Rural Trauma: Does Inter-Hospital Transfers Affect Outcomes?

M. Jabran Younus
Chris Wargo
Megan Rapp
James Dove
Denise Torres
Kenneth Widom
DiAnne Leonard
Susan Baro
Jeffrey Wild

Trauma Surgery
Geisinger Medical Center

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Rural Trauma

- Nearly 70% of all trauma deaths occur in rural areas despite the fact that majority of the population lives in urban areas.

- 84% of all US residents have access to Level I or II trauma center within one hour but only 24% of residents in rural areas have access within one hour.

Direct Admission vs. Inter-Hospital Transfer

- Several studies have found that direct admission to trauma center improves outcomes.
  - Is it realistic in rural trauma that all injured patients are transferred to definitive care?

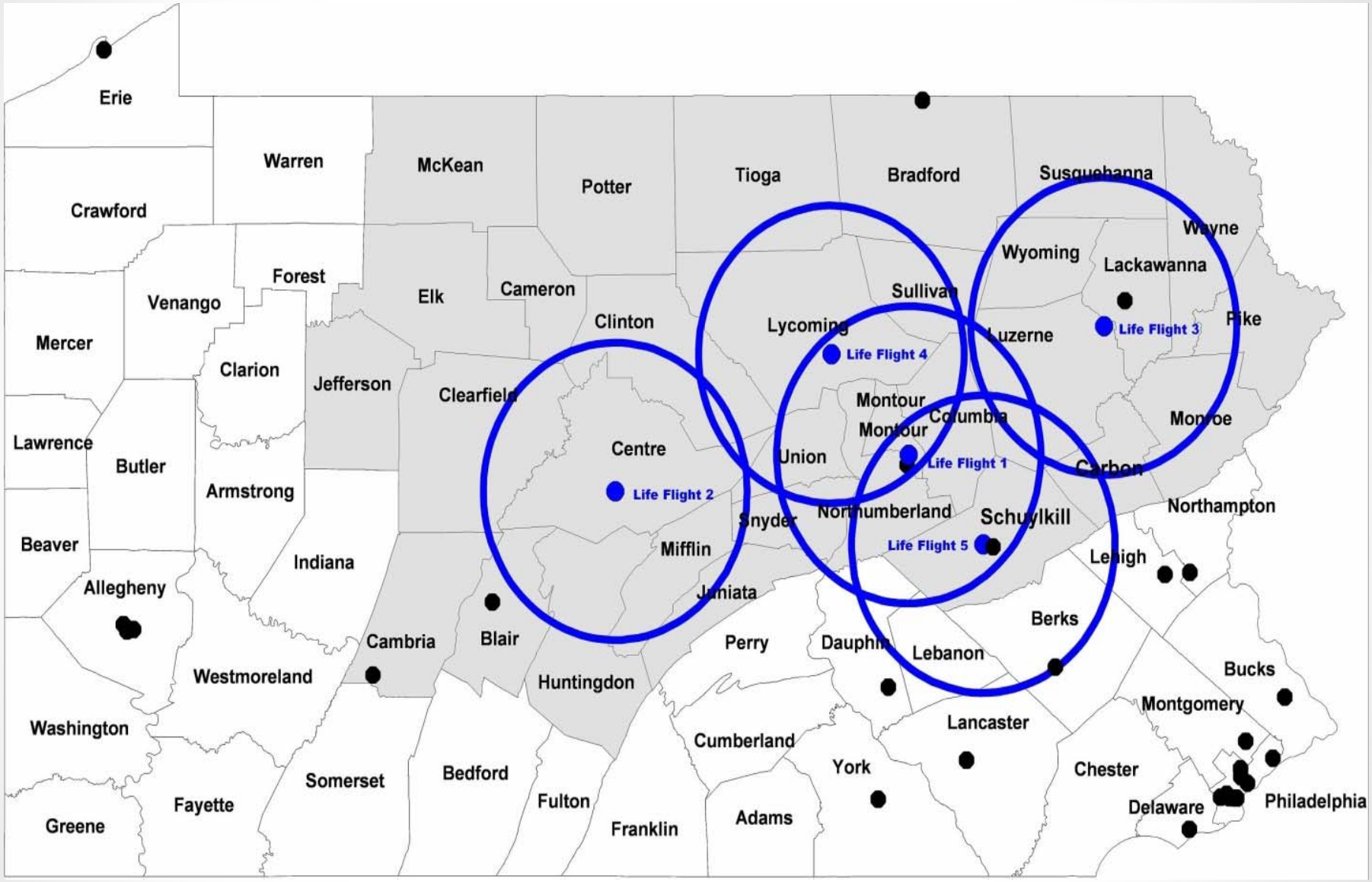
- In a recent meta-analysis, overall no difference in mortality between Inter-hospital transfer's (IHT) and direct admissions.

