

The healthcare build environment: 50 years past and 50 years into the future

Where we Were

Where we Are

Where we're Going



The **problem** stems from a century-long development, **expansion**, and **contraction** of hospital square-footage, and subsequent **capabilities** and **capacity** changes; additionally, the **specialty**, **complexity**, and **volume** of patients, coupled with an array of changes to health insurance coverage and **reimbursables** has shaped the healthcare system to its current posture, and is making it challenging to predict its **operational**, **social**, **critical**, and **geographic** needs for the future.

The “block” was the dominant hospital style of the mid-20th century.

High patient volume
Wide-spread entitlement
Surge in health coverage



<https://artsandculture.google.com/asset/block-bellevue-hospital>

Deep floor plates
Stacked geometries
Heavy dimensioning
Retrofit constraints

The “mega hospital” was the suburban response to the modern movement

Appendages

Wards

Interstitial space

Mall-like



<https://artsandculture.google.com/asset/19-mcmaster>

The “bar” acknowledged shallower floor plates



<https://artsandculture.google.com/asset/early-modern-bar-paimio-aaltofound>

Lawton, OK | Reynolds Army Hospital



<https://www.hippostcard.com/listing/ok-oklahoma-fort-sillreynolds-army-hospital>

Lawton, OK | Reynolds Army Community Hospital



Lawton, OK | Comanche County Memorial Hospital



Comanche
County
Memorial
Hospital

Chickasha, OK | Grady Memorial Hospital



Pivot to algorithm | decision tree

Where we Were

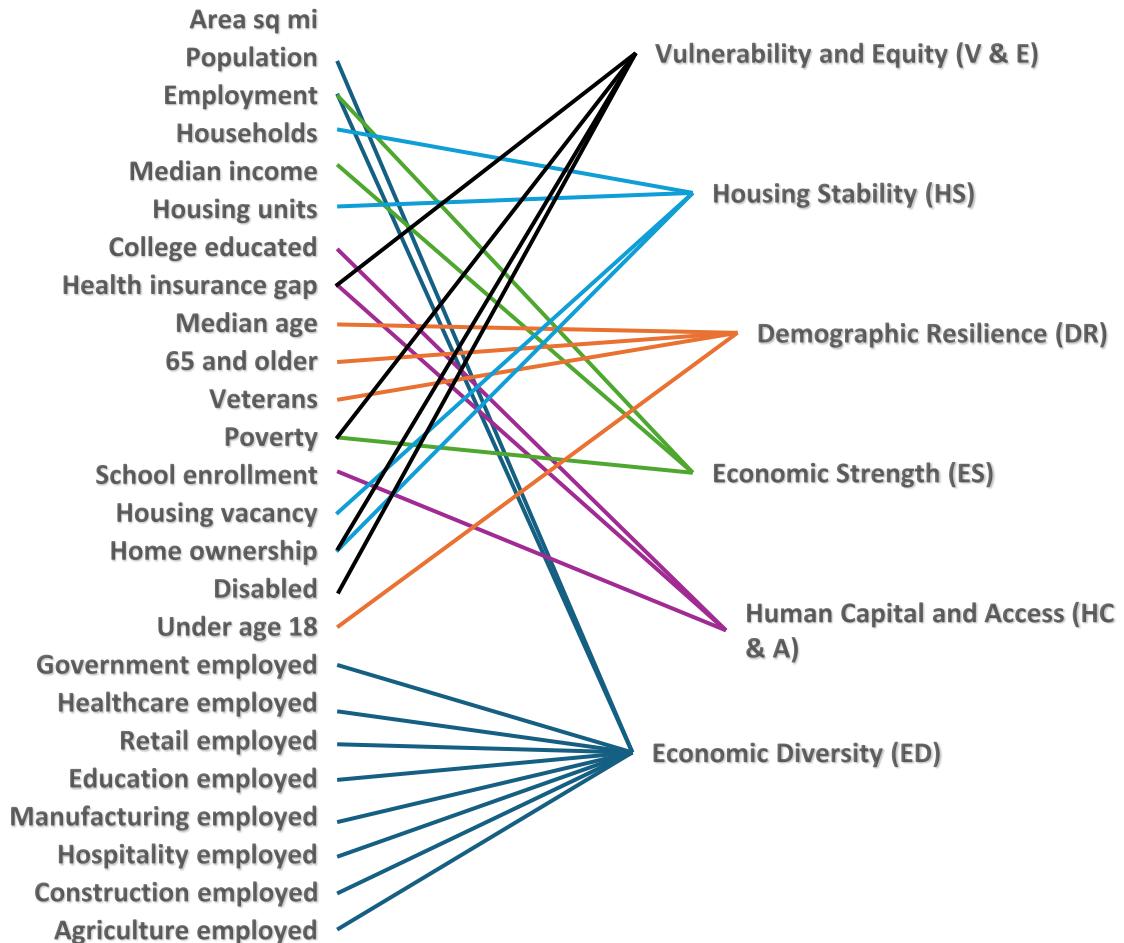
Where we Are

Where we're Going

Gaps, findings, and way ahead: The research-guided assertion is there is a case for **targeting** static, mid-size urban areas and their inventory of peripheral healthcare buildings for adaptive reuse and reinvestment

Aim to develop an **algorithm** to predict the best municipalities to analyze the building inventory, and then perform adaptive reuse to bolster the healthcare built environment

Data clustering and formulas



City	V & E ¹	HS ²	DR ³	ES ⁴	HC & A ⁵	ED ⁶
City						

1. **V & E** inverts poverty, disability, and health insurance gap, while using home-ownership as a positive; weighted values are .4, .3, .2, .1, respectively
 $=ROUND(((100-B2)*0.4 + (100-C2)*0.3 + (100-D2)*0.2 + E2*0.1),0)$
2. **HS** correlates units with households, and then gives weights to ownership and vacancy, and is indicative of economic performance, and economic resilience; weights are .4, .45, and .15, respectively
 $= (MIN(1,MAX(0,((B2/C2)-0.8)/(1.2-0.8)))*100*0.4 + D2*0.45 + E2*0.15)$
3. **DR** incorporates age cohorts, with balanced age structure scored to offset extreme aging and youth bulges
 $= (MAX(0,100-ABS(B2-35)/20*100)+MAX(0,100-ABS(C2-D2)/50*100)+MIN (E2/20*100,100))/3$
4. **ES** is the composite of the employment platform, earning power/income, and poverty; weights are .4, .4, .2, respectively
 $= (RANK.EQ(B2,$B$2:$B$9,0)-1)/(COUNTA($B$2:$B$101)-1)*100 | =(RANK.EQ(C2,C2:C9,0)-1)/(COUNTA(C2:C101)-1)*100 | =(RANK.EQ(D2,D2:D9,1)-1)/(COUNTA(D2:D9)-1)*100 || =(0.4*M2)+(0.4*N2)+(0.2*O2)$
5. **HC & A** measures local skills and the population ability to use health and education services; college and school enrollment positive; lack of health insurance negatively influences value
 $= ((RANK.EQ(B2,$B$2:$B$9,0)-1)/(COUNTA($B$2:$B$9)-1)*100+(RANK.EQ (C2,$C$2:$C$9,0)-1)/(COUNTA($C$2:$C$9)-1)*100+(RANK.EQ(D2,$D$2:$D$9,1)-1)/(COUNTA($D$2:$D$9)-1)*100)/3$
6. **ED** is given a score of 'entropy' where the higher the score, the more evenly employment is distributed; lower scores are more niche pockets of employment
 $=LET(popRange,$B$2:$B$9, empRateRange,$C$2:$C$9, sectorRange,D2:K2, sectorPct, sectorRange/100, sectorSum, SUM(sectorPct), shares, IF(sectorSum>0, sectorPct/sectorSum, sectorPct), entropy, -SUM(IF(shares>0, shares * LN(shares), 0)), N, COLUMNS(sectorRange), entropy_norm, IF(N>1, entropy / LN(N), 0), empRate_cur, C2/100, empRate_vec, empRateRange/100, empRate_norm, IF(MAX(empRate_vec)-MIN(empRate_vec)>0,$

Equations

Vulnerability and Equity (V & E)

G2	=ROUND(((100-B2)*0.4 + (100-C2)*0.3 + (100-D2)*0.2 + E2*0.1),0)					
A	B	C	D	E	F	G
1	Urban Center	Poverty %	Disabled Population %	Health Insurance Gap %	Home Ownership %	Vulnerability and E
2	Altus	17	16	15	56	81
3	Duncan	20	21	16	68	79
4	Ardmore	17	22	14	56	79
5	Lawton	20	25	11	48	77
6	Wichita Falls	14	16	17	57	82
7	Ada	16	15	20	45	80
8	Chickasha	19	20	15	52	79
9	OKC	15	15	12	57	83

Economic Strength (ES)

M2	= (RANK.EQ(B2,\$B\$2:\$B\$9,0)-1) / (COUNTA(\$B\$2:\$B\$101)-1) * 100 =(0.4*M2)+(0.4*N2)+(0.2*O2)						
A	B	C	D	M	N	O	P
1	Urban Center	Median Household Income	Employment Poverty %	Income	Employe Poverty	Economic Strength	
2	Altus	55550.00	0.55	0.17	42.85714	57.14286	57.14286
3	Duncan	57020.00	0.52	0.20	28.57143	85.71429	100
4	Ardmore	52954.00	0.57	0.17	85.71429	28.57143	42.85714
5	Lawton	55506.00	0.47	0.20	57.14286	100	85.71429
6	Wichita Falls	63835.00	0.54	0.14	14.28571	71.42857	0
7	Ada	51792.00	0.60	0.16	100	14.28571	28.57143
8	Chickasha	55039.00	0.55	0.19	71.42857	42.85714	71.42857
9	OKC	70040.00	0.64	0.15	0	0	14.28571

Housing Stability (HS)

F2	= (MIN(1,MAX(0,((B2/C2)-0.8)/(1.2-0.8)))*100*0.4 + D2*0.4				
A	B	C	D	E	F
1	Urban Center	Housing Units	Households	Home Ownership %	Housing Inventory Vacan Housing Stability
2	Altus	9,021	7,371	56	18
3	Duncan	11,089	9,333	68	72
4	Ardmore	11,384	9,787	56	14
5	Lawton	39,738	33,438	48	16
6	Wichita Falls	43,762	38,289	57	13
7	Ada	8,043	6,688	45	17
8	Chickasha	7,735	6,391	52	17
9	OKC	314,255	290,311	57	8

Human Capital and Access (HC & A)

E2	= ((RANK.EQ(B2,\$B\$2:\$B\$9,0)-1)/(COUNTA(\$B\$2:\$B\$9)-1)*100 \$D\$2:\$D\$9,1)-1)/(COUNTA(\$D\$2:\$D\$9)-1)*100) / 3					
A	B	C	D	E	M	
1	Urban Center	Bachelors Degree %	School Enrolled %	Health Insurance Gap	Human Capital and Access	M
2	Altus	24	72	15	43	
3	Duncan	20	80	16	48	
4	Ardmore	22	80	14	29	
5	Lawton	20	74	11	33	
6	Wichita Falls	27	61	17	71	
7	Ada	30	64	20	67	
8	Chickasha	20	72	15	52	
9	OKC	37	70	12	29	

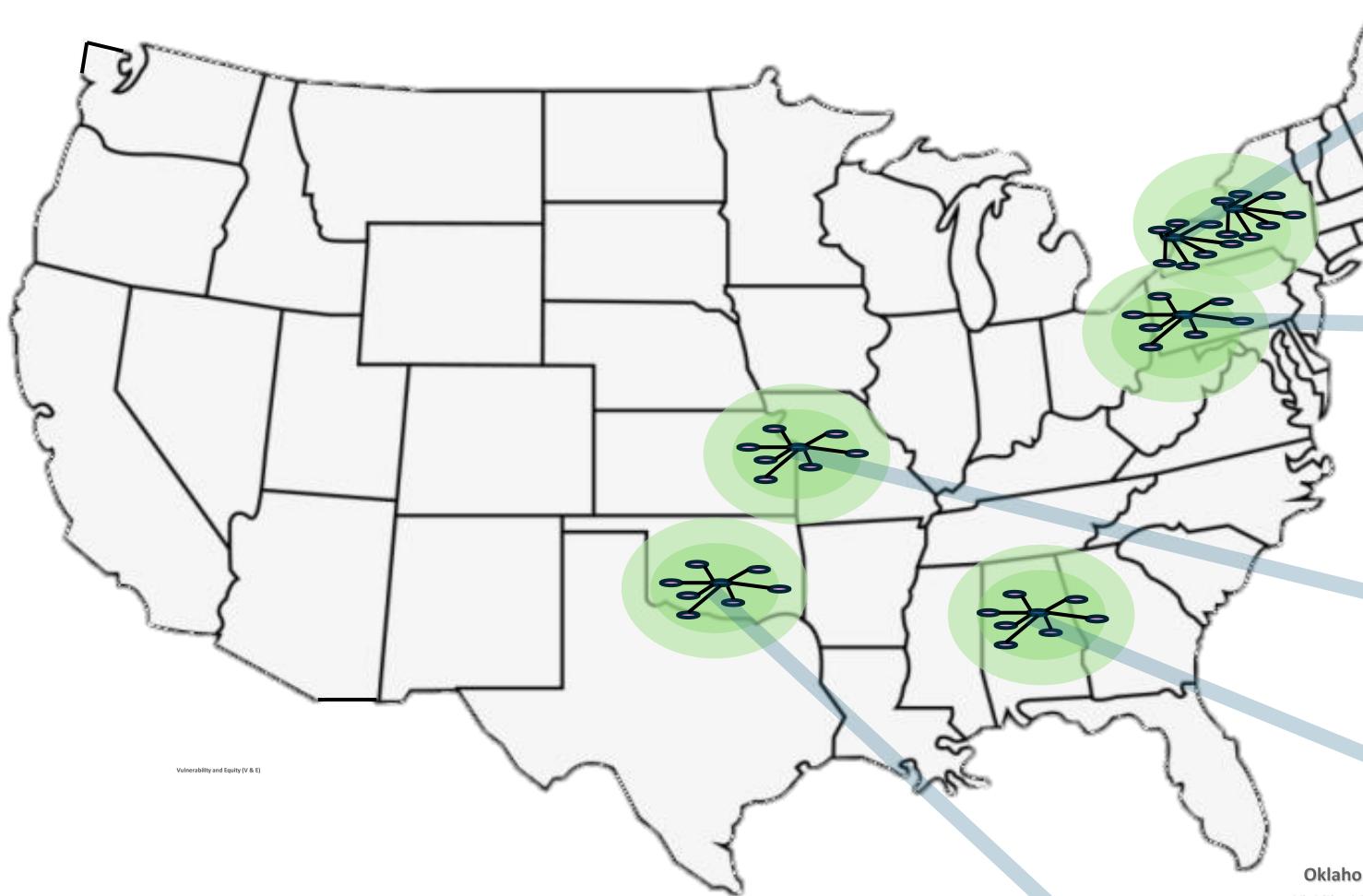
Demographic Resilience (DR)

F2	= (MAX(0,100 - ABS(B2-35)/20*100) +					
A	B	C	D	E	F	
1	Urban Center	Median Age	Under 18 %	65 and Older	Veterans %	Demographic Resili
2	Altus	34	25	17	18	81
3	Duncan	40	22	21	9	73
4	Ardmore	37	25	16	7	70
5	Lawton	34	23	12	17	86
6	Wichita Falls	35	21	16	9	78
7	Ada	33	25	14	7	67
8	Chickasha	37	21	16	7	72
9	OKC	35	25	14	7	71

Economic Diversity (ED)

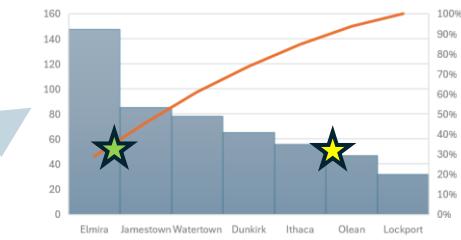
M2	=LET(sRange,D2:K2, sPct, sRange/100, sSum, SUM(sPct), s, IF(sSum>																
A	B	C	D	E	F	G	H	I	J	K	L	M					
1	Urban Center	Population	Employment %	Government	Healthcare	Er	Retail	Employ	Education	Em	Manufactur	in	Hospitality	En	Construction	Agriculture	Employed %
2	Altus	10,725	54.6%	14.5%	13.6%	10.1%	10.2%	0.5%	7.2%	7.0%	3.9%	3.9%	7.0%	7.2%	7.5%	7.0%	97
3	Duncan	22,692	51.5%	4.3%	13.2%	13.0%	7.3%	9.4%	5.9%	6.5%	0.6%	63	92				
4	Ardmore	24,725	56.8%	3.8%	14.6%	12.7%	6.9%	13.9%	6.8%	8.3%	6.1%	1.3%	72	92			
5	Lawton	90,381	46.9%	11.0%	13.7%	13.4%	9.6%	8.7%	8.3%	6.1%	1.0%	63	94				
6	Wichita Falls	102,316	54.1%	6.3%	17.6%	13.2%	9.2%	7.3%	11.1%	5.5%	0.4%	72	91				
7	Ada	16,481	60.2%	9.3%	16.6%	11.7%	11.5%	7.5%	5.2%	6.1%	1.4%	76	93				
8	Chickasha	16,051	55.3%	4.7%	14.6%	12.9%	8.5%	11.5%	8.5%	5.1%	0.9%	68	92				
9	OKC	681,054	64.0%	7.6%	13.6%	11.7%	8.8%	7.2%	7.5%	0.6%	0.6%	96	94				

5-city algorithm results



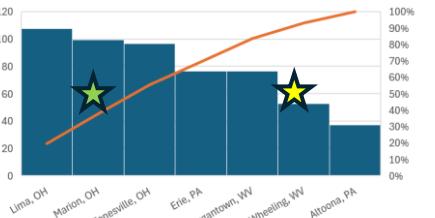
Buffalo / Rochester

Viability | Potentia



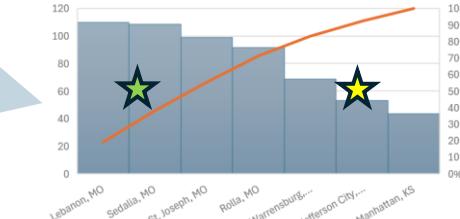
Pittsburg

Viability | Potentiality



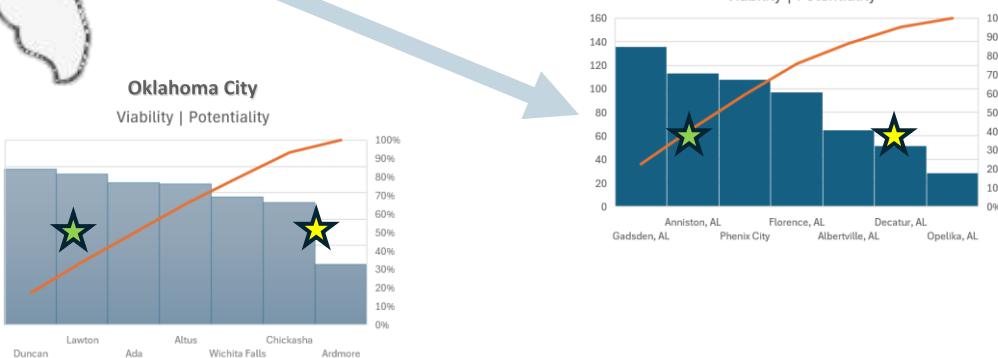
Kansas City

Viability | Potentiality



Birmingham

Viability | Potentiality

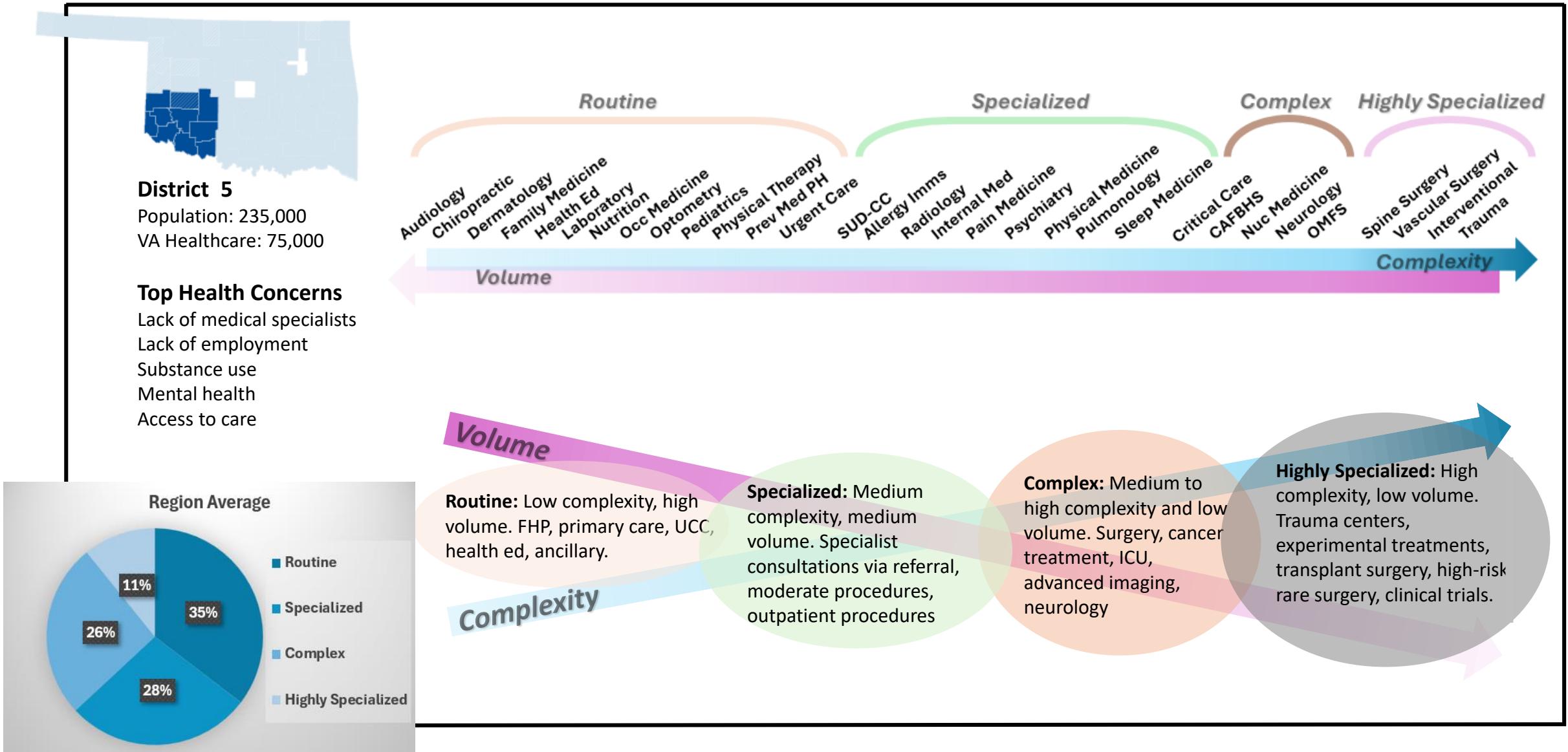


Oklahoma City

Viability | Potentiality



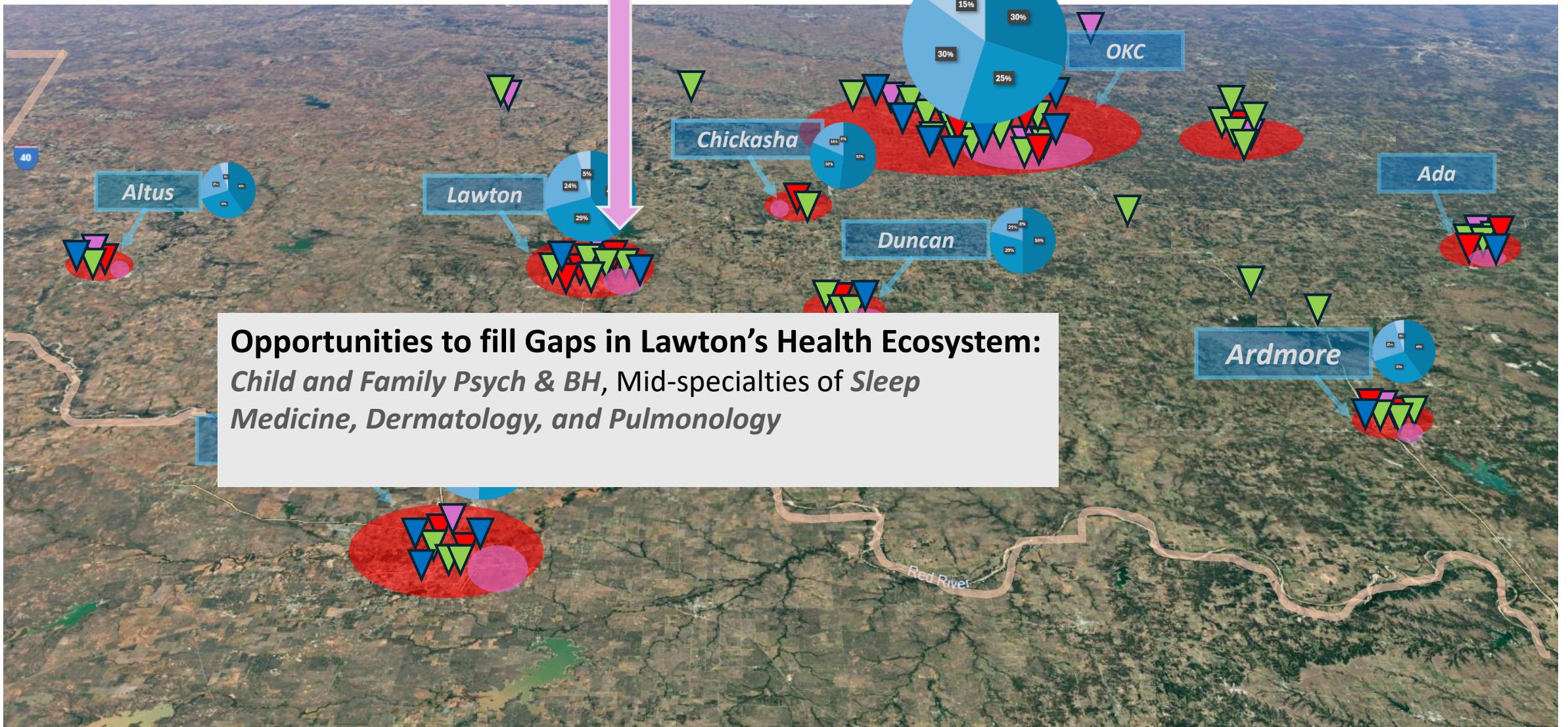
Definitions – medical service lines, complexity, volume



Southwest Oklahoma – medical specialty capability, complexity, volume, age-group

Specialty		Complexity	Volume	Pediatric	Young adult	Middle aged	Over 65	Military-aged	Hahu Capability	Lawton Capability	Wichita Falls Capability	Duncan Capabil	Chickasha Capability	Ardmore Capability
Addiction Medicine	Routine	High	Medium	Low	High	Medium	Low	High	Yes	Yes	Yes	Yes	Yes	Yes
Allergy Immunology	Specialized	Medium	Low	High	Medium	Medium	Low	Low	Yes	No	Yes	No	No	Yes
Audiology	Routine	Low	Medium	High	Medium	Medium	High	High	Yes	Yes	Yes	Yes	Yes	Yes
Aviation Medicine	Specialized	High	Low	Low	High	Medium	Low	High	No	No	No	No	No	No
Cardiology	Specialized	High	High	Low	Medium	High	High	Medium	No	Yes	Yes	Yes	Yes	Yes
Cardiothoracic Surgery	Highly Specialized	High	Low	Low	Low	Medium	High	Low	No	No	Yes	No	No	No
Child and Adolescent Psychiatry	Complex	High	Medium	High	Medium	Low	Low	Low	Yes	No	Yes	No	No	No
Chiropractic	Routine	Low	Medium	Low	High	High	Medium	High	Yes	Yes	Yes	Yes	Yes	Yes
Colorectal Surgery	Complex	High	Low	Low	Medium	High	Low	No	No	No	Yes	No	No	No
Cosmetic Medicine	Routine	Low	Medium	Low	High	High	Low	Medium	No	Yes	Yes	Yes	No	No
Critical Care Medicine	Complex	High	Medium	Low	Medium	High	High	Medium	No	Yes	Yes	No	Yes	Yes
Dermatology	Routine	Low	High	Medium	High	High	High	Medium	Yes	Yes	Yes	Yes	Yes	Yes
Diagnostic Radiology	Specialized	Medium	High	High	High	High	High	High	Yes	Yes	Yes	Yes	Yes	Yes
Emergency Medicine	Complex	Medium	High	Medium	High	High	High	High	No	Yes	Yes	Yes	Yes	Yes
EMS Prehospital Medicine	Routine	Low	High	Medium	High	High	High	High	No	Yes	Yes	Yes	Yes	Yes
Endocrinology	Specialized	High	Low	Medium	Medium	High	High	High	No	No	Yes	Yes	Yes	Yes
Family Medicine	Routine	Low	High	Low	High	High	High	High	Yes	Yes	Yes	Yes	Yes	Yes
Forensic Medicine	Highly Specialized	High	Low	Low	Low	Medium	Low	Low	No	No	Yes	No	No	No
Gastroenterology	Complex	High	Medium	Low	Medium	High	High	Medium	No	Yes	Yes	Yes	No	Yes
General Surgery	Complex	High	High	Low	Medium	High	High	Medium	No	Yes	Yes	Yes	Yes	Yes
Geriatric Medicine	Specialized	Medium	Medium	Low	Medium	High	Low	No	No	Yes	No	No	Yes	Yes
Health Education / Health Promotion	Routine	Low	High	Medium	High	High	High	High	Yes	Yes	Yes	Yes	Yes	Yes
Hematology	Highly Specialized	High	Medium	Low	Medium	Medium	High	Low	No	Yes	No	No	Yes	Yes
Hepatology	Specialized	High	Low	Low	Low	Medium	High	Low	No	No	Yes	No	No	No
Hospital Medicine	Specialized	Medium	High	Low	Medium	High	High	Medium	No	Yes	Yes	Yes	Yes	Yes
Hyperbaric Medicine	Highly Specialized	High	Low	Low	Low	Medium	Low	Medium	No	No	Yes	No	No	No
Infectious Diseases	Specialized	High	Low	Medium	Medium	Medium	Medium	Medium	No	No	Yes	No	No	No
Internal Medicine	Specialized	Medium	High	Low	Medium	High	High	Medium	Yes	Yes	Yes	Yes	Yes	Yes
Interventional Cardiology	Highly Specialized	High	Medium	Low	Low	Medium	High	Low	No	No	Yes	No	No	No
Interventional Radiology	Highly Specialized	High	Low	Low	Low	Medium	High	Low	No	No	Yes	No	No	No
Laboratory Tech	Routine	Medium	High	High	High	High	High	Low	Yes	Yes	Yes	Yes	Yes	Yes
Maternal Fetal Medicine	Complex	High	Low	High	Low	Low	Low	Low	No	No	Yes	No	Yes	Yes
Medical Genetics	Highly Specialized	High	Low	Medium	Low	Low	Low	Low	No	No	Yes	No	No	No
Medical Oncology	Highly Specialized	High	Medium	Low	High	High	High	Low	No	No	Yes	No	No	No
Military Medicine	Specialized	Low	Medium	Low	High	Medium	Low	High	No	Yes	No	No	No	No
Neonatology	Complex	High	Low	High	Low	Low	Low	No	No	Yes	No	No	No	Yes
Nephrology	Complex	High	Medium	Low	Low	Medium	High	Low	No	Yes	Yes	No	No	No
Neurology	Complex	High	Medium	Low	Medium	High	High	Medium	Yes	Yes	Yes	No	No	No
Neurosurgery	Highly Specialized	High	Low	Low	Medium	Medium	High	Low	No	No	Yes	No	No	Yes
Nuclear Medicine	Highly Specialized	High	Low	Low	Medium	High	High	Low	No	Yes	Yes	No	No	Yes
Nutrition Care / Dietitian	Routine	Low	High	Medium	High	High	High	High	Yes	Yes	Yes	Yes	Yes	Yes
Obstetrics Gynecology	Complex	Medium	High	Low	High	Medium	Low	High	No	Yes	Yes	Yes	Yes	Yes
Occupational Medicine	Routine	Low	Medium	Low	High	High	Medium	High	Yes	Yes	Yes	Yes	No	Yes
Ophthalmology	Routine	Low	High	Medium	Medium	Medium	High	High	No	Yes	Yes	Yes	No	Yes
Optometry	Routine	Low	High	Medium	High	High	High	Medium	Yes	Yes	Yes	Yes	Yes	Yes
Oral Maxillofacial Surgery	Complex	High	Low	Low	Medium	Medium	Low	Low	Yes	No	Yes	No	No	No
Orthopedic Surgery	Complex	High	High	Medium	High	High	High	High	No	Yes	Yes	No	No	Yes
Otolaryngology ENT	Complex	High	Medium	Medium	Medium	High	High	Medium	No	Yes	Yes	No	No	Yes
Pain Medicine	Specialized	Medium	Medium	Low	Medium	High	High	Medium	Yes	Yes	Yes	Yes	No	Yes
Palliative Care Hospice	Specialized	High	Medium	Low	Medium	High	Medium	High	No	Yes	Yes	Yes	Yes	Yes
Pathology Cytology	Specialized	High	Medium	Low	Medium	High	High	Medium	No	Yes	Yes	Yes	Yes	Yes
Pediatric Cardiology	Complex	High	Low	High	Low	Low	Low	No	No	Yes	No	No	No	No
Pediatric Emergency Medicine	Complex	High	Medium	High	Medium	Low	Low	Low	No	No	Yes	No	No	No
Pediatric Surgery	Complex	High	Low	High	Low	Low	Low	No	No	Yes	Yes	No	No	No
Pediatrics	Routine	Medium	High	High	Low	Low	Low	Low	Yes	Yes	Yes	Yes	Yes	Yes
Physical Medicine	Specialized	Medium	Low	Medium	Medium	High	High	High	Yes	Yes	Yes	Yes	No	Yes
Physical Therapy (PT)	Routine	Medium	High	Medium	High	High	High	High	Yes	Yes	Yes	Yes	Yes	Yes
Plastic Surgery	Highly Specialized	High	Medium	Low	Medium	Medium	Low	Medium	No	Yes	Yes	No	No	No
Preventive Medicine Public Health	Routine	Low	High	Medium	High	High	High	High	Yes	Yes	Yes	Yes	Yes	Yes
Psychiatry Outpatient	Specialized	Medium	High	Medium	High	High	High	High	Yes	Yes	Yes	Yes	Yes	Yes
Pulmonology	Specialized	Medium	Medium	Low	Medium	High	High	Low	Yes	Yes	Yes	No	No	Yes
Radiation Oncology	Highly Specialized	High	Low	Low	High	High	High	Low	No	No	Yes	No	No	Yes
Reproductive Endocrinology	Highly Specialized	High	Low	Low	High	Medium	Low	Medium	No	No	Yes	No	No	No

Oklahoma City & southwest Oklahoma



Hospital System

Clinic / Outpatient Group

VA System

Peripheral System



Routine

Specialized

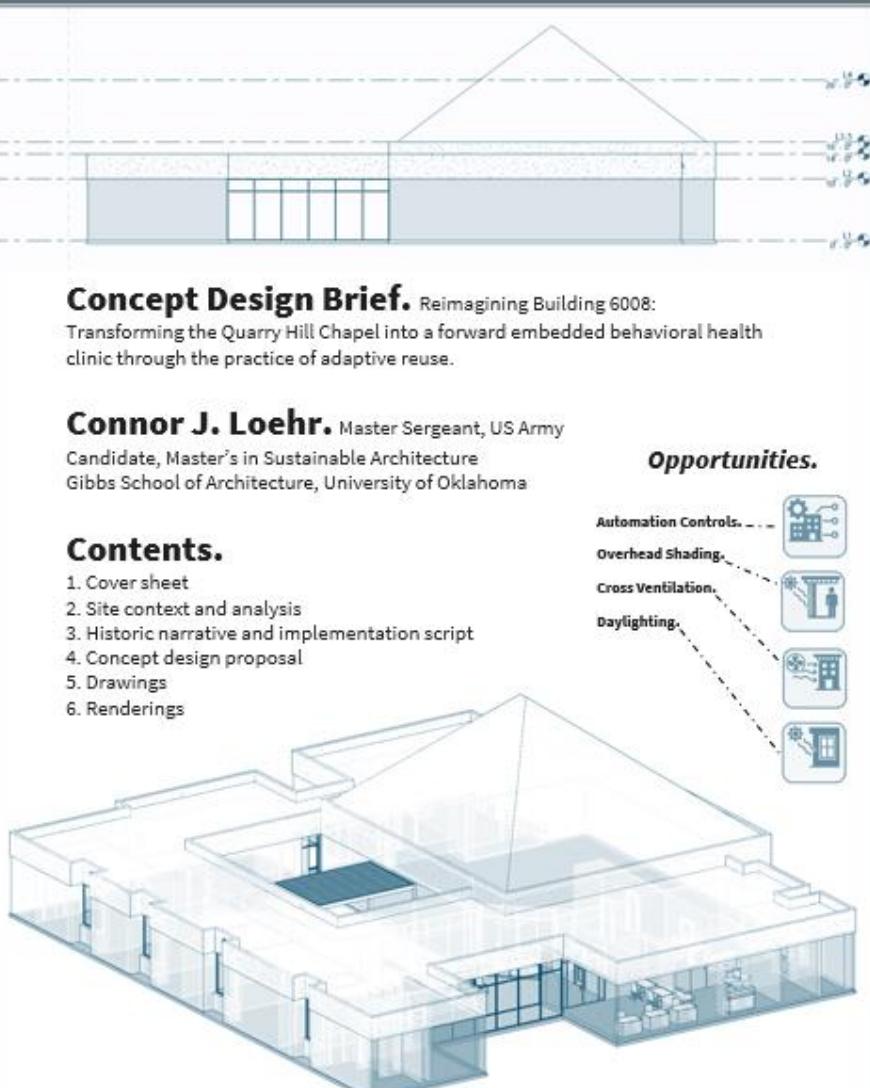
Complex

Highly Specialized

Population

Disabled Veteran

Lawton, OK and the community of Fort Sill – reimaging a vacated chapel into a BH clinic



Concept Design Brief. Reimagining Building 6008: Transforming the Quarry Hill Chapel into a forward embedded behavioral health clinic through the practice of adaptive reuse.

Connor J. Loehr. Master Sergeant, US Army
Candidate, Master's in Sustainable Architecture
Gibbs School of Architecture, University of Oklahoma

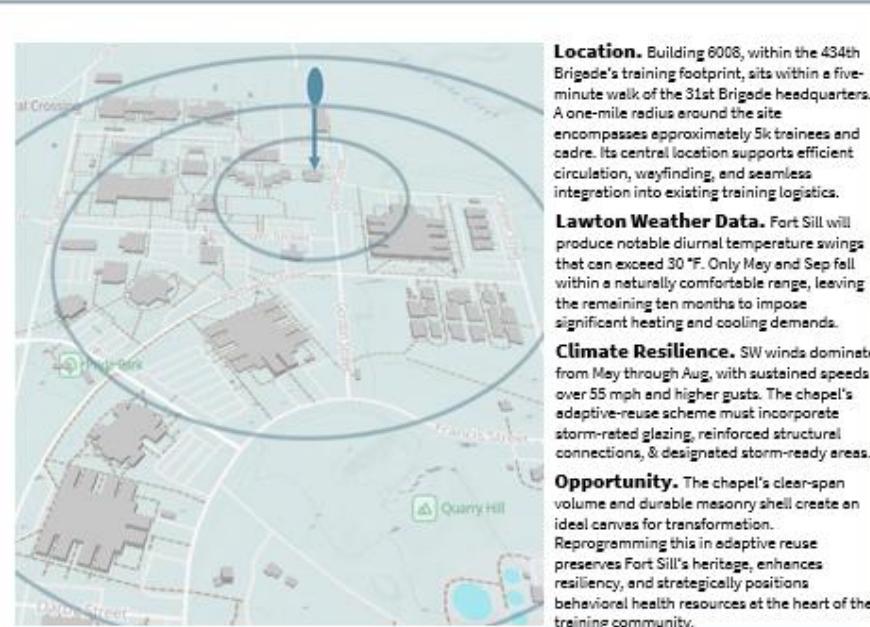
Contents.

1. Cover sheet
2. Site context and analysis
3. Historic narrative and implementation script
4. Concept design proposal
5. Drawings
6. Renderings

Opportunities.

- Automation Controls.
- Overhead Shading.
- Cross Ventilation.
- Daylighting.

Cover Sheet
16 August 2025



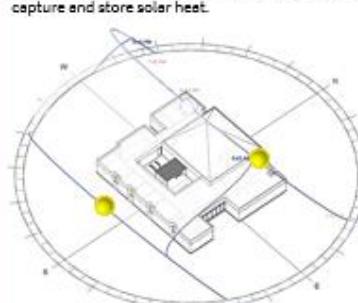
Location. Building 6008, within the 434th Brigade's training footprint, sits within a five-minute walk of the 31st Brigade headquarters. A one-mile radius around the site encompasses approximately 5k trainees and cadre. Its central location supports efficient circulation, wayfinding, and seamless integration into existing training logistics.

Lawton Weather Data. Fort Sill will produce notable diurnal temperature swings that can exceed 30°F. Only May and Sep fall within a naturally comfortable range, leaving the remaining ten months to impose significant heating and cooling demands.

Climate Resilience. SW winds dominate from May through Aug, with sustained speeds over 55 mph and higher gusts. The chapel's adaptive-reuse scheme must incorporate storm-rated glazing, reinforced structural connections, & designated storm-ready areas.

Opportunity. The chapel's clear-span volume and durable masonry shell create an ideal canvas for transformation. Reprogramming this in adaptive reuse preserves Fort Sill's heritage, enhances resiliency, and strategically positions behavioral health resources at the heart of the training community.

Sun Orientation. The original architectural design considered glazing and envelope performance. The solar arc tracks in the southern portion of the sky, and the 1-foot-thick masonry exterior walls provide substantial thermal mass to capture and store solar heat.



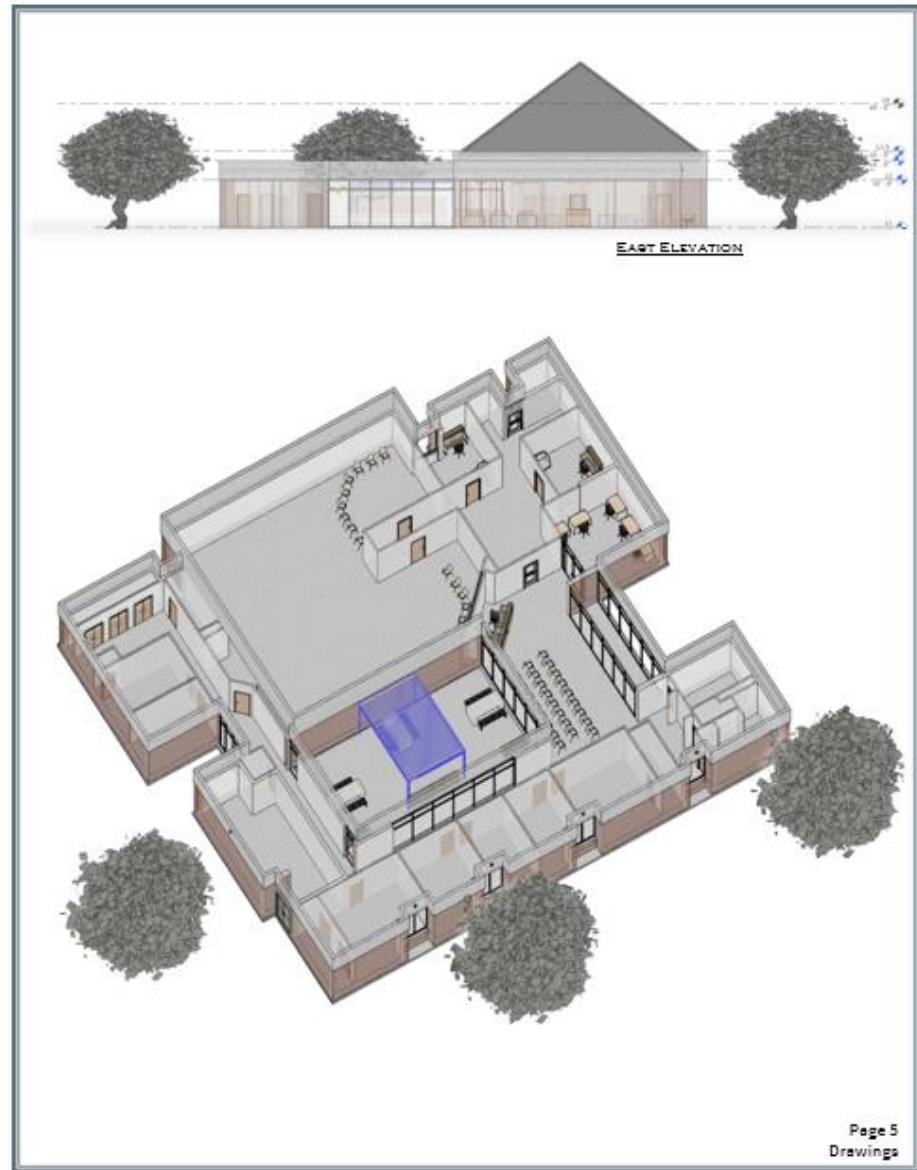
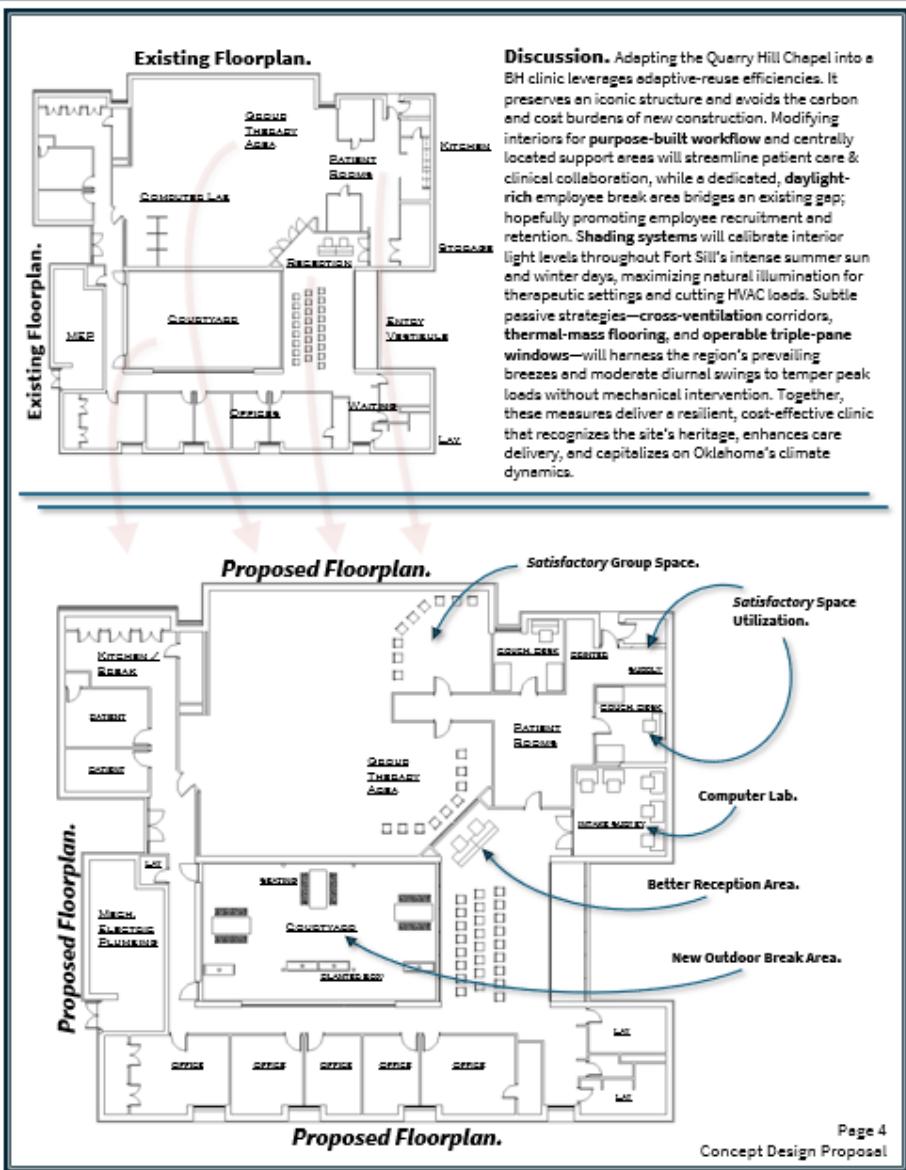
Daylighting Analysis. The daylighting analysis indicates a marked imbalance due to the existing window configuration. South-facing offices achieve satisfactory illumination levels, whereas common areas experience significant glare throughout the day. The courtyard has potential as an outdoor break area; however, the installation of overhead shading devices is recommended.



South Offices Satisfactory.

Page 2
Site Context & Analysis

Lawton, OK and the niche community of Fort Sill



Lawton, OK and the niche community of Fort Sill



Outdoor break area



Patient computer lab



Functional reception area

Conclusion

Where we Were

Where we Are

Where we're Going

Aiming to develop an **algorithm** to predict the best municipalities to analyze the building inventory, and then perform adaptive reuse to bolster the healthcare built environment.