

# Good Data Practices

## Cyberseminar Series 4.0

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*Focusing on the interaction between  
research design and data decisions*

# *Learning objectives of the Good Data Practices 4.0 series*

## *Series participants will*

- Understand how previous research results and conceptual/decision models influence the development of the research question
- Learn how a research question can influence the choice of study design
- Understand ways in which research questions and study designs can affect decisions about data
- Become aware of potential data management and analysis challenges and ways they might be addressed
- Become familiar with potential limitations in VA data sources and examples of ways to address them

# Poll #1 Participation in 2017 sessions

Not including today's session, how many of the previous 2 sessions in this year's Good Data Practices series did you attend?

- None
- 1
- 2



# Good Data Practices Cyberseminar

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## Study Design and Data Decisions in a Study of Intensive Care Unit Telemedicine (TICU) Monitoring

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Iowa City VA Medical Center



February 21, 2017

## Poll #3: Your experience with MedSAS datasets

Have you ever used the National Patient Care Database (NPCD) Medical SAS Datasets?

- One year or less
- More than 1, less than 3 years
- At least 3, less than 7 years
- At least 7, less than 10 years
- 10 years or more

# *Learning objectives for this session*

- Describe Intensive Care Unit Telemedicine and its role in the VA
- Define the key variables and data resources to evaluate TICU
  - ❖ Challenges in research design, especially involving facility matching
  - ❖ Understand how to evaluate alternative data sources
- Illustrate the transition to the VINCI environment: data exploration, fear of the unknown, and the influence of previous experience
- Explain the limitations of data collected for clinical purposes (rather than research purposes)

# Outline

- Background, Evolution, & Goals
- Goal 1: TICU Impact on Patient Outcomes
  - ❖ Key Variables and Data Sources
  - ❖ Goal 1 Challenges
  - ❖ Goal 1 Results
  - ❖ Project Evolution and Updates
- Goal 2: Evaluate TICU Utilization
- Summary of lessons learned

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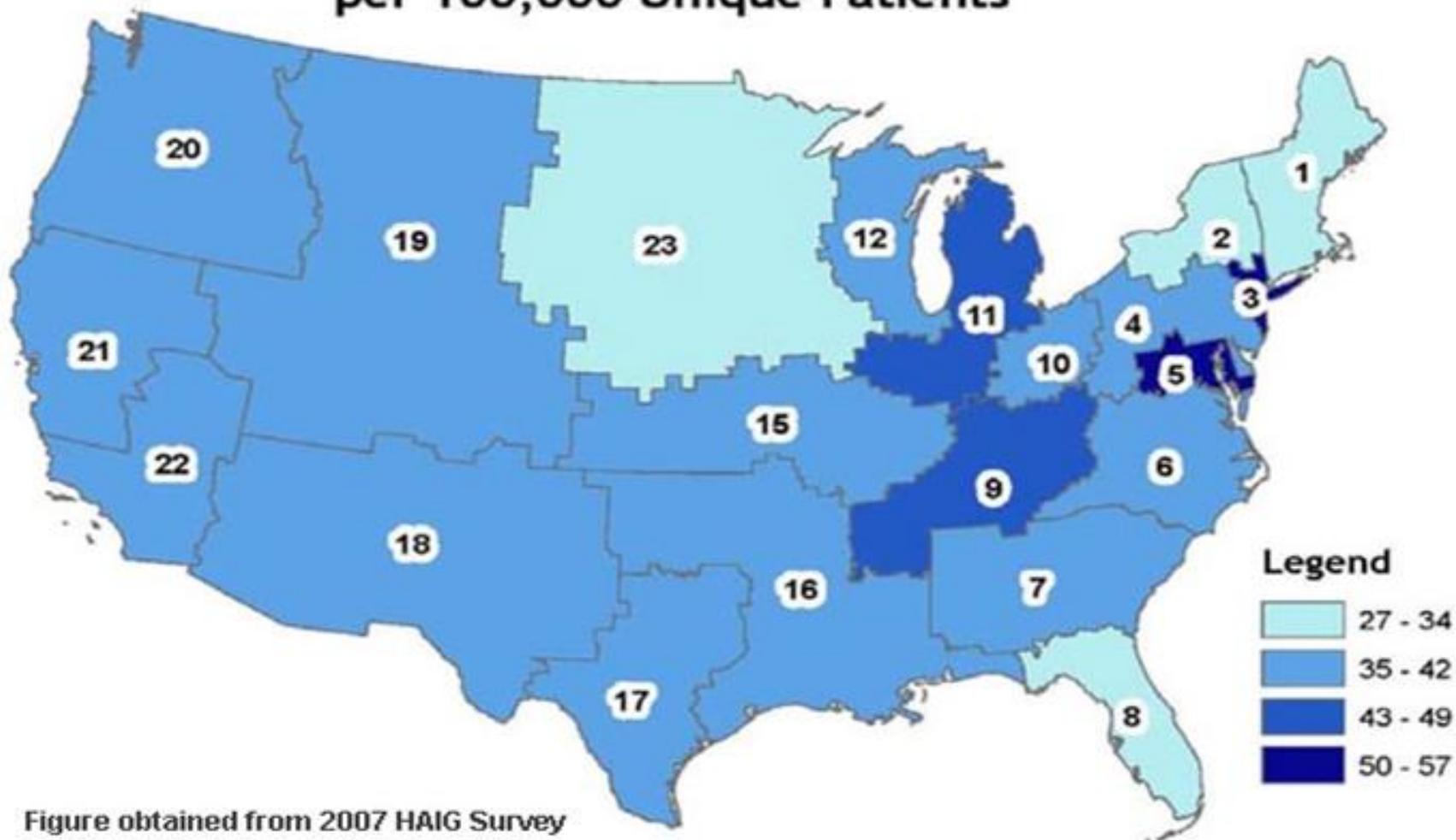
# Background and Evolution