Implications of Transfer Process

- Delay to definitive care
- Longer hospital and ICU length of stay
- Repeat imaging/procedures
- Increased costs
- Higher morbidities and mortalities

Objective

The aim of this study was to evaluate the morbidity and mortality of direct admissions versus inter-hospital transfers in a rural setting.



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Patients & Methods

Design: Retrospective Cohort Study

Setting: Level 1 TC

Period: Jan. 2008– Dec. 2012

Sample Size: n = 3,316 (Level I & II Alert)

- Direct Admissions: 57.7%
- Inter-hospital Transfers: 42.3%

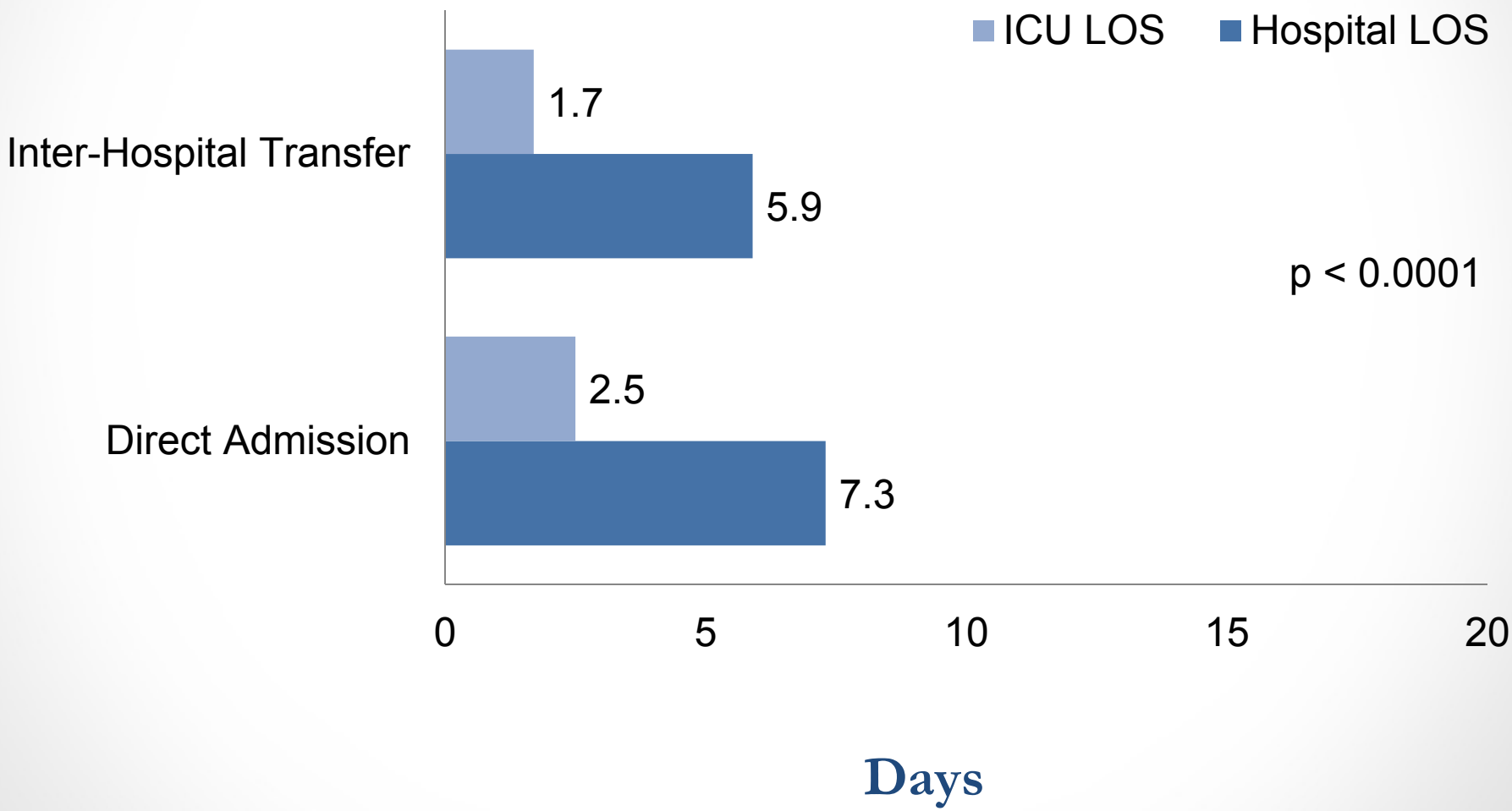
Outcomes:

