A Better Fit for Rural Hospitals

Integrating Revealed and Stated Preference Analysis to Improve Maternal Healthcare Access in Rural Areas

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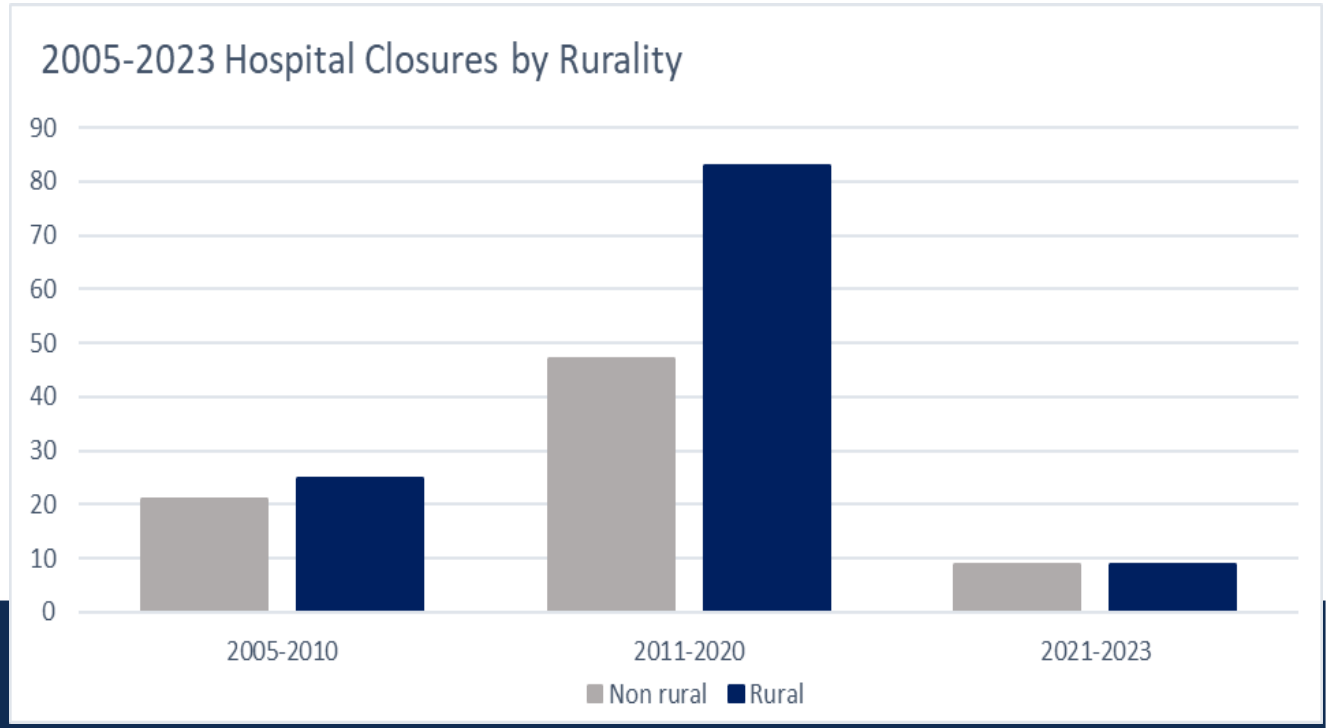
Introduction

Hospital Closures and Rurality

- **35%** of the 5,157 community hospitals in the country, are in rural areas.2021 Hospital Statistics, AHA
- From 2005 to 2023
  - 199 hospitals closed, **60%** of those in rural areas.
  - In urban areas, hospital closures doubled from 2005-2010 to 2011-2020,but they tripled in rural areas.
  - **72%** percent of the rural hospital closures during the last decade
- Rural hospitals additional contributions go beyond health care.
  - 4% decrease in per-capita income
  - 1.6% increase in the unemployment rate.



