RURAL TRAUMA
Challenges & Opportunities

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Objectives

- To define the scope of practice and resource challenges facing rural general surgeons.
- To explore differences in outcomes among patients treated in rural versus urban environments.
- To review means of improving efficiency in order to avoid delays in transportation.

What do rural surgeons do?

Most Common Surgical Procedures in the US
(2014 Healthcare Cost and Utilization Project)

- Appendectomy
- Breast biopsy
- Carotid endarterectomy
- Cataract surgery
- Cesarean section
- Cholecystectomy
- Coronary artery bypass or PTCA
- Debridement of wound, burn, or infection
- Dilation and curettage (D&C)
- Skin graft
- Hemorrhoidectomy
- Hysterectomy
- Hysteroscopy
- Hernia repair (umbilical, inguinal, incisional)
- Lymph node biopsy or excision
- Mastectomy
- Lumpectomy
- Partial colectomy
- Peripheral vascular interventions
- Prostatectomy
- Surgery for low back pain
- Tonsillectomy or tympanostomy

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Rural Scope of Practice

- **Appendectomy, breast biopsy, cholecystectomy, wound debridement, burns, skin grafts, hemorrhoidectomy, hernia repair, lymph node biopsy, mastectomy, lumpectomy, partial colectomy**
- Emergency general surgery, vascular surgery and obstetrics (C-sections)
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- A rural general surgeon trained in selected obstetric/gynecologic operations could perform 66% of all in-patient procedures in rural hospitals.
- With the inclusion of simple vascular cases, head/neck, amputations, and nephrectomies, this could approach 70%.

Where do we do it?

Rural America

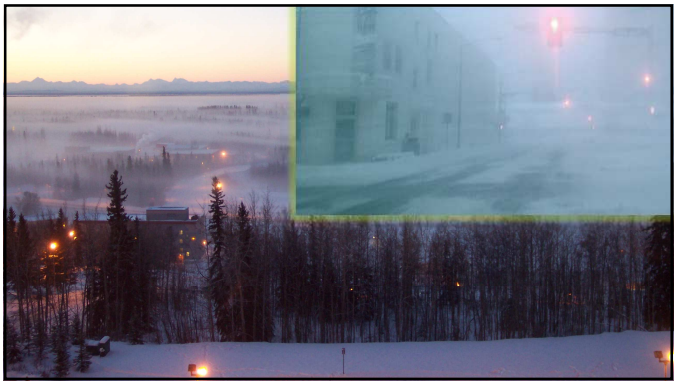
- 15% US population (46 million people)
- 72% US land mass

Map created by Eric Gaba via wikimedia

Alaska

- Population 735,720
- 665,384 square miles (2.5x Texas, 425x Rhode Island)
- Population density 1.2 people per square mile
  - Massachusetts 866.6
  - Washington 107.8
- Most recent census data:
  - White: 65.26%
  - Alaska Native (Iñupiat, Yupik, Aleut, Eyak, Tlingit, Haida, Tsimshian, Athabaskan) and Native American: 14.22%
- Home to 17 of the 20 highest mountain peaks in the US
- Long, dark, cold winters (-80F at Prospect Creek in 1971)


University of Alaska
Fairbanks
UAF
A Land, Sea
and Space
Grant Institution
-45°F



Resource Challenges

- Allergy & immunology
- Anesthesiology
- Dermatology
- Radiology
- Interventional Radiology
- Emergency Medicine
- Family Medicine
- Internal Medicine
- Critical Care
- Gastroenterology
- Geriatric Medicine
- Hematology
- Oncology
- Infectious Disease
- Cardiology
- Nephrology
- Pulmonology
- Rheumatology
- Sleep Medicine
- Sports Medicine
- Genetics
- Neurology
- OB/Gyn
- Ophthalmology
- Pathology
- Pediatrics
- Rehabilitation
- Prevention
- Psychiatry
- Radiation Oncology
- General Surgery
- Colorectal Surgery
- GYN Oncology
- Plastic Surgery
- Craniofacial Surgery
- Hand Surgery
- Neurosurgery
- Vascular Surgery
- Orthopedic Surgery
- Podiatry
- Spine Surgery
- ENT
- Pediatric Surgery
- Thoracic Surgery
- Cardiac Surgery
- Urology

