



# Severe sepsis treatment and outcomes: early recognition by prehospital providers

## SOUTH DENVER PREHOSPITAL SERVICES:

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# ABSTRACT

## ▶ INTRODUCTION:

- Prehospital providers have unique role in time-sensitive conditions

## ▶ PURPOSE: To determine if the EMS sepsis alert protocol is associated with survival, time to antibiotic administration, volumes of intravenous fluid administration, and lengths of stay in patients with sepsis, severe sepsis, and septic shock.

## ▶ QUESTION: Is there an association between the EMS sepsis alert and survival with the independent predictors of time to antibiotic administration, volumes of intravenous fluid administration, and lengths of stay in patients with sepsis, severe sepsis, and septic shock.

# METHODS

- ▶ **DESIGN:** Retrospective cohort; prospectively collected data

- ▶ **SETTING**

- ▶ January 1, 2010 through December 31, 2012.
- ▶ Porter, Littleton, Parker Adventist Hospitals

- POPULATION:**

- ▶ EMS 911 dispatched ambulance patients

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- ▶ PORTER JOINT IRB APPROVAL
  - ▶ ANALYSIS BY STATA 14.2 : COLLEGE TOWN, TEXAS

# DATA SOURCES

## ▶ EMS log;

- ▶ Prospective data collection EMS sepsis alerts called prior to arrival: Paramedic must say “sepsis alert”

## ▶ EMR:

- ▶ ED documented vital signs, venous lactate, WBC, EMS and ED IVF administration, Endotracheal tube insertion, Central line, Mechanical ventilation, Total length of stay (LOS), Blood products, Comorbid and chronic conditions (DRG)

# VARIABLES

## ▶ OUTCOME

- ▶ Survival at discharge

## ▶ PREDICTORS:

- ▶ Sepsis alert
- ▶ Time to antibiotics  $\geq$  6hrs after arrival
- ▶ IVF measured at 2, 6, and total hours
- ▶ LOS-total hospital

## ▶ \*COVARIATES:

- ▶ Baseline characteristics
- ▶ Lab values

# METHODS

## INCLUSION CRITERIA

- 911 EMS dispatched ambulance patients
- Age  $\geq 17$
- Not pregnant
- Admitted
- DNR
- CA with organ failure

## EXCLUSION CRITERIA

- Interfacility transfers
- Arrest in ED or prior to arrival
- Left ED AMA

## STATISTICAL ANALYSIS:

### LOGISTIC REGRESSION

Odds and risk ratio to compare probability of survival for patients transported as prehospital sepsis alerts versus no alerts, or those for whom no protocol was initiated

# INTERVENTION AND PROTOCOL

- ▶ **EMS SEPSIS ALERT** : 3 -step process:
  - ▶ **1. IDENTIFICATION**: Prehospital Sepsis Alert Criteria **WITH**
    - ▶ Lactate-Pro point-of-care (POC) meters;
  - ▶ **2. TREATMENT** EMS standard medical shock therapy, IVF resuscitation up to 2,000 ml of normal saline and administration of high flow oxygen
  - ▶ **3. ADVANCE NOTIFICATION** of ED: sepsis alert patient arrival.

## Sepsis Alert Criteria

- 1) Patient age above 17
- 2) Not pregnant
- 3) At least **two** of the SIRS (Systemic Inflammatory Response Syndrome) criteria:
  - a. Temperature greater than 38° C (100.4° F) or lower than 36° C (96.8° F)
  - b. Pulse greater than 90
  - c. Respiratory rate greater than 20 OR mechanically ventilated **and**
- 4) Suspected or documented infection **and**
- 5) Hypoperfusion as manifested by **one OR MORE** of the following:
  - a. Systolic BP less than 90 **or**
  - b. MAP < 65 **or**
  - c. Lactate level ≥ 4 mmol/L





