EMERGENCY GENERAL SURGERY OUTCOMES AT CRITICAL ACCESS HOSPITALS COMPARED WITH RURAL NON-CRITICAL ACCESS AND URBAN HOSPITALS IN KENTUCKY (2016–2024)

HSD96

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SCHOOL OF PUBLIC HEALTH & INFORMATION SCIENCES

INTRODUCTION

- Critical Access Hospital (CAH) designation is intended to preserve access to care in rural areas by reducing financial vulnerability[1,2]. Existing evidence does not provide definitive conclusions about the quality of surgical care at CAHs.
- Some studies report higher transfer rates and higher mortality for complex procedures, while others show similar or lower mortality and comparable or better post-acute care use[3–7]. However, these studies may be subject to selection bias, which we attempt to minimize.

Other studies: Similar or better outcomes at CAHs

Evidence Gap - Selection Bias

Some studies: Higher transfers & mortality at CAHs

OBJECTIVE

To compare emergency general surgery (EGS) outcomes across CAHs, rural non-CAHs, and urban hospitals among rural Kentucky residents.

METHODS

Design
- Repeated cross-sectional observational study using Kentucky Health Facility and Services (KHFS) inpatient claims data (2016–2024).

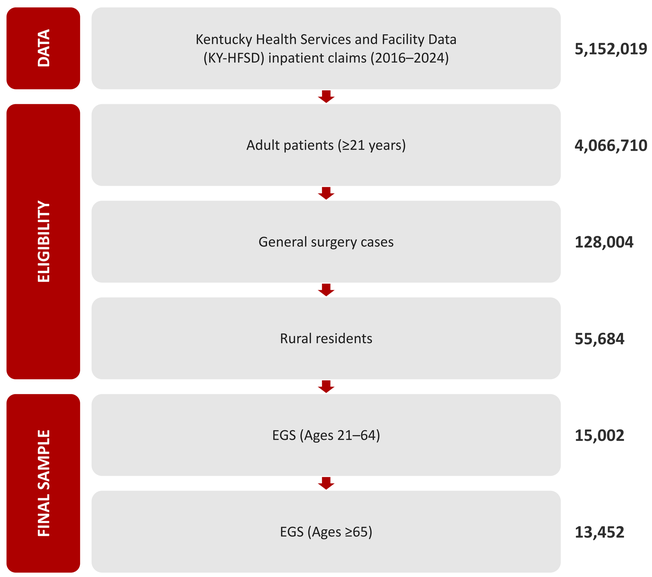
Population
- Adult rural residents (≥21 years) undergoing inpatient EGS, identified using ICD-10-PCS codes (Figure 1).

Primary outcomes
- Routine discharge, post-acute care (PAC) use, and length of stay (LOS).

Secondary outcome
- Composite adverse outcome (death, hospice discharge, or postoperative complication).

Analysis
- Linear probability models with high-dimensional fixed effects were used, adjusting for patient demographics, Charlson Comorbidity Index (CCI), admission and hospital factors, and including county, year, and county-by-year fixed effects with hospital-level clustered standard errors. LOS was analyzed similarly using log-linear regression.
- Analyses a priori stratified by age group (21–64 vs ≥65).

Figure 1. Study Sample Selection from Kentucky Inpatient Claims (2016–2024)



RESULTS

~2%
Of EGS Cases Treated At CAHs
(Figure 2)

0.0%
Transfer Rate At CAHs
vs 32.8% / 36.3% urban

2.8%
Postop Complications At CAHs (21–64)
vs 9.0% rural / 14.0% urban

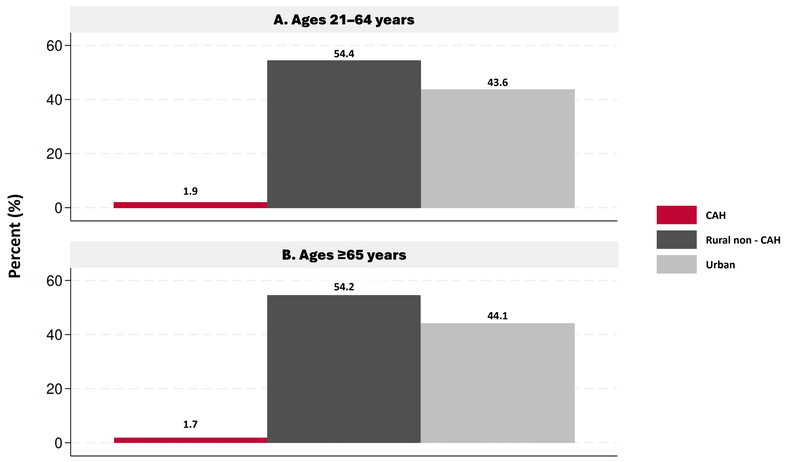
Patient Complexity:
Patients treated at CAHs had lower clinical complexity — lower mean CCI (ages 21–64: 0.61 vs 0.96 vs 1.40; ages ≥65: 1.64 vs 2.52 vs 3.02) and shorter median LOS (ages 21–64: 3 vs 4 vs 5 days; ages ≥65: 5 vs 6 vs 7 days) compared with rural non-CAHs and urban hospitals (Table 1).

Transfers & Complications:
Urban hospitals had substantially higher transfer rates among adults aged 21–64 (32.78%) and those aged ≥65 (36.27%), compared with rural non-CAHs (4.12% and 3.85%, respectively), and were negligible in CAHs (0.0%) across both age groups (Table 1). Postoperative complication rates were also higher at urban (14.0%; 24.7%) vs rural non-CAH (9.0%; 20.9%) vs CAH (2.8%; 7.0%) (Table 2).

Table 1. Patient Characteristics by Hospital Type and Age Group

Characteristic	Ages 21–64			Ages ≥65		
	CAH (n=291)	Rural non-CAH (n=8,165)	Urban (n=6,546)	CAH (n=229)	Rural non-CAH (n=7,292)	Urban (n=5,931)
Sex						
Male	130 (44.7%)	3,765 (46.1%)	3,067 (46.9%)	105 (45.9%)	3,579 (49.1%)	2,923 (49.3%)
Female	161 (55.3%)	4,400 (53.9%)	3,479 (53.2%)	124 (54.2%)	3,713 (50.9%)	3,008 (50.7%)
Race						
White	281 (96.6%)	7,877 (96.5%)	6,271 (95.8%)	228 (99.6%)	7,118 (97.6%)	5,779 (97.4%)
Primary Payer						
Medicaid / Medicare	128 (44.0%)	4,249 (52.0%)	2,826 (43.2%)	202 (88.2%)	6,509 (89.3%)	5,406 (91.2%)
Commercial	138 (47.4%)	3,342 (40.9%)	3,314 (50.6%)	23 (10.0%)	521 (7.1%)	360 (6.1%)
Clinical Characteristics						
Transfer	0 (0.0%)	336 (4.1%)	2,146 (32.8%)	0 (0.0%)	281 (3.9%)	2,151 (36.3%)
Complications at Admission	15 (5.2%)	771 (9.4%)	773 (11.8%)	32 (14.0%)	1,515 (20.8%)	1,252 (21.1%)
CCI (mean)	0.61	0.96	1.40	1.64	2.52	3.02
LOS, median (days)	3	4	5	5	6	7

Figure 2. Share of Rural EGS Cases by Hospital Type & Age Group



KEY OBSERVATION

- **Only ~2% of rural EGS cases in Kentucky were treated at CAHs** (1.9% among ages 21–64; 1.7% among ages ≥65), even though CAHs serve a disproportionately rural catchment.
- Rural non-CAH hospitals handled the majority of cases (54.4% ; 54.2%), with urban hospitals treating (43.6%; 44.1%).

RESULTS — ADJUSTED OUTCOMES

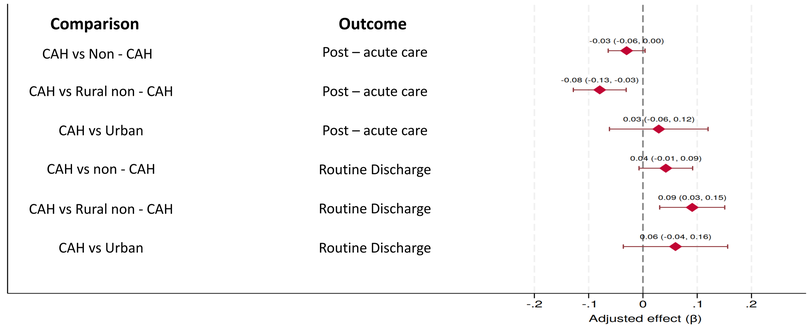
Table 2. Incidence of Postoperative Complications by Hospital Type & Age Group

Hospital Type	Ages 21–64			Ages ≥65		
	CAH (n=291)	Rural non-CAH (n=8,165)	Urban (n=6,546)	CAH (n=229)	Rural non-CAH (n=7,292)	Urban (n=5,931)
Postoperative Complications (2016–2024)	8 (2.8%)	735 (9.0%)	919 (14.0%)	16 (7.0%)	1,526 (20.9%)	1,464 (24.7%)

Ages 21–64: CAH Associations

- **Lower PAC use** (β = −0.03 pp) and **higher routine discharge** (β = 0.042) vs non-CAHs; not statistically significant.
- Larger, significant differences vs rural non-CAHs: PAC β = −0.080 pp; routine discharge β = 0.091 pp (p ≤ 0.05).
- No significant differences vs urban hospitals (Figure 3).

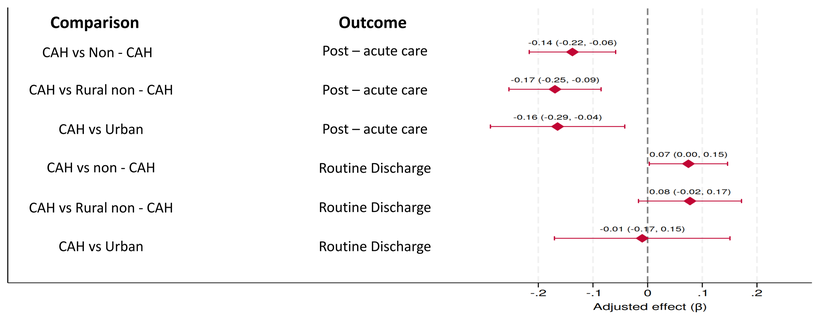
Figure 3. Adjusted Differences in EGS Outcomes by Hospital Type (Ages 21–64)



Ages ≥ 65: CAH Associations

- **Substantially lower PAC use** vs non-CAHs, rural non-CAHs, and urban hospitals (β = −0.14 to −0.17 pp; p ≤ 0.05).
- **Higher routine discharge** vs non-CAHs (β = 0.075 pp; p ≤ 0.05).
- Adverse outcomes and LOS did not differ meaningfully across hospital types (Figure 4).

Figure 4. Adjusted Differences in EGS Outcomes by Hospital Type (Ages ≥65)



CONCLUSION

- To our knowledge, this observational study is the first to examine surgical outcomes at CAHs within a rural context, with direct comparisons to rural non-CAH and urban hospitals.
- Overall, patients treated at CAHs had lower PAC use, higher rates of routine discharge, and comparable LOS and adverse outcomes.
- However, patients treated at CAHs tended to be less medically complex, with fewer comorbidities — a key consideration when interpreting outcome differences across hospital types.

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