOT per year of birth were statistically different ( $p<0.001$ ), while mean LOS-LOT per year of birth was not ( $p=0.114$ ).

**Conclusions:** Close to half of the babies treated for NOWS had a prolonged LOS, most of which was due to a social hold or a hold by child protective services. The average cost of treatment for infants with NOWS is \$79,937.75. By addressing underlying factors that prolong the stay in the hospital past medical care, we may be able to decrease medical spending and improve overall care for these neonates.

## Objective

To determine what factors effect length of treatment (LOT), and the difference between LOT and length of hospital stay (LOS) in neonates with NOWS.

## Demographics

Mean Maternal Age, years	29.3
Male, n (%)	128 (55.9%)
C-section, n (%)	94 (26.8%)
Mean Birth weight, grams	2975
Mean Gestational Age, weeks	37.4
Readmissions, n (%)	18 (7.9%)
Treated with Phenobarbital, n (%)	98 (42.8%)
Mean Length of Treatment, days	25.6
Mean Length of Hospital Stay, days	32.4
Prolonged stay, n (%)	143 (62.4%)
Mean difference LOS-LOT, days	6.1

## Reasons for Prolonged Stay

Child Protection Placed Hold	61 (41.7%)
NAS Scoring Continued (Borderline Scores)	23 (16.1%)
Time Unreasonable for Discharge	38 (26.6%)
Monitoring Feeding	6 (4.2%)
Other Medical Conditions	15 (10.5%)

## Methods

- Retrospective medical record review conducted by using EPIC EHR system
- Neonates diagnosed and pharmacologically treated for NOWS from 2011 – 2017
- 3 scores  $\geq 8$  on the Modified Finnegan Neonatal Abstinence Scoring Tool (FNAST) was considered indicative of withdrawal that required pharmacological treatment
- Prolonged LOS > 48 hours following cessation of pharmacological treatment for NOWS; reason for prolonged stay determined
- The difference between LOS and LOT was assessed for correlation with demographic data and treatment factors using Ordinary Least Squares regression and the Mann-Whitney U Test

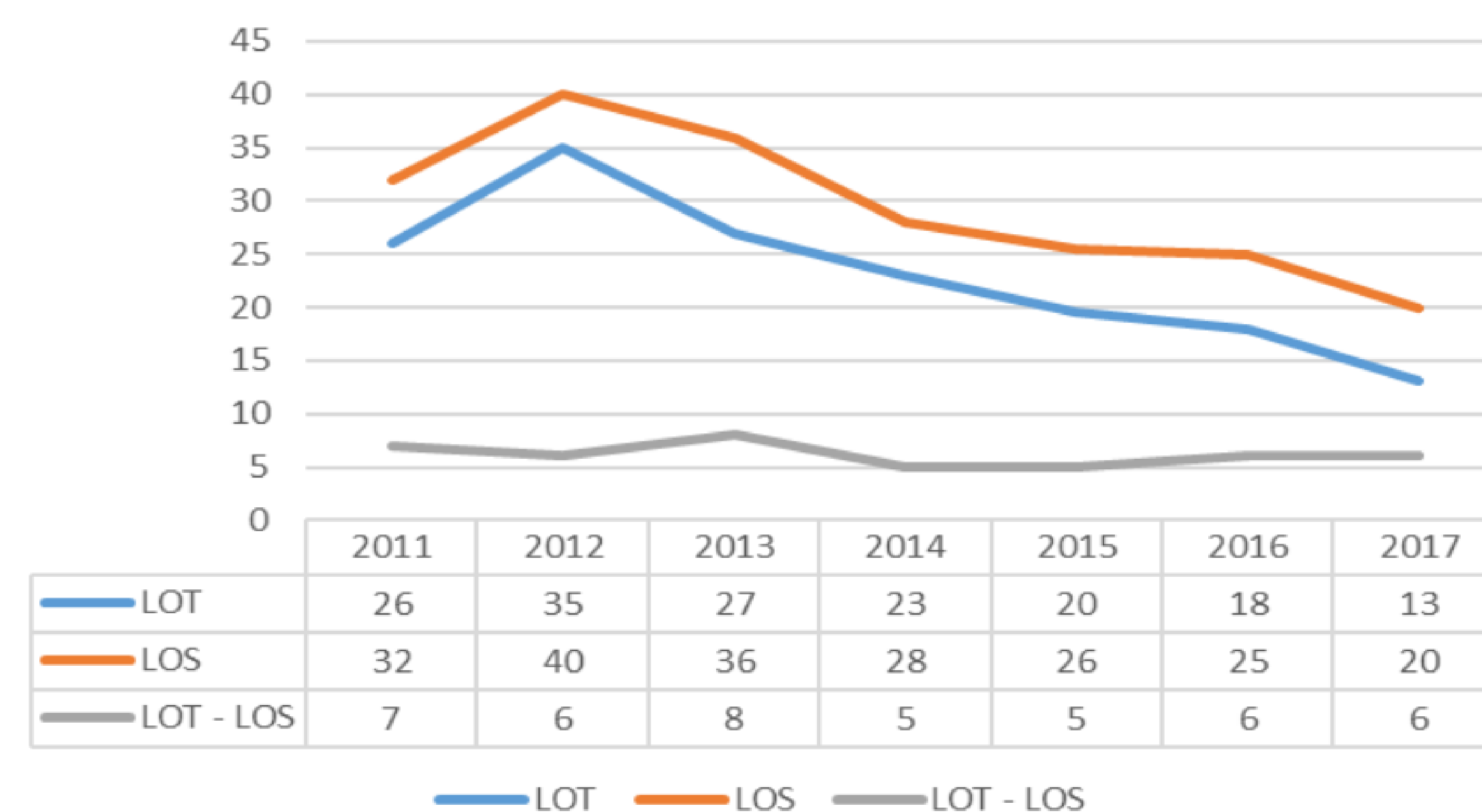
## Results

- A total of 229 neonates were identified
- The median LOT was 22 days and the median LOS was 29 days
- 62% of included neonates had a prolonged stay
- 43% of the prolonged stays were attributable to a hold placed by child protection service
- Increased time between LOT and LOS correlated with increased maternal age ( $p=0.001$ ) and treatment received in the NICU ( $p=0.005$ )
- Trend between shorter stay and higher birth weight ( $p=0.05$ ) and gestational age ( $p=0.08$ )
- No relationship between polysubstance use ( $p=0.929$ ) or readmission within 30 days ( $p=0.882$ ) and prolonged stay.
- Mean LOS and LOT per year of birth were statistically different ( $p<0.001$ ), but the difference between LOS and LOT was not impacted by time ( $p=0.114$ ) (Figure 1).

## Introduction

NOWS includes a constellation of symptoms in neonates following in utero exposure to maternal opioids. The incidence of NOWS has risen over the past 20 years and is accompanied by a high cost of care. Depending on symptom severity, NOWs is treated with either nonpharmacological interventions or various opioids, with possible adjunct medications. Most research on NOWS, including studies assessing treatment pharmacotherapy and hospital service, use length of stay (LOS) as primary outcome measure for treatment effectiveness. However, the utility of this measure, how it corresponds to treatment efficacy and to length of treatment (LOT), is uncertain.

Figure 1. Mean LOS, LOT, and difference between LOS and LOT by year of birth



## Conclusions

Over half the neonates pharmacologically treated for NOWS had a prolonged stay after cessation of treatment, over 40% of this was due to a hold placed by child protective services. LOS and LOT were impacted by a variety of factors, including year of birth. More research is needed to assess methods of decreasing prolonged LOS after termination of treatment, which can lead to decreased healthcare burden.

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