The Epidemiology of Interfacility Transports in a Largely Rural State: Incident Descriptives and Associated Factors for Air Transports

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INTRODUCTION

Emergency Medical Services(EMS) not only respond to emergencies, but also ensures patients get transported to higher levels of care through interfacility transports. Kansas is composed of 85% rural or frontier counties and has nearly one million residents living in these areas. With this composition, interfacility transports (IFT) by air and ground are common. As EMS continues to face the burden of limited resources, it is important to analyze ground and air transport services for IFT to understand when and how they are being utilized, especially in differing population densities.

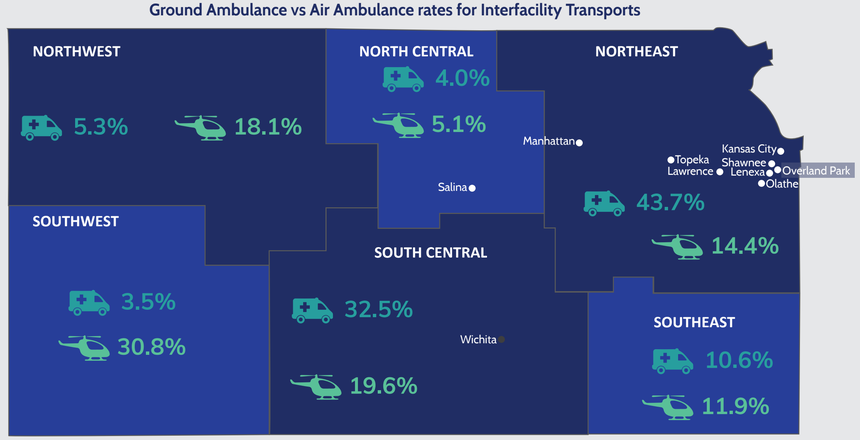
OBJECTIVE

To describe differences in patients and variables associated with ground and air transports for IFT within the state of Kansas.

METHODS

A retrospective analysis was performed of all IFT electronic patient care records within the state of Kansas from 2020 to 2021. This data was analyzed for descriptives of gender, age, race, provider primary impressions (eSituation.11), initial Glasgow Coma Scale score (GCS) (eVitals.23), initial patient acuity (eSituation.13), Kansas region, scene county location, procedure performed, medication given, and IFT destination state were extracted. Scene county location was matched with U.S. Census Bureau data to determine population density classification. Incidents were excluded from analysis if provider primary impression was missing, or incident location originated outside the state of Kansas. Chi-square analysis and multivariable logistic regression model (aOR, 95% CI) was used to assess for statistical significance.

Ground Ambulance vs Air Ambulance rates for Interfacility Transports



RESULTS

There were 76,641 IFTs, with almost 13% transported by air (47% helicopter and 53% fixed wing). A majority of air IFT patients were male (57%), mean age of 50.8±26.7, White (72%), had an initial acuity of critical or emergent (95%) and had a destination within Kansas (68%). In comparison, 75% of air IFT originated in a rural or frontier county and 37% of ground IFT originated in rural or frontier county. A logistic regression model found the odds of utilizing air IFT compared to ground IFT was higher in pediatric patients (≤ 17 yrs)(aOR 2.5, 95% CI 2.3-2.8) compared to geriatric (≥ 65 yrs); Stroke-related (aOR 6.0, 95% CI 5.3-6.7) and respiratory-related provider primary impression (aOR, 2.1, 95% CI 1.9-2.3) compared to other impressions; a GCS of 3-8(severe) (aOR, 3.6, 95% CI 3.3-4.0) compared to 15 (normal); and a scene location of frontier (aOR 15.2, 95% CI 13.4-17.3), rural (aOR 11.6, 95% CI, 10.4-13.0) or densely-settled rural county (aOR 8.6, 7.6-9.7) areas compared to Urban areas.

Table 1. Ground and Air Interfacility Transport Incident Descriptives in the State of Kansas

Variable	Ground IFT	Air IFT	Variable	Ground IFT	Air IFT
N (%)	66,894(87.3%)	9,747(12.7%)	**PROCEDURE PERFORMED(EPROCEDURE.03)[1]**		
SEX			Yes	50.3%	73.8%
Male	50.8%	56.5%	**MEDICATION ADMINISTERED(EMEDICATION.03)[2]**		
Female	49.1%	43.4%	Yes	21.9%	66.3%
AGE – MEAN (±SD), YEARS	57.0±25.2	50.8±26.7	**Scene Location by Kansas Regions**		
Race/ethnicity			Northwest	5.3%	18.1%
White	79.4%	71.9%	Southwest	3.5%	30.8%
Black/African-American	6.1%	3.0%	South Central	32.5%	19.6%
Hispanic	3.8%	7.5%	North Central	4.0%	5.1%
Multiple/Other Races	2.5%	5.3%	Northeast	43.7%	14.4%
Unknown	8.2%	12.3%	Southeast	10.6%	11.9%
PROVIDER PRIMARY IMPRESSION GROUP (ESITUATION.11)			Unknown	<1%	<1%
Other	63.4%	43.2%	**SCENE COUNTY LOCATION POPULATION DENSITY[3]**		
Cardiac	9.5%	14.5%	Frontier	6.1%	17.4%
Stroke	2.5%	8.8%	Rural	12.5%	17.8%
Trauma	12.9%	15.5%	Densely-Settled Rural	18.7%	40.4%
Respiratory	5.3%	11.3%	Semi-Urban	14.5%	13.9%
Seizure	1.2%	2.7%	Urban	47.4%	7.1%
Infectious Disease	5.2%	3.0%	Unknown	0.9%	3.4%
INITIAL TOTAL GLASGOW COMA SCORE (EVITALS.23)			**DESTINATION STATE (EDISPOSITION.05)**		
15 (Normal)	80.9%	65.6%	Kansas	81.6%	67.5%
13-14 (Mild)	6.9%	8.8%	Missouri	12.9%	15.0%
9-12 (Moderate)	2.8%	4.6%	Nebraska	1.5%	3.0%
3-8 (Severe)	3.1%	14.4%	Oklahoma	1.1%	2.8%
Unknown	6.3%	6.6%	Colorado	<1%	9.4%
INITIAL ACUITY (ESITUATION.12)			Other States	<1%	1.5%
Lower Acuity (Green)	51.1%	1.4%	Unknown	2.9%	<1%
Emergent (Yellow)	35.8%	50.3%			
Critical (Red)	5.3%	44.6%			
Dead (Black)	<1%	<1%			
Unknown	7.7%	3.7%			