Introduction

Implications for Maternal Care in Rural Areas

- 9.5% of the total community hospital births occurred in rural areas. **Only half of them count with obstetric services.**
- Obstetric units identified as **“relatively unprofitable”** are often the first to close (Hung et al., 2016)
- From 2004 to 2014
  - **9% rural counties lost access to obstetric services**. The consequences affect disproportionally most vulnerable populations (AHA,2022, Hung et al., 2016; Kozhimannil et al., 2016)
- 2016 study, 263 hospitals across the country.
  - 79% staffing issues
  - 32% financial issues (budget cuts, re-organizations or inclusions in other systems or administrations)
  - 16% low reimbursement rates, conditioned by high percentage of patients with Medicaid or no payment

Introduction

Hospital Care Models for Rural Areas

- Different organizational models have been developed to provide options of care for rural communities.
  - It is not clear how the tradeoffs that people make are weighted.
    - Distance to care, service availability, quality of care, ready access to emergency care, services offered, etc.
- **Cost-benefit analysis (CBA)** provides monetary value to the health outcomes achieved.
- There are three main methods to estimate the monetary value of health outcomes:
  - Human capital
  - Revealed preferences
  - Stated preferences
    - **Discrete Choice Experiments**

Methods

1

Revealed Preference Analysis

Patterns of hospital care utilization

Patient rurality and time to receive care, health outcomes and cost.

2

Stated Preference Analysis

Discrete Choice Experiment

Study of the preferences for hospital care of rural expressed by rural communities

3

Predictive Model

Integrating findings from the revealed and stated preference analysis to determine the effect of variations in attributes in patients' choices

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Patterns of Care

Maternal Outcomes

- Induction and cesarean section (delivery discharges)
- Complications (Pregnancy, childbirth and puerperium)

Hospital Care

- Receiving care outside the region
- Length of stay

Cost

Data Sources

Patient Discharge Data HCAi
Rural Urban Commuting Area Codes
International Classification of Diseases, Tenth Revision (ICD-10)

Hospital Value-Based Purchasing Program Annual Report
National Bureau of Economic Research

Medicare Severity-Diagnosis Related Groups (MS-DRGs) and Base Payment Rate Annual Report

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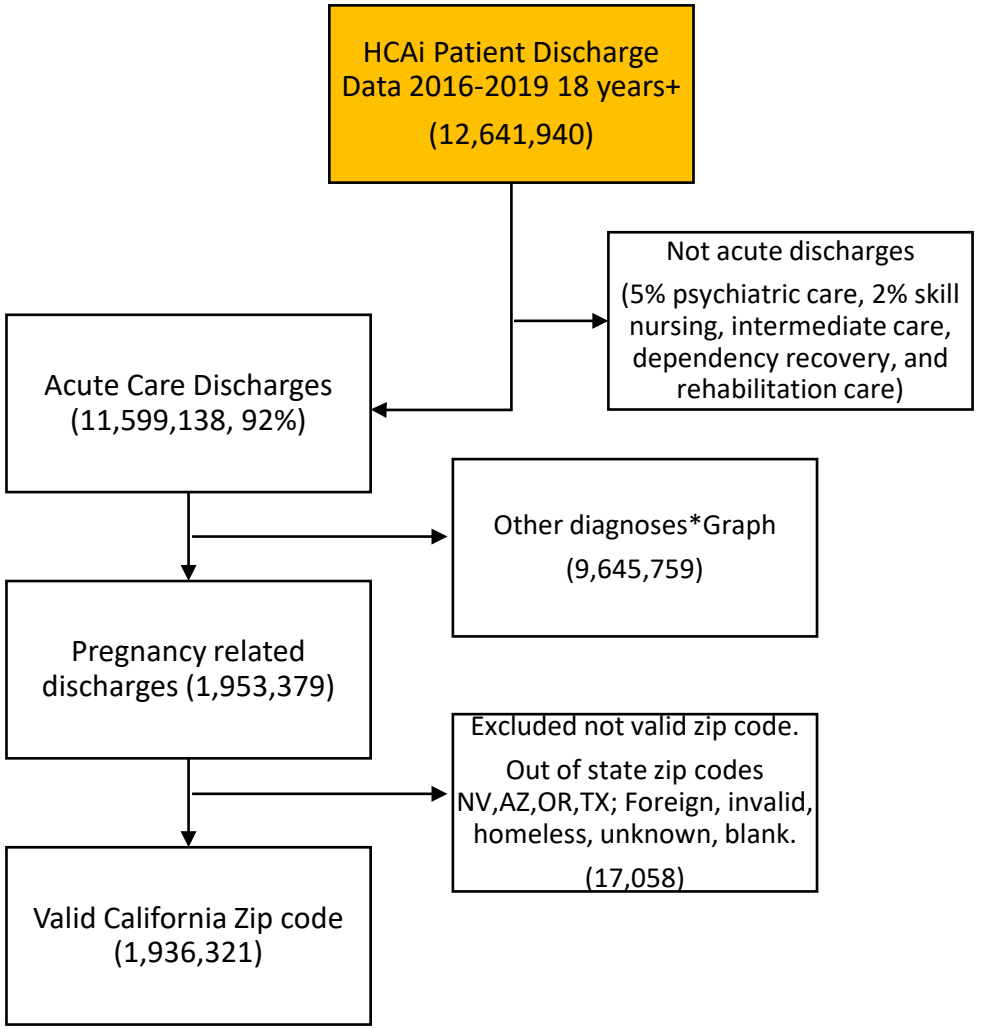
Results

Sample Selection

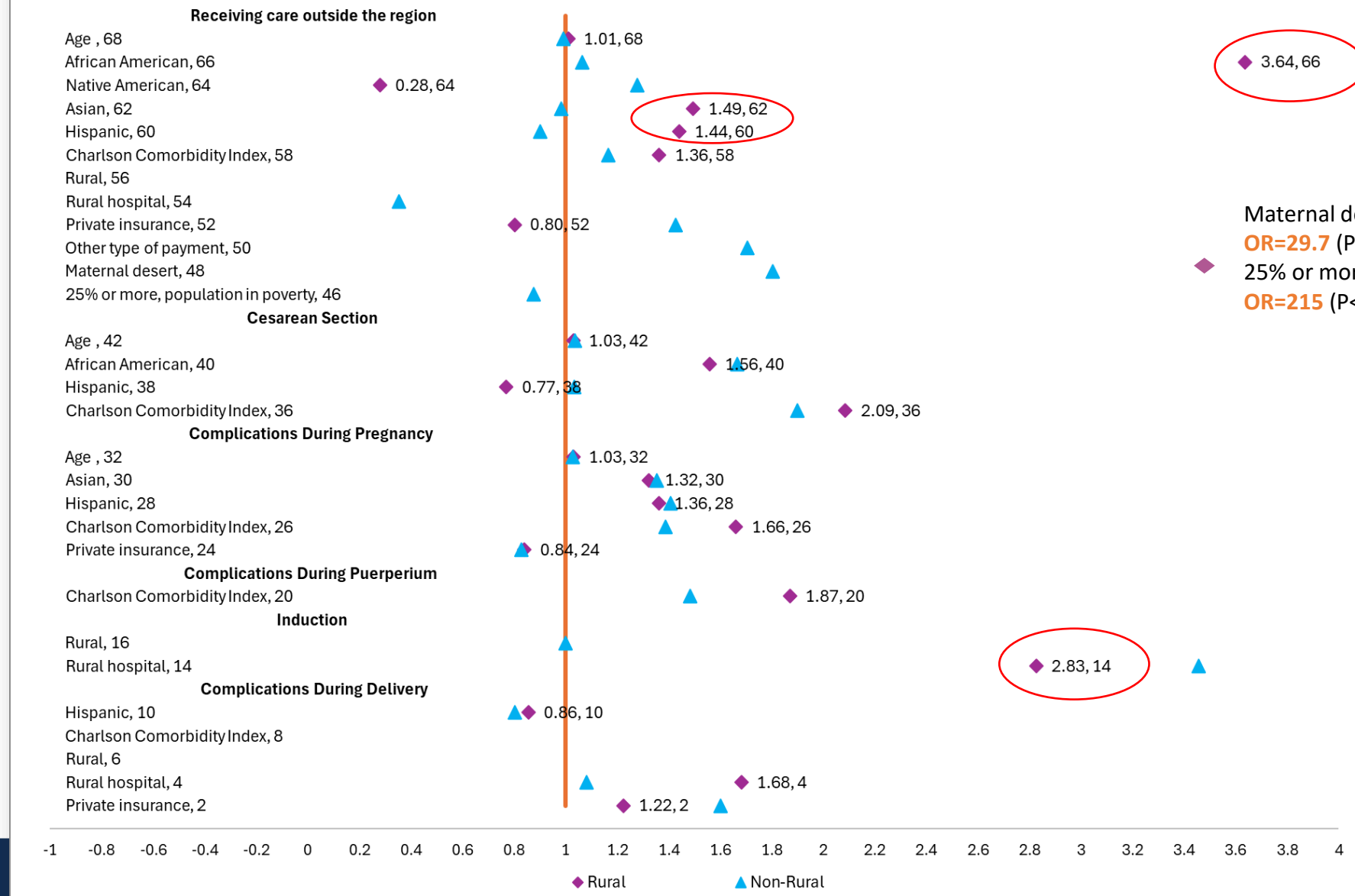


Socio-demographics

Summary statistics pregnancy, childbirth, and puerperium discharges by patient rurality.

Variable	All discharges		Rural		Non-rural	
	Mean	SD	Mean	SD	Mean	SD
Age	30	6	**28**	6	30	6
African American	6%		**3%**		6%	
Native American	0%		**3%**		0%	
Asian	18%		**4%**		18%	
Hispanic	45%		**39%**		45%	
White	29%		**51%**		29%	
Other	1%		1%		1%	
Length of stay	3	2	**2**	2	3	2
Medicaid	45%		**60%**		45%	
Private insurance	52%		**34%**		53%	
Other type of payment	1%		2%		0%	
Charlson Comorbidity Index	.08		.08		.08	
Institutional Discharge	0.53%		0.95%		0.52%	
Death at discharge	0.009%		0.003%		0.009%	
Rural	**2%**					
Distance to care (miles)	10	16	**31**	32	10	15
Outside care	70%		94%		70%	
Maternal Health Care Desert	2%		22%		2%	
Facility low score for safety	32%		38%		32%	
Complications related to pregnancy	7%		7%		7%	
Hypertensive complications	7%		7%		7%	
Complications during labor	28%		26%		28%	
Complications during puerperium	1%		1%		1%	
Any complication	54%		53%		54%	
25% or more, population in poverty	11%		**24%**		11%	
Cost	$ 7,357	$ 3,724	**$ 8,409**	$3,845	$ 7,341	$ 3,720
N	1,936,321		29,801		1,906,520	

Rurality and Maternal Care Outcomes



Summary of Findings Hospital Discharges

Patterns of Care

Receiving care outside their region

- Rural patients were **10 times** more likely to travel for pregnancy care than non-rural patients (31 mi vs 11).
- Patients living in maternal care deserts were **30 times**, and in higher poverty rates by **215 times**.
- All ethno-racial divisions showed higher odds of requiring treatment outside their locality than White rural patients. African American patients **4 times higher.**

Induction

- Hospital rurality increased the odds by **300%.**

Cost

- Rural patients paid, in average, **$417** more
- Rural hospitals in average **$2,650** more expensive
- Stratified analysis African American patients paid **$2,470** more than White rural patients. **$355** in the non-rural group.

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Methods

Stated Preference Analysis

- Discrete Choice Experiment Questionnaire
  - Literature review
  - Interviews with stakeholders, hospital representatives and public health authorities.
  - Seven attributes identified
- Pilot study to verify comprehension, length, and overall quality of the survey instrument.
- Randomized sample of adults aged 18 years and above residing in rural communities in California

Methods

Table 1. Attributes and levels	
Health status	Generally healthy without chronic conditions History of sinus or respiratory infections Hypertension/high blood pressure Serious chronic condition - Heart disease or diabetes
Type of facility	Primary care facility Critical care hospital Basic Hospital Full-Service Hospital with Specialist Clinics
Time it takes to get to the facility	10 minutes in car or ambulance ride 30 minutes in car or ambulance ride 45 minutes in car or ambulance ride More than 1 hour in a car or ambulance ride
How long you have to wait to be seen when you get to care	No wait – seen immediately 30 minute wait 1 hour wait 2 hour or more wait
Quality of care	Poor – Good care for simple things but considerable chance of complications or misdiagnosis for complicated conditions (20% chance) Good – Generally good care, but some chance of complications or misdiagnosis for complicated conditions (10% chance) Excellent care, little to no chance of complications or misdiagnosis for complicated conditions (<1%chance)
Familiarity with the provider	High familiarity Know some of the providers No familiarity
Cost	$0 (costs are all paid by county or insurance company) $50 $200 $500

Example:

Feature	*Healthcare Option 1*	*Healthcare Option 2*
Your health condition	Serious chronic condition - Heart disease or diabetes	Serious chronic condition - Heart disease or diabetes
Type of facility	Primary care facility	Critical care hospital
Time it takes to get to the facility	30 minutes in car or ambulance ride	10 minutes in car or ambulance ride
How long you have to wait to be seen when you get to care	1 hour wait	No wait – seen immediately
Quality of care	Good	Excellent care
Familiarity with the provider	Know some of the providers	No familiarity
Cost to you	$0 (costs are all paid by county or insurance company)	$0 (costs are all paid by county or insurance company)

Healthcare Option 2 ○ Healthcare Option 2 ○

Analysis

- Descriptive statistics
  - Age, gender, race-ethnicity, current and previous health, morbidities, educational, marital status, income, access to healthcare and previous experiences when receiving care.
- Conditional logit model
  - $Uij = \beta HealthS + \beta 1Type + \beta 2Time2Facility + \beta 3WaitTime + \beta 4Quality + \beta 5Familiarity + \beta 6Cost + \varepsilon$
  - Linear and categorical specifications.
- Willingness to pay
- Statistical analysis using Stata 18.0.

Socio-demographics

Table 2. Descriptive statistics

Variable	Mean	SD
Age	44	17
Sex		
Female	65%	
Male	33%	
Transgender or non-binary	2%	
Race-Ethnicity		
Asian/ Pacific Islander	4%	
African American	4%	
Hispanic	11%	
Native American	3%	
White	72%	
Other race	5%	
Current health status		
Good/very good/excellent	68%	
Poor/fair	32%	
Previous year health		
Good/very good/excellent	62%	
Poor/fair	38%	
Educational level		
Less than high school	7%	
Highschool/some college/technical	60%	
College/university	26%	
Graduate degree	6%	
1 to 3 morbidities	22%	
4 or more morbidities	21%	
Income (US dollars)	$ 39,179	$ 34,415
N	204	

Results

Table 3. Discrete Choice Analysis Coefficients for the Preferences for Hospital Care in Rural Areas.

Attribute/ Level		Categorical Model Estimate		SE	Linearized Model Estimate		SE
Primary care facility		-0.19	*	(0.08)	-0.18	*	(0.08)
Critical Care Access Hospital		-0.06		(0.08)	-0.03		(0.08)
Basic Hospital		-0.26	**	(0.08)	-0.23	**	(0.08)
Full Hospital		Omitted			Omitted		
Time to the facility					**-0.006**	***	**(0)**
30 minutes in car or ambulance ride		**-0.27**	***	**(0.08)**			
45 minutes in car or ambulance ride		**-0.14**	†	**(0.08)**			
More than 1 hour in a car or ambulance ride		**-0.35**	***	**(0.08)**			
Wait time					**-0.004**	***	**(0)**
No wait – seen immediately		Omitted					
30-minute wait		**-0.18**	*	**(0.08)**			
1 hour wait		**-0.30**	***	**(0.08)**			
2 hour or more wait		**-0.46**	***	**(0.08)**			
Quality of care (Linear: % of complications)					**-0.096**	***	**(0)**
Poor		**-1.83**	***	**(0.08)**			
Good		**-0.47**	***	**(0.07)**			
Excellent		Omitted					
Familiarity							
High Familiarity		Omitted			Omitted		
Know some of the providers		-0.17	**	(0.07)	-0.16	*	(0.06)
No familiarity		-0.20	***	(0.07)	-0.16	*	(0.07)
Cost					**-0.003**	***	**(0)**
$0 (costs are all paid by county or insurance company)		Omitted					
	$50	-0.44	***	(-0.44)			
	$200	-0.54	***	(-0.54)			
	$500	-1.53	***	(-1.53)			

†P<.10,*P<.05, **P<.01, ***P<.001
SE: Standard error

Summary of Findings DCE

- Significant preference for a full-service hospital over a primary care facility or basic hospital.
- Variations in these preferences associated to race/ethnicity, educational level, and health scenarios presented.
- **Waiting time, quality of care, and cost** were the only statistically significant factors across all stratified analyses.
- Variability in the **quality of care** was the attribute with greater influence on participants' preferences.

Implications

- **How would the modification of the presented attributes affect patient's choices?**
- **Are the actual choices comparable to the simulations obtained by the model?**

How can this information be utilized to increase rural hospital utilization?

PEOPLE CHOICES

PATTERNS OF CARE

Attributes people's choices
Modifiable aspects of care

DECISION MAKING

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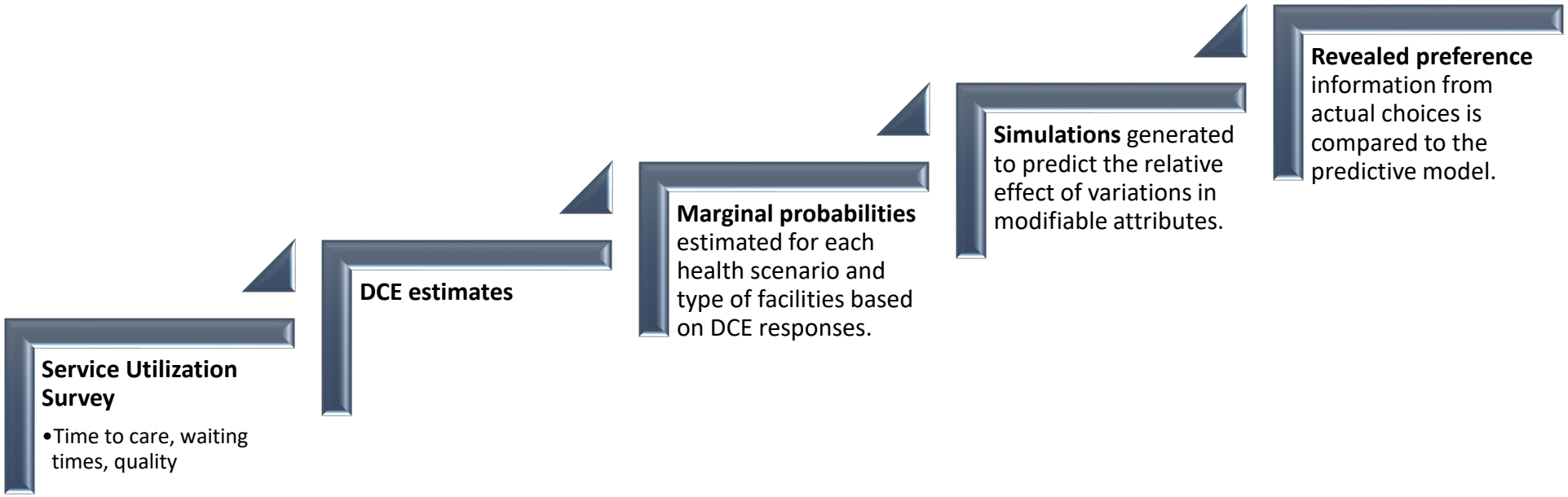

*Statistical analysis was performed using Stata/MP 17.0 and 18.0

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Methods
Reference Values

Table 2. Reference values for healthcare utilization obtained from the survey responses

Questionnaire		Reference Values
Current Health Status		
	Good	33%
	Very Good	25%
	Fair	24%
	Excellent	11%
	Poor	8%
Primary care facility	(72%)	
	Time it takes to get to the facility	20
	How long you have to wait to be seen when you get to care	20
	Quality of care	Very good
	Cost to you	$ 30
Critical Access Hospital	(47%)	
	Time it takes to get to the facility	30
	How long you have to wait to be seen when you get to care	50
	Quality of care	Very good
	Cost to you	$ 70
Basic Hospital	(36%)	
	Time it takes to get to the facility	30
	How long you have to wait to be seen when you get to care	50
	Quality of care	Good
	Cost to you	$ 70
Full hospital	(28%)	
	Time it takes to get to the facility	30
	How long you have to wait to be seen when you get to care	50
	Quality of care	Good
	Cost to you	$ 70

Results

Marginal Analysis

Marginal probabilities for each health scenario, comparing primary care facility and full-service hospital.

	Generally healthy/No chronic conditions		Respiratory disease		Chronic moderate		Serious chronic condition	
Type of facility	Primary care facility	Full-Service Hospital	Primary care facility	Full-Service Hospital	Primary care facility	Full-Service Hospital	Primary care facility	Full-Service Hospital
Time it takes to get to the facility (minutes)	20	30	20	30	20	30	20	30
How long you have to wait to be seen when you get to care (minutes)	20	50	20	50	20	50	20	50
Probability of complications (quality of care)	1%	10%	1%	10%	1%	10%	1%	10%
Familiarity with the provider	Know some of the providers	No familiarity	Know some of the providers	No familiarity	Know some of the providers	No familiarity	Know some of the providers	No familiarity
Cost to you (dollars)	$30	$70	$30	$70	$30	$70	$30	$70
	59.8%	41.2%	49.8%	**50.3%**	**57.3%**	42.7%	47.6%	**52.4%**

Results

Marginal Probabilities and Revealed Scenarios

- **Revealed preference analysis**
  - 7,511 rural patients admitted for labor-related complications
  - 39% in rural hospitals
  - 61% in non-rural hospitals.

- Average distance traveled
  - Rural hospitals 20 miles, travel time of 22 minutes.
  - Non-rural hospitals traveled an average distance of 36 miles, estimated travel time of 40 minutes.
- The waiting time for care was fixed at 150 minutes for both scenarios.

Patients with labor related complications		
Rural hospital	39.1%	2,923
Non rural hospital	60.9%	4,549
Missing	0.52%	39
		7,511

Rural patients with complications of labor, delivery discharges				
	Rural Hospital		No Rural Hospital	
Variable	Mean	SD	Mean	SD
Distance to care	20	22	36	34
Time to facility	22		40	
Waiting time	150		150	
Cost	$ 10,196.97	$ 3,247.55	$ 6,771.41	$ 3,001.63
Familiarity with the provider	Some		No	
N	2,921		4,549	

Results

Marginal Probabilities and Revealed Scenarios

Table 7. Marginal probabilities considering revealed preference parameters for rural patients for complications during labor		
Type of facility	Critical care hospital	Basic Hospital
Time it takes to get to the facility (minutes)	22	40
How long you have to wait to be seen when you get to care (minutes)	150	150
Quality of care	8%	11%
Familiarity with the provider	Know some of the providers	No familiarity
Cost to you (dollars)	$ 10,197	$ 6,771
	0.50%	99.5%

Results

Marginal Probabilities and Revealed Scenarios

Table 8. Marginal probabilities adjusting out of pocket expenditures in the revealed preference parameters for rural patients for complications during labor

	Critical care hospital	Basic Hospital
Type of facility		
Time it takes to get to the facility (minutes)	22	40
How long you have to wait to be seen when you get to care (minutes)	150	150
Quality of care	8%	11%
Familiarity with the provider	Know some of the providers	No familiarity
Cost to you (dollars)	$ 1,530	$ 1,016
	32.5%	67.5%

Results

Marginal Probabilities and Revealed Scenarios

Table 10. Marginal probabilities adjusting out of pocket expenditures and waiting time in the revealed preference parameters for rural patients for complications during labor		
Type of facility	Critical care hospital	Basic Hospital
Time it takes to get to the facility (minutes)	22	40
How long you have to wait to be seen when you get to care (minutes)	30	150
Quality of care	8%	11%
Familiarity with the provider	Know some of the providers	No familiarity
Cost to you (dollars)	$ 1,500	$ 1,500
	63.4%	36.6%

Summary of Findings Predictive Model

- Adjusting out of pocket expenses, the estimated marginal probabilities are similar to those observed in the revealed preference analysis **(33% stated vs 39% revealed**)
- The use of stated preferences found significant value for **quality improvement** and reductions in waiting and travel times.
- Providing support that **decreases additional healthcare expenses** has a substantial impact in the probability of patients preferring their rural hospital.
- The probability of opting for a critical access hospital after **equaling patient's out-of-pocket expenditure** indicated a **52.9% probability**. If additionally, there was a reduction in **waiting time**, the probability of people choosing a critical access hospital **increased to 63%**.

Final Conclusions

- Rural hospitals face unique challenges, and a "one-size-fits-all" approach may not be suitable.
- There are significant differences in the patterns of care experienced in rural areas. Those differences are affecting the most disadvantaged groups in our population.
- Improving quality of care and reducing waiting times increase the probability of patients choosing a facility.
- Closing obstetric services increases costs for patients, including travel and lodging expenses. Better options for rural communities should consider their needs and preferences.
- Knowing what factors are valued the most can help rural hospitals to regain the lost demand and ensure remaining in operation, providing important relief to the already overflowed healthcare system.

Limitations

- Cost estimations based on DRG. Travel expenses and lost wages are underestimated.
- Quality of care was based on the quality metrics reported by the facilities. Hospitals without reporting quality metrics or lack of adjustment in relation to complexity of the interventions or facility's resources is per se an opportunity for improvement.
- The period of data collection for the survey and DCE coincided with the COVID-19 pandemic, which impeded the utilization of alternative methods for survey distribution.

Next Steps

- Increase demand, program and provider effectiveness, through standardization of processes that allow us to use both, big data and user preferences.
- Further research must uncover disparities among rural populations, particularly those in highly marginalized groups.
- Intervention assessment should be evidence based, and integrate return on investment, to increment higher accountability and ensuring policy outcomes are focused on achieving desired results.
- This analysis was centered on a specific group of diagnoses. Similar analyses underway to assess disparities in other morbidities and services.

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Questions?

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Thank You!