- Overall population analysis
- Subgroup analysis

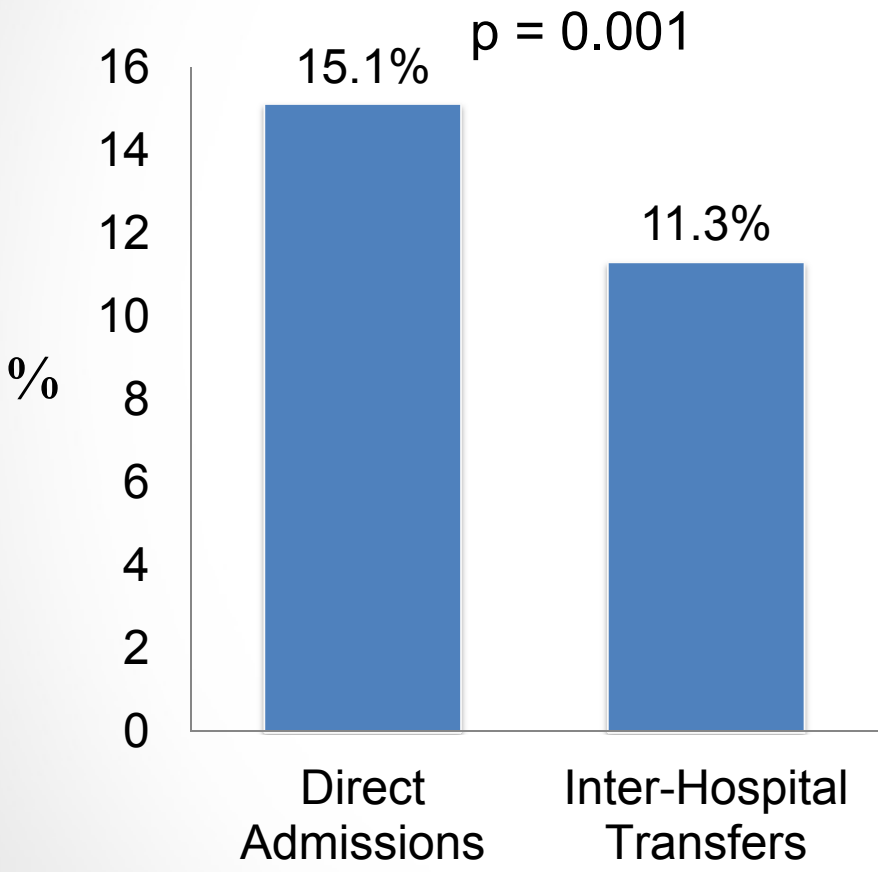
Demographics

Variable	Direct Admissions: No. (%)	Inter-Hospital Transfers: No. (%)	p-value
Sample Size	**1914 (57.7%)**	**1402 (42.3%)**	
Age* >65	**45.4 ±20.5** 376 (19.6%)	**50.8 ±23.8** 452 (32.2%)	<.0001
Sex Male:	1350 (70.5%)	892 (63.6%)	