IFT = Interfacility Transport
[1]Excluded observation and basic monitoring
[2]Excluded oxygen and saline
[3]Population Density Classification
http://www.ipsr.ku.edu/ksdata/ksah/population/popden2.pdf

Table 2. Characteristics of Kansas Air Interfacility Transports, 2020-2021

Variable	Variable Level	Air Transport N (% of All IFT)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Gender (ePatient.13)	Male	5,491(13.9%)	1.00	1.00
	Female	4,221(11.4%)	0.82(0.79-0.85)*	0.83(0.79-0.88)*
	Unknown	5(12.5%)	-	-
Age in years (ePatient.15)	<17	1,625(18.3%)	1.74(1.65-1.84)*	2.47(2.38-2.97)*
	18-24	417(14.3%)	1.36(1.24-1.49)*	1.56(1.34-1.82)*
	25-34	614(13.6%)	1.29(1.19-1.40)*	1.64(1.45-1.86)*
	35-44	720(12.6%)	1.19(1.11-1.29)*	1.34(1.20-1.50)*
	45-54	900(13.1%)	1.24(1.16-1.33)*	1.29(1.17-1.43)*
	55-64	1,686(13.9%)	1.32(1.25-1.39)*	1.26(1.17-1.37)*
	>65	3,744(10.5%)	1.00	1.00
Race (ePatient.14)	White	7,007(11.7%)	1.00	1.00
	Black/African-American	291(6.7%)	0.57(0.51-0.64)*	1.02(0.87-1.19)
	Hispanic	733(22.2%)	1.91(1.78-2.04)*	1.94(1.72-2.18)*
	Multiple/Other Races	514(23.8%)	2.04(1.89-2.21)*	2.66(2.32-3.06)*
Provider Primary Impression Group (eSituation.11)	Other	4,408(9.3%)	1.00	1.00
	Cardiac	1,328(18.7%)	2.01(1.90-2.13)*	1.64(1.50-1.79)*
	Stroke	802(34.6%)	3.73(3.50-3.97)*	5.96(5.28-6.72)*
	Trauma	1,420(15.4%)	1.66(1.56-1.75)*	1.37(1.26-1.49)*
	Respiratory	1,036(24.3%)	2.61(2.46-2.78)*	2.08(1.87-2.31)*
	Seizure	244(25.8%)	2.77(2.48-3.10)*	1.80(1.44-2.24)*
	Infectious Disease	365(10.4%)	1.12(1.01-1.24)*	1.28(1.11-1.49)*
Procedure Performed (eProcedure.03)	Yes	7189(17.6%)	1.89(1.82-1.98)*	1.07(0.99-1.15)
	No	2511(9.3%)	1.00	1.00
Medication Given (eMedication.03)	Yes	6465(30.7%)	5.34(5.13-5.55)*	2.85(2.67-3.04)*
	No	3170(5.8%)	1.00	1.00
Initial Total Glasgow Coma Score (eVitals.23)	15 (Normal)	6391(10.6%)	1.00	1.00
	13-14 (Mild)	856(15.6%)	3.84(3.66-4.02)*	1.70(1.53-1.88)*
	9-12 (Moderate)	451(19.2%)	1.82(1.67-1.99)*	1.86(3.30-4.02)*
	3-8 (Severe)	1405(40.5%)	1.48(1.38-1.58)*	3.64(3.30-4.012)*
Scene County Location Population Density[1]	Frontier	1,700(29.4%)	13.79(12.68-15.00)*	19.72(17.38-22.38)*
	Rural	1,736(17.2%)	8.04(7.39-8.76)*	7.95(7.04-8.99)*
	Densely-Settled Rural	3,941(24.0%)	11.24(10.39-12.16)*	11.52(10.28-12.91)*
	Semi-Urban	1,350(12.2%)	5.74(5.25-6.27)*	3.87(3.41-4.39)*
	Urban	691(2.1%)	1.00	1.00

[1]Population Density Classification *P-Value significant <0.05

CONCLUSION

Within Kansas, air IFT appears to be used more for pediatric patients, stroke or respiratory-related incidents, severely ill/injured (GCS 3-8) patients, and within rural areas. Further analysis of mileage associated with enroute/transport times traveled by EMS and transferring/transferred facility capabilities can help provide insight into specific needs for rural communities. Identifying factors which may influence ground versus air transport for IFT patients will help ensure resources are available and being used efficiently.

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