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- Radiology
- Emergency Medicine
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- OB/Gyn
- Pediatrics
- Psychiatry
- General Surgery
- Orthopedic Surgery

Fairbanks Memorial Hospital

- >35,000 ER visits in 2018
- 466 trauma patients
- 172 met criteria for "trauma activation"
- 56 required urgent surgical intervention
- 213 required admission
- 70 required transfer to definitive care (66% neurosurgery)

- 57% male
- 17% pediatric
- 81.5% blunt

Population Challenges

Rural populations are smaller, older, poorer, sicker and less employed.

- Rural America was home to >20% of the US population in 1981.
- 19% of the rural population is over 65 years old compared to 11% urban.
- Between 18 and 64 years of age, the lowest rates of insurance are found in rural counties that DO NOT abut a major metropolitan area.
- Federal poverty rate 14.5% in urban areas, 17.7% in rural counties.

Nakayama, D and T Hughes. Issues That Face Rural Surgery in the United States. J Am Coll. Surg. 2014;219:814-8.

Nationwide 11.6%

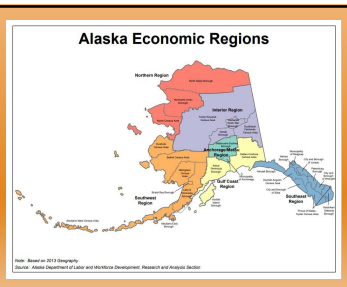
West Virginia 20%

Washington 9.1%

Alaska 14.6%

- Rural populations are also less attended.
- General surgeon to population ratio:
  - 7.7 per 100,000 in 1981
  - 5.7 in 2005
    - 5.85 urban counties
    - 4.31 rural counties
- There were more general surgeons in practice in 1981 than 2005 (by 723).
- Among 3,436 federally designated hospital service areas:
  - 18% have no surgeon
  - 30% have <3 surgeons per 100,000 population*

*Critical shortage or "surgical desert" per Ricketts and colleagues at the ACS.



Northern & Interior population 140,000
5 general surgeons
Ratio 3.5

Whose outcomes are better?

Should rural residents with colon cancer travel to urban hospitals for colectomy?

Meyers, Melissa and Samuel R.G. Finlayson. JACS September 2005. Volume 201, Issue 3, Page S72.

- Dartmouth group used Medicare claims data (1995-99) to compare operative mortality.
- 90% of rural hospitals performed <57 colectomies/year compared to 28% of urban hospitals.
- No statistically significant difference in risk-adjusted mortality overall.
- Low volume rural hospitals, showed significantly lower (6.6%, 95% CI 6.3-6.9%) mortality than low volume urban hospitals (7.2%, 95% CI 7.0-7.4%).

Clinical and financial outcomes at urban and rural hospitals among patients receiving inpatient surgical care.

Gani, Faiz et al. JACS October 2018. Volume 227, Issue 4. Pages S140–S141.

- Johns Hopkins group used National Inpatient Sample (2012-14) to compare clinical outcomes and health care costs for colectomy, appendectomy, and cholecystectomy.
- 1,805,310 patients (89% urban, 11% rural).
- Rural hospitals had lower postoperative morbidity (OR 0.940; 95% CI, 0.898-0.983) and shorter length of stay (RR 0.917; 95% CI, 0.905-0.929).
- Postoperative mortality (OR 0.907; 95% CI, 0.800-1.029) and failure to rescue (OR 0.975; 95% CI, 0.851-1.117) were comparable.
- Rural hospital incurred $1,648.96 more cost per patient (95% CI, $1,404.052-$1,893.84; $p < 0.001$).
- Independent of operation, payer status, and elective vs emergent.

Why not consolidate?