Trauma Alert: 1 2	784 983	453 883	
Arrival to definitive care (hh:mm)	1:25 ± 1:54	5:36 ± 6:44	
SBP*	136.7±29.5	139.0±27.1	0.0184
GCS* <8	**12.5±4.6** 370 (19.3%)	**13.0±4.3** 220 (15.7%)	0.0018
ISS	**18.7±12.1**	**16.6±10.4**	<.0001

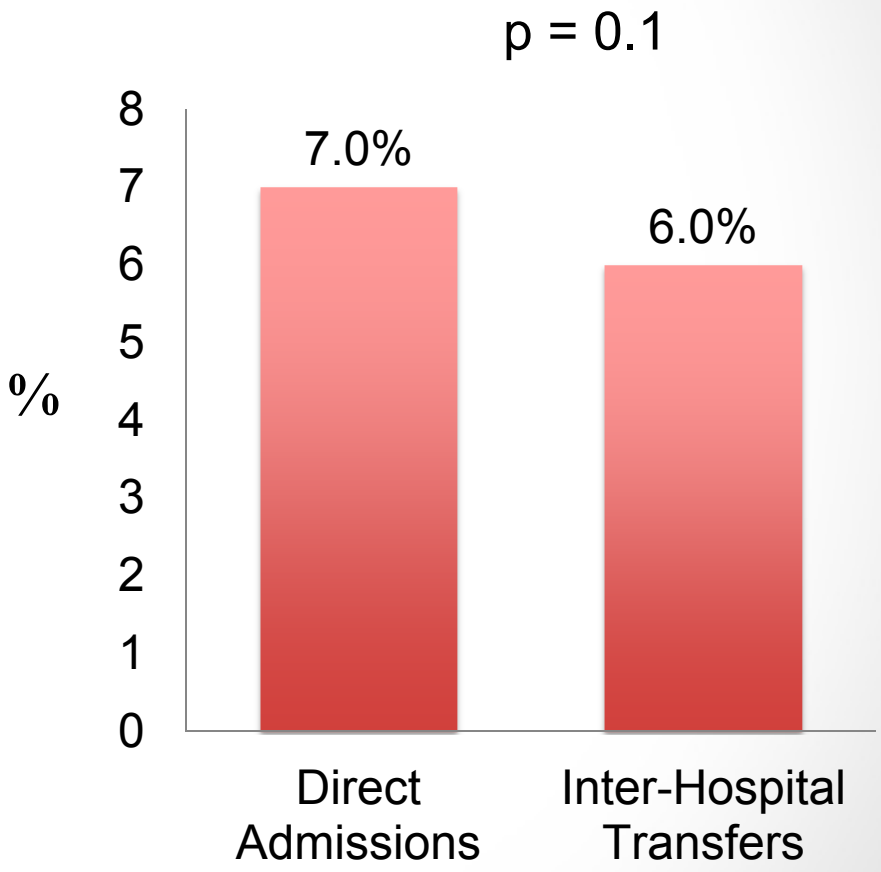
Hospital & ICU Length of Stay (days)



Morbidity



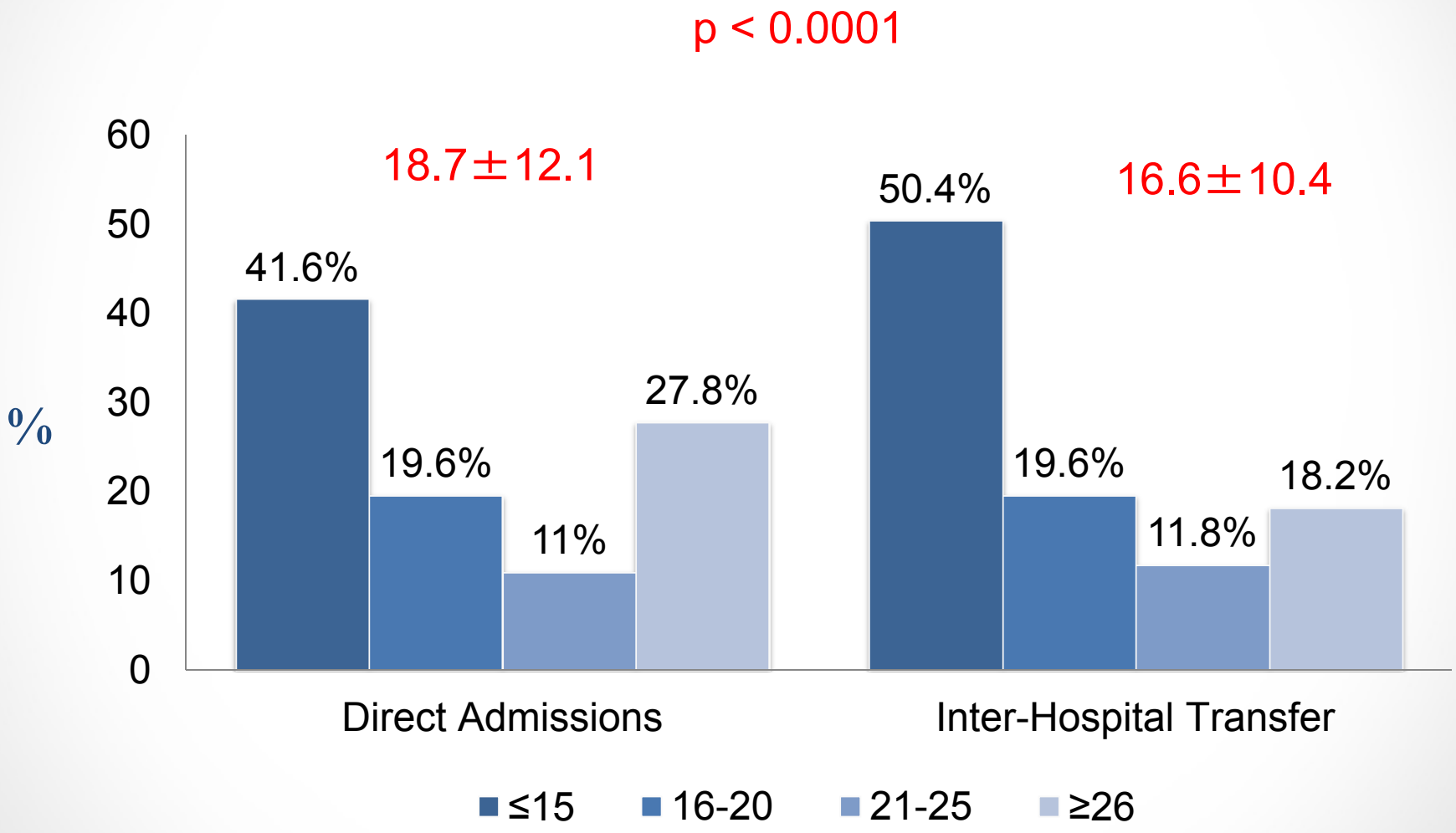
Mortality



Subgroup Analysis

- ISS groups
  - 16-20
  - 21-25
  - ≥26
- Geriatric (≥65 years)
- Severe brain injury
  - ≤GCS 8
- Inter-hospital transfer time

Injury Severity Score



Geriatric Trauma (≥65 years)

Variable	Direct Admissions: No. (%)	Inter-Hospital Transfers: No. (%)	p-value
Sample Size	378 (19.7%)	452 (32%)	
Age*	**76.4 ± 8.0**	**79.3 ± 8.0**	<0.0001
Sex Male:	 227	 208	<0.0001
ISS* 16-20 21-25 26+	17.2 ± 10.5 53 50 87	17.2 ± 10.6 105 58 88	0.9564 0.0088
GCS* <8	13.0 ± 4.0 52	13.2 ± 4.0 60	0.4979
Hospital LOS (days)*	6.9 ± 7.0	6.2 ± 6.1	0.1440
ICU LOS (days)*	**2.6 ± 5.5**	**1.7 ± 4.3**	0.0180
Vent. Days	1.7 ± 4.6	1.0 ± 3.4	0.0169
Complication Rate:	21.4%	16.6%	0.1072
Mortality: In-hospital	 **74 (19.6%)**	 **62 (13.7%)**	 0.0237

Geriatric Mortality

Variable	Direct Admissions: No. (%)	Inter-Hospital Transfers: No. (%)
Sample Size	74	62
Age*	79.2.0 ± 8.4	82.0 ± 6.7
Sex Male:	 52	 31
Time from SOI to TC (hh:mm)	1:25 ± 1:37	05:01 ± 3:45
ISS* 16-20 21-25 26+	25.6 ± 10.6 12 9 42 (56.7%)	24.5 ± 13.0 9 13 27 (43.5%)
GCS* <8	7.9 ± 5.4 42	8.5 ± 5.6 31
Craniotomy	**5**	**2**
Other Surgery for hemorrhage	**8**	**1**
TBI	**51 (69%)**	**43 (69%)**
Comfort care in ED	**30 (40%)**	**17 (27%)**
Mortality excluding comfort care	**11%**	**10%**

GCS ≤ 8

Variable	Direct Admissions: No. (%)	Inter-Hospital Transfers: No. (%)	p-value
Sample Size	232	149	
Age*	39.4 ± 18.0	43.0 ± 22.0	0.0998
Sex Male:	175	99	
ISS*	31.5 ± 12.7	27.8 ± 12.3	0.0055
GCS*	3.4 ± 1.2	3.6 ± 1.3	0.3250
Hospital LOS (days)*	14.1 ± 10.1	15.6 ± 10.3	0.3949
ICU LOS (days)*	9.2 ± 7.2	13.2 ± 9.8	0.6964
Vent. Days	6.7 ± 6.7	6.5 ± 7.5	0.7775
Complication Rate:	71	48	0.7357
Mortality: In-hospital	36 (15.5%)	17 (12.1%)	0.3707

Inter-Hospital Transfer Time Analysis

Variable	0-3:00 hrs: No. (%)	3:01-06:00 hrs: No. (%)	p-value
Sample Size	203 (20.7%)	521 (53.1%)	
Age*	44.5 ± 22.3	49.7 ± 23.5	0.0064
>65	47	162	0.0359
Sex			
Male:	145	320	0.0123
Trauma Alert:			
1	102	162	
2	84	342	
ISS*	**17.7 ± 11.8**	16.0 ± 9.7	0.0414
GCS*	**11.5 ± 5.2**	13.5 ± 3.7	<0.0001
<8	59	59	<0.0001
Hospital LOS (days)*	**7.2 ± 8.8**	5.7 ± 6.0	0.0084
ICU LOS (days)*	**2.8 ± 5.9**	1.4 ± 4.0	0.0005
Vent. Days	**1.9± 4.9**	1.0 ± 3.3	0.0041
Complication Rate:	**14.3%**	12.0%	0.3844
Mortality:			
In-hospital	**10.3%**	4.2%	0.0028

Conclusion

- Overall, direct admissions were more severely injured with higher ISS and lower GCS.
- IHT appeared to not have detrimental impact on mortality.
- Patients that arrived from IHT within the first three hours had a higher ISS and lower GCS.
- In the geriatric mortality group, excluding patients who were made comfort care in the ED, mortality was similar between direct admissions and IHT.

Discussion

- Current triage practices do allow for the most critically injured patients to be directly admitted to our Level I trauma center.
- The data suggests that if patients survive the initial hours after a trauma, mortality is not affected by stabilization at non-Level I trauma centers.
- We suspect this may be due to standardization of care with the practice of ATLS guidelines as well as rural trauma development courses.

Questions?