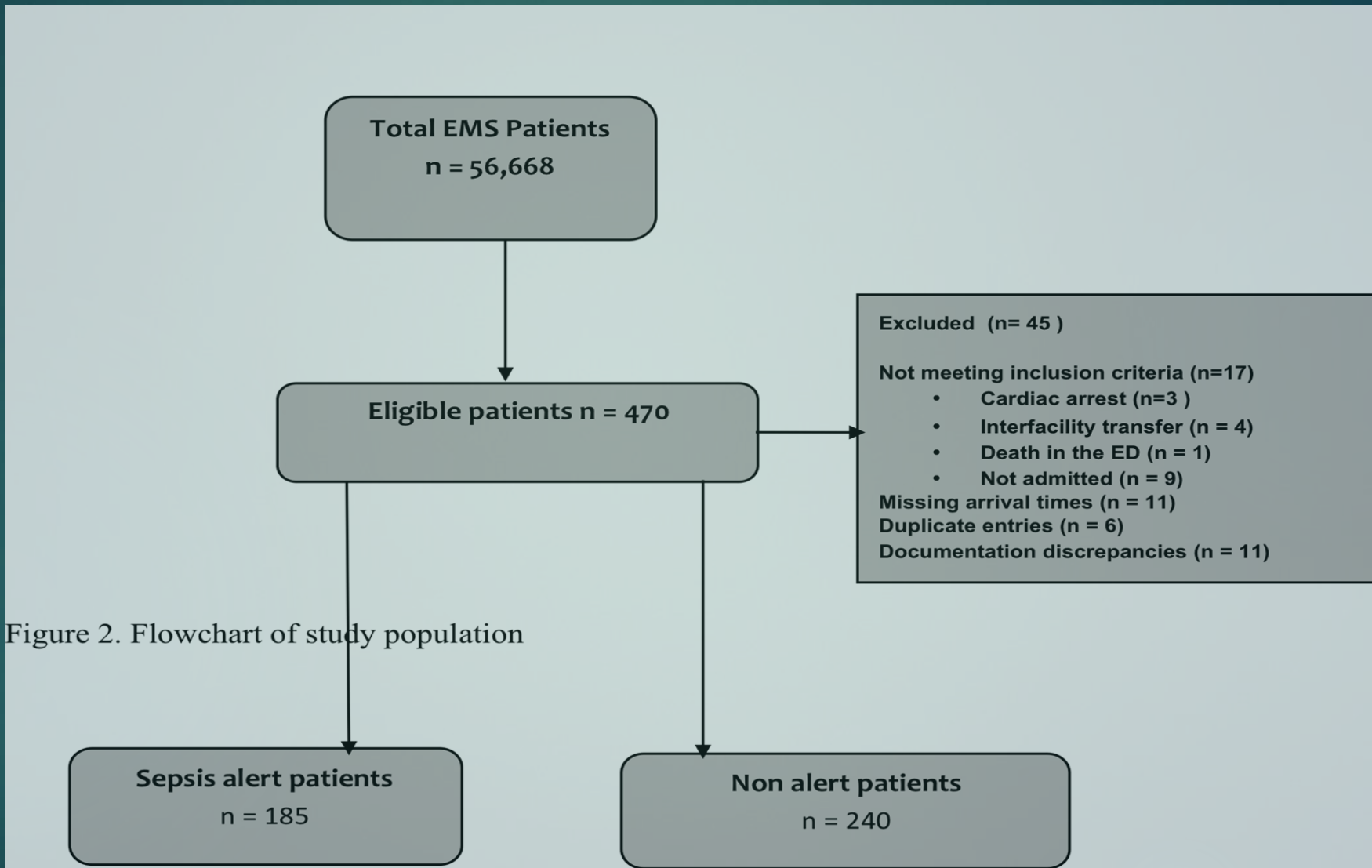


Figure 2. Flowchart of study population

# SURVIVAL

OVERALL: 81.2%

## ▶ ALERTS

▶ N = 185

▶ 88.6% SURVIVAL

## ▶ NON ALERTS

▶ N = 240

▶ 76.2%

CRUDE ODDS RATIO = 2.43

RISK RATIO = 1.16

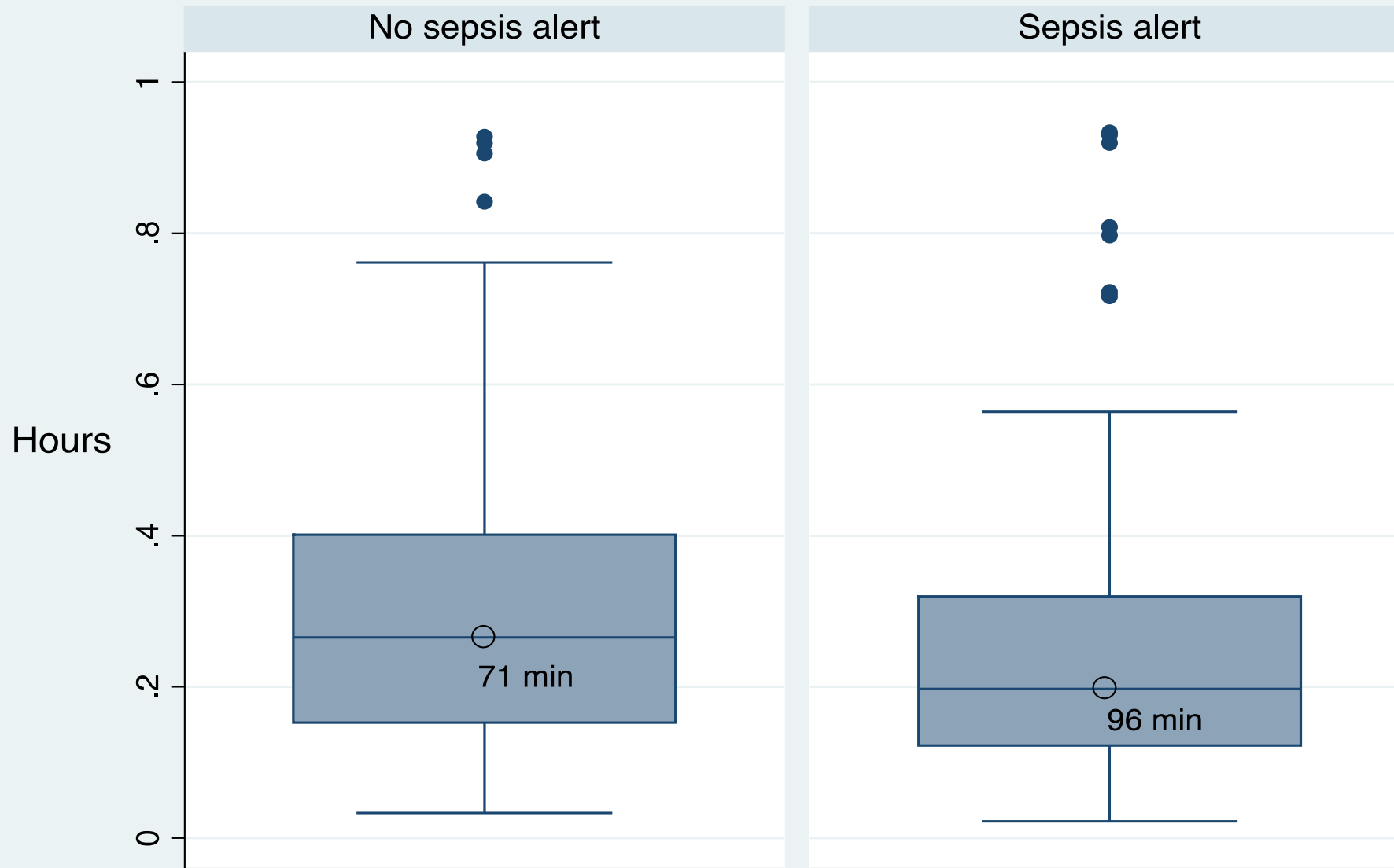
NNT = 8.25

P = .000

# RESULTS

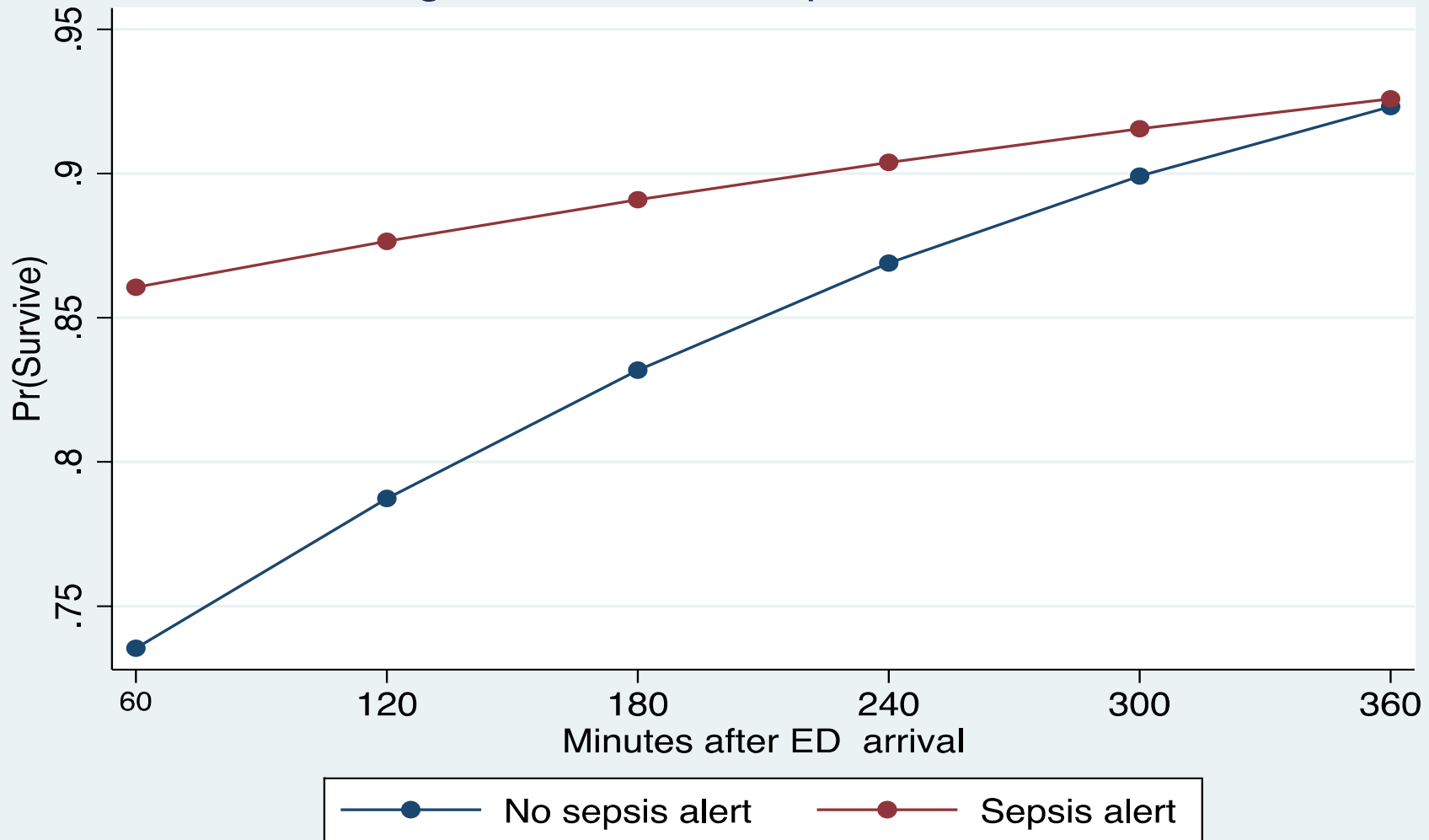
▶ Variable	Odds ratio	95% Confidence Interval	p value
▶			
▶			
▶ Sepsis alert initiated	1.85	1.000 – 3.743	0.047
▶ Systolic blood pressure<90	1.02	1.008 - 1.030	0.001
▶ Venous lactate >4	0.33	0.191 - 1.584	0.000
▶ WBC	0.89	0.502 – 1.559	0.700
▶ HxDiabetes	0.95	0.510 - 1.794	0.891
▶ HxCancer	0.67	0.347 - 1.286	0.228
▶ HxTobacco Use	2.27	0.986 – 5.231	0.054

▶ Reference group is sepsis alert



Median: IQR: Time to antibiotic administration  $\leq$  6 hours after ED arrival

Predictive Margins of survival: sepsis alerts vs non-alerts



# Sub-group analysis

## ▶ ALERTS:

- ▶ Primary DRG Sepsis = 51%
- ▶ ED Physician Primary Impression Sepsis = 34%
- ▶ Sepsis POA = 31%

## ▶ NON-ALERTS:

- ▶ Primary DRG Sepsis = 74%
- ▶ ED Physician Primary Impression Sepsis = 27%
- ▶ Sepsis POA = 31%

# Paramedic Identification

- ▶ Of non-alerts: 30.2% transported by trained paramedics
- ▶ Of alerts: 93% transported by trained paramedics
- ▶ Of all alert patients: 66% were considered septic: ED provider impressions, or documented as POA



# Clinical practice

- ▶ EMS alert patients = shorter time to antibiotics: every hour of delay results in 7.6% increase in mortality. (Kumar et al, 2006)

71 min (alerts) vs. 96 min (non alerts)  $p = .002$

- ▶ Decreased length of stay:

7.35 (alerts) vs. 8.34 (non alerts)  $p = .027$

- ▶ IVF at 2 hrs after arrival:

1300 ml (alerts) vs 1000 (non alerts) (12% missing values)

- ▶ INCREASED ODDS OF SURVIVAL: 1.85 FOR ALERTS vs. NON ALERTS

- ▶ NNT = 8

# Other considerations

- ▶ Only sepsis and severe sepsis are defined in SEPSIS-3 (new)
- ▶ Sepsis definition now a moving target: very confusing, especially for coders and clinicians
- ▶ SIRS criteria not considered sensitive enough to define sepsis
- ▶ qSOFA adds sensitivity, but is not reliable due to mentation and vital sign changes due to medications, especially for field providers
- ▶ Venous lactates linear relationship = increased risk of mortality.
- ▶ 57% of EMS alerts used venous lactate readings

# Time-sensitive conditions: EMS makes a difference

- ▶ MI: onset to recanalization: Onset defined
- ▶ Embolic CVA: onset to alteplase or IR: Onset defined
- ▶ Sepsis: Onset to antibiotics: Onset unclear;  
EMS alert fills definition gap.

# Case study

- ▶ 35 M: EMS sepsis alert
- ▶ Septic shock HR: 160, 80/50, 104 (?)
- ▶ ABX: 23 minutes
- ▶ Discharge to inpatient rehab