- 2012: VISN 23 implemented tele-remote monitoring in ICUs
- **2011-2015**: HSR&D funding 2011-2015
- **2015-2017**: Office of Rural Health funding
  - → expanded aims
  - → expanded TICU implementation

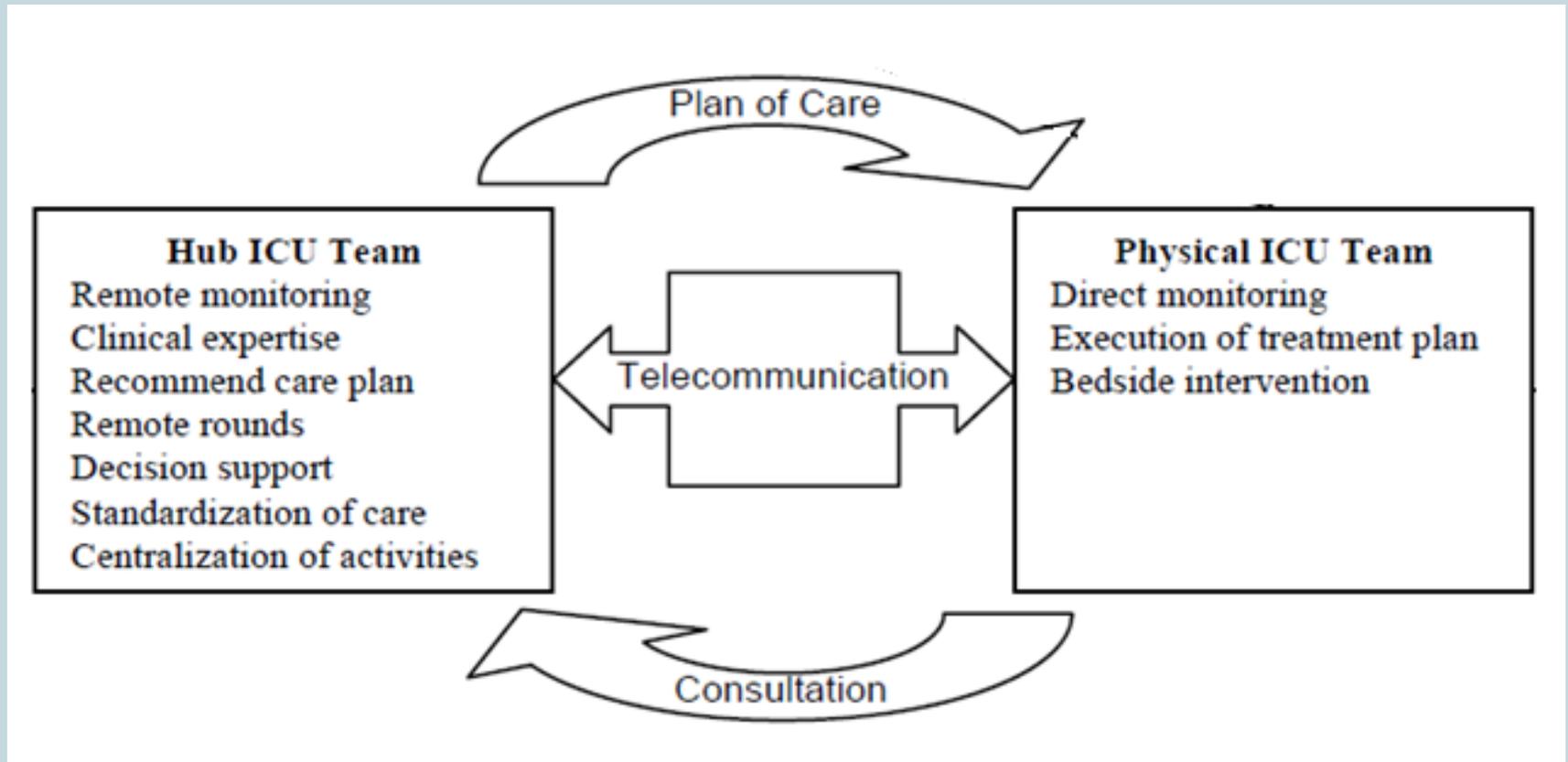


# VA ICU Bed Capacity

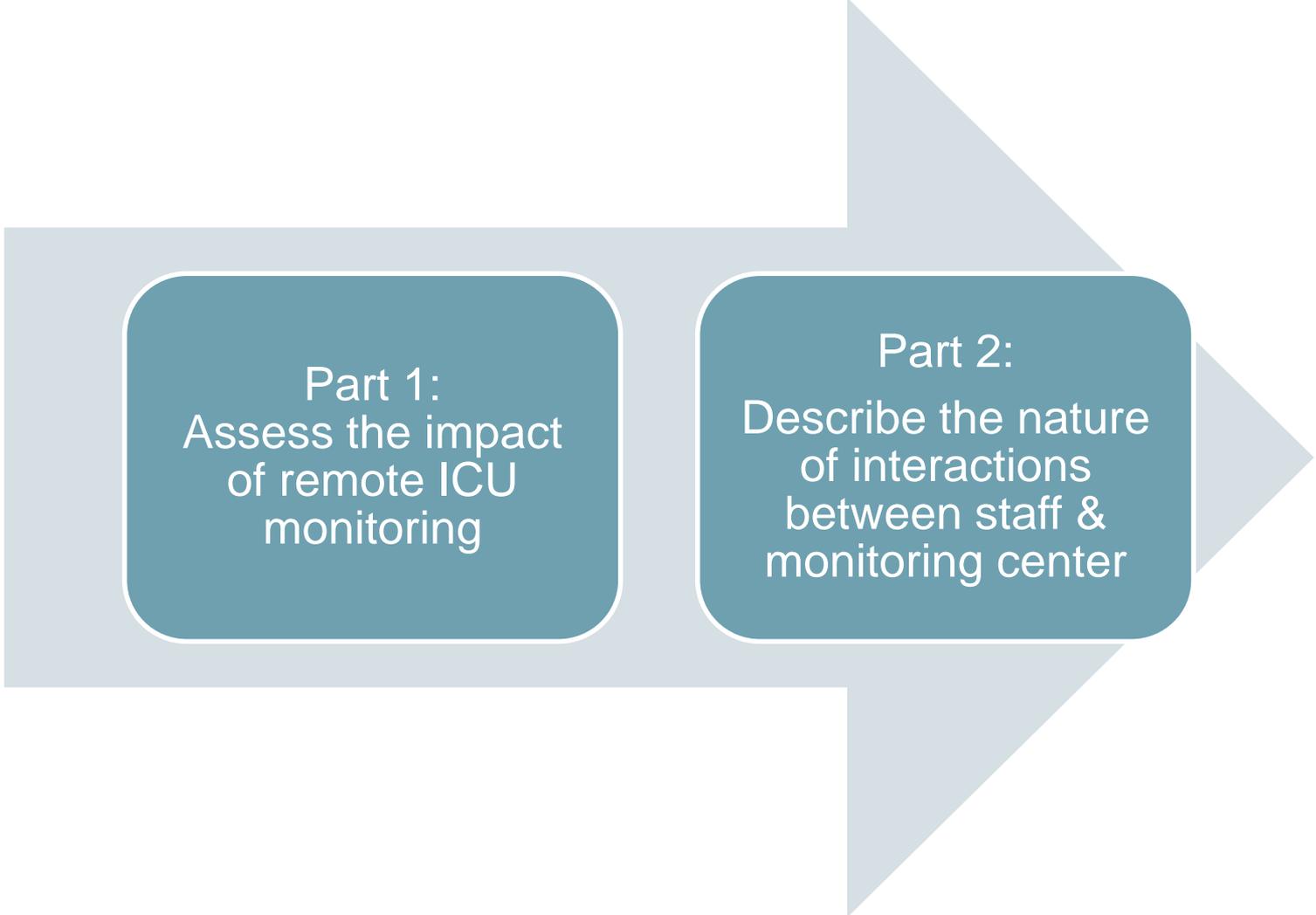
2007 Operational ICU Beds  
per 100,000 Unique Patients