Rural Scope of Practice

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Emergency General Surgery

- Appendicitis
- Cholecystitis
- Strangulated hernia
- Bowel obstruction
- Perforated ulcer
- Necrotizing fasciitis
- Ischemic limbs
- Trauma

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Rural Trauma Burden

- Traumatic injuries are a leading cause of death around the world.
- WHO estimates 5 million traumatic deaths per year, on par with HIV/AIDS, malaria and tuberculosis.
- Rural populations have disproportionately high injury mortality rates after…
  - motor vehicle crashes
  - traumatic occupational injuries
  - drowning
  - unintentional firearm injuries
  - residential fires
  - electrocutions
  - suicides

- Outdated road design
- Increased vehicular speed
- Occupational hazards (e.g. agriculture, hunting)
- Increased severity of injury
- Secondary prevention
  - Seatbelts
  - Helmets
  - Child safety seats
- Limited emergency medical services
- Increased transport times (distance, weather, decision-making)
- Limited access to surgical care

Peek-Asa et al.

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Peek-Asa et al.

Density of surgeons significantly associated with reduced risk of death from motor vehicle crashes in US counties.

David C. Chang et al. J Am Coll Surg 2011;212:862–866.

- Retrospective analysis of MVC deaths per 1 million inhabitants of each of 3,225 counties from 2001-2003.
- Primary independent variable was density of surgeons per 1 million population.
- Adjusted for density of general practitioners, urbanicity, and socioeconomic status.
- Median MVC deaths per million = 226 (IQR 158–320).
- Median surgeons per million = 55 (IQR 0–105).
- Unadjusted, each additional surgeon per million was associated with 0.38 fewer MVC deaths per million population (p 0.001).
- Multivariate analysis, 0.16 fewer MVC deaths per million population (p 0.001).

Geographic distribution of trauma burden, mortality, and services in the United States: Does availability correspond to patient need?

Rios-Diaz, Arturo et al. J Am Coll Surg 2016;223:764e773.

- 2013 state-level data on trauma admissions, trauma centers, surgical critical care providers.
- Compared distribution of trauma admissions with state-level availability.
- 1,345,024 trauma admissions, 2,496 SCC providers, and 1,987 TCs across the country.
- 521 Level I or II trauma centers.
  - Considerable variation between top 5 and bottom 5 states (8/1).
  - Less variation in trauma admission density (1.5/1).
- Trauma admissions positively associated with provider density and age-adjusted mortality (p 0.001).
- Trauma admissions negatively associated with per-capita income ($p < 0.001$).
- Age-adjusted mortality was inversely associated with the number of SCC providers.
- For every additional SCC provider, decrease 618 deaths per year.

Supply & Demand

- Approximately 1,000 surgeons complete residency each year.
- To meet demand, each rural hospital in the US needs to recruit two general surgeons between 2011 and 2030.
- 82.7% would have to choose rural surgery to meet the need.
- Instead…
  - >70% pursue specialties.
  - 3% would like to practice in a community of 25,000 or less.

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Peek-Asa et al.

Factors impacting patient outcomes in urban vs. rural areas.

Alanazy, Ahmed et al. Int J Environ Res Public Health. 2019, 16, 1728.

- Time
  - …before bystander intervention
  - …before EMS activation
  - …to EMS arrival
  - …on scene
  - …en route to the closest hospital
  - …initial evaluation, determination of stability, labs/imaging, consults, decision to transfer, means of transport (air vs. ground), etc.

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A comparison of metropolitan vs. rural major trauma in western Australia.

Fatovich et al. Resuscitation. 2011 Jul;82(7):886-90.

- 3333 major trauma patients (2005 urban, 1328 rural).
- Mean time to definitive care
  - 59 minutes in urban settings
  - 11.6 hours in rural settings
- Not surprisingly, there was a significantly increased risk of death (OR 2.60, 95% CI 1.05-6.53, p=0.039) in the rural group.
- However, despite higher injury severity scores, rural patients who reached definitive care had an adjusted OR for death of 1.10 (95% CI 0.66-1.84, p=0.708).

In honor of the "Golden Hour"…

- Maximize every opportunity for efficiency.
- Do not delay transfer to definitive care.
  - Consider transfer early in the assessment process.
  - Quickly determine the needs of the patient and the capabilities of the institution.
  - Only order tests that will identify life-threatening injuries that can be treated or stabilized before transfer.

ATLS 10th Edition Student Manual

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