# Remote ICU Monitoring Overview



# ICU Telemedicine Monitoring Goals



Part 1:  
Assess the impact  
of remote ICU  
monitoring

Part 2:  
Describe the nature  
of interactions  
between staff &  
monitoring center

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Goal 1: Compare outcomes in facilities that implemented TICU units vs facilities without TICU

- Initial Analytic strategy:
  - ❖ Evaluate change outcomes from the 6 months before and after TICU implementation, relative to the change in matched facilities outside VISN 23 with no TICU

*→ TICU was implemented in a staggered manner in VISN 23 between August 2011 - February 2012*

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# Key Variables: Patient Outcomes

- Primary Outcomes:
  - ❖ Mortality (in-ICU, in-Hospital, 30-day mortality)
  - ❖ Readmission within 30 days
  - ❖ Length of Stay (ICU & Hospital)
- Intermediate Outcomes
  - ❖ Ventilator acquired pneumonia
  - ❖ Catheter-related bloodstream infections
  - ❖ VTE prophylaxis

# Key Variables: Patient Covariates

- Demographics (age, sex, race)
- Primary Diagnosis (AHRQ Clinical Classification)
- Comorbidities (ICD-9-CM Diagnosis Algorithms)
- Admission Severity -- How to measure?
  - ✓ Labs within 24-hours of admission (e.g., Albumin, Bilirubin, Creatinine, BUN)
  - ✓ Vital Signs? (e.g., heart rate, respiration, temp, BP)
  - ✓ Mechanical ventilation?

# Patient Level Data Sources

- VA Patient Treatment File (PTF): administrative data for VA inpatient admissions
  - VA Bed Section File: units of stay
  - VA Procedures & Surgery Files: ICD-9-CM procedure codes
- VA Vital Status File: dates of death for VA users
- Decision Support Services (DSS) Laboratory Files for lab tests and lab results collected during inpatient stays
- Vital Signs File: blood pressure, temperature, pulse
- Intermediate Outcomes: Inpatient Evaluation Center (IPEC)

## Key Variables: Facility Characteristics

- ICU type (medical, surgical, and mixed)
- ICU level of complexity (ranging from 4 to 1)
- Bed size
- Intensivist Staffing (open/closed)
- Patient volume, characteristics, and baseline outcomes
- Population density, rurality

## Data Sources: Facility Level

- VA Healthcare Analysis and Information Group (HAIG) Survey of ICU Organizational Characteristics
- VA MedSAS Inpatient Files summarized to ICU unit (patient volume, mean ICU Length of stay, mortality)
- VA Inpatient Evaluation Center (IPEC data files include variables reported to IPEC for VA ICU patients:
  - a) Risk-adjusted mortality and length of stay (LOS);
  - b) Process measures for specific patient populations (e.g., use of ASA for AMI, venous thromboembolism [VTE] prophylaxis);
  - c) Intermediate outcomes (e.g., catheter related bloodstream infections [CR-BSI] , ventilator associated pneumonia [VAP]).

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## Challenges: Project management

- Analyst turnover
- Investigator turnover
- TICU Implementation delays / Expansion of TICU

## Challenges: Data management

- Difficulty matching facilities
- Missing admission severity (labs) data
- Transition to VINCI
- No IPEC data access

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# Characteristics of the 8 pairs of intervention and matched control ICUs

Pair ID	TICU	ICU type	Management	ICU level	# Patients	White (%)
1	Yes	Mixed	Open	3	146	94
	No	Mixed	Open	3	158	97
2	Yes	Mixed	<b>Open with intensivist consults</b>	2	301	94
	No	Mixed	<b>Open</b>	2	400	92
3	Yes	MICU	Open	<b>3</b>	<b>103</b>	89
	No	MICU	Open	<b>4</b>	<b>54</b>	94

# Patients in Intervention and Control ICUs

	<b>BEFORE TICU</b>	<b>AFTER TICU</b>
<b>TICU Facility</b>	1,708	1,647
<b>non-TICU Facility</b>	1,664	1,920
<b>Total</b>	3,372	3,567

# Baseline Characteristics of Patients in Intervention and Control ICUs

Period	Intervention		Control		P-Value
	Pre	Post	Pre	Post	
<b><i>Demographics</i></b>					
Age, mean	66.2	66.4	67.5	67.7	0.70
Race = White	93%	91%	88%	90%	0.42
Mechanical Ventilation	7%	8%	7%	7%	0.35
<b><i>Comorbidities (examples):</i></b>					
Ischemic Heart Disease	42%	42%	39%	40%	0.68
COPD	38%	37%	39%	40%	0.27
Heart Failure	23%	22%	25%	26%	0.23
Cerebrovascular	19%	18%	15%	16%	0.25
Renal disease	17%	18%	17%	18%	0.95

Most abnormal results for 8 laboratory tests around  $\pm$  24 hours of ICU admission

### Example: Creatinine

	Intervention		Control		P-Value
Period	Pre	Post	Pre	Post	
Number pts	1708	1647	1664	1920	
Number Missing	307 (18%)	247 (15%)	333 (20%)	365 (19%)	
<i>After imputation:</i>					
Cr <0.49	1.5%	1.3%	1.3%	1.8%	
0.5<Cr< 1.4	71.0%	72.0 %	69.0%	69.0%	
1.5<Cr< 1.94	11.0 %	10.0%	12.0%	11.0 %	
Cr >1.95	16.0 %	17.0%	18.0%	18.0%	.88

## Risk Adjusted Odds of Mortality and Relative Length of Stay for Patients in Intervention and Control ICUs

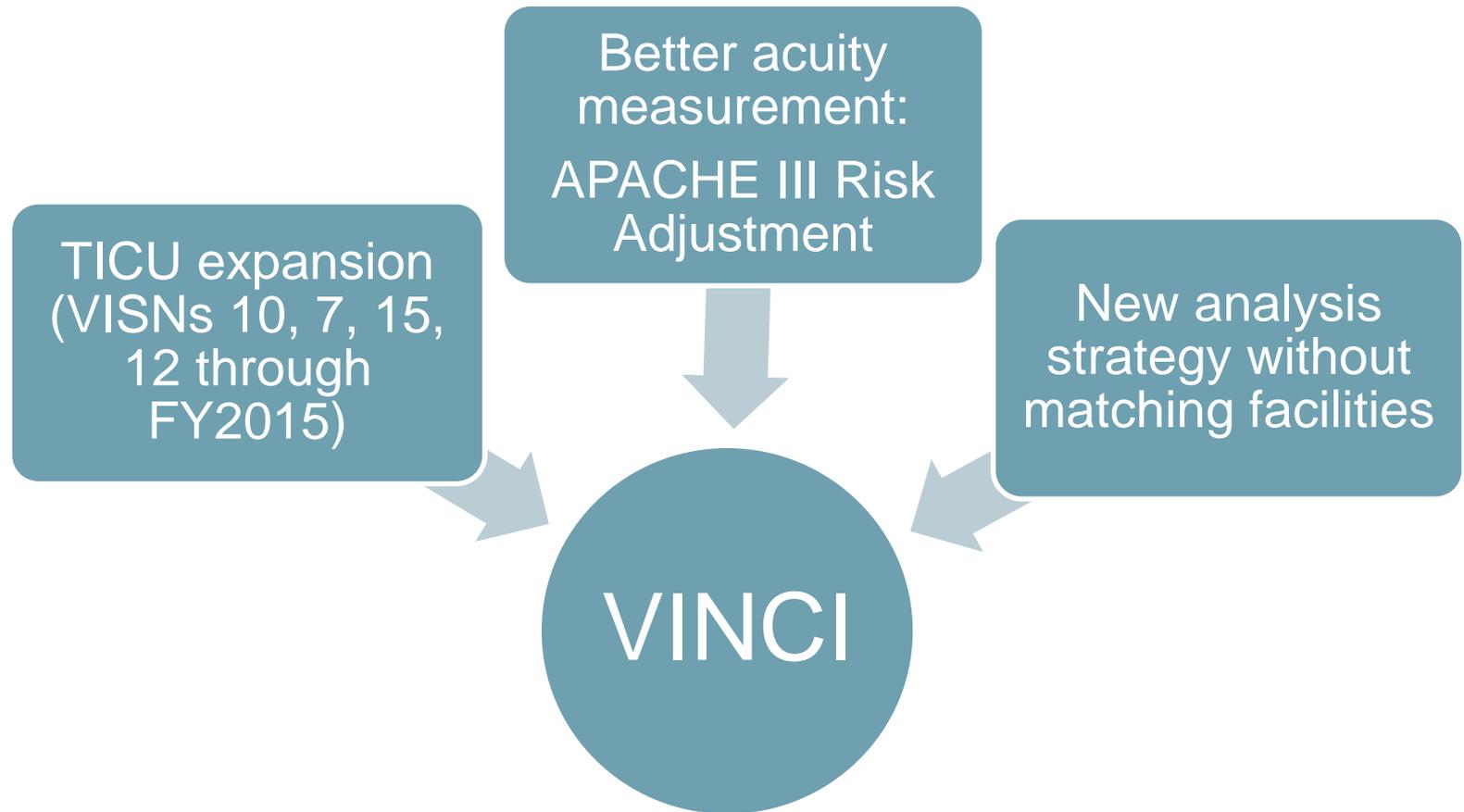
	Intervention ICUs Post- (vs Pre-) (n=3,355)		Control ICUs Post- (vs Pre-) (n=3,584)		Relative Magnitude of Change in Intervention vs Control ICUs (n=6,939)	
	OR	P-value	OR	P-value	OR	P-value
<b><i>MORTALITY</i></b>						
ICU Mortality	<b>1.07</b>	<b>0.82</b>	<b>0.88</b>	<b>0.65</b>	<b>1.21</b>	<b>0.63</b>
Hospital Mortality	<b>1.33</b>	<b>0.20</b>	<b>0.82</b>	<b>0.30</b>	<b>1.62</b>	<b>0.10</b>
30-day Mortality	<b>1.10</b>	<b>0.52</b>	<b>0.79</b>	<b>0.06</b>	<b>1.39</b>	<b>0.09</b>
<b><i>Relative LOS</i></b>						
ICU LOS	<b>1.02</b>	<b>0.58</b>	<b>1.00</b>	<b>0.99</b>	<b>1.02</b>	<b>0.68</b>
Hospital LOS	<b>1.03</b>	<b>0.43</b>	<b>0.93</b>	<b>0.05</b>	<b>1.11</b>	<b>0.05</b>

Models adjusted for patient demographics, comorbidity, primary diagnosis upon ICU admission via CCS categories, and the most abnormal laboratory values during the 24 hours surrounding ICU admission.

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# Project Evolution



## Expanded TICU analysis

- **566,254** admissions to VA ICUs during October 2009 through September **2015** identified in MedSAS Inpatient data.
- **97,785 (17.3%)** were admitted to units that implemented tele-ICU during the period (VISN 7, 10, 15 & 23).
  - o 62,620 admitted before implementation date
  - o 35,165 admitted after implementation date

## Expanded TICU analysis:

### Variables:

- ❖ Patient characteristics similar to previous with the addition of APACHE III score.
  - Vital Signs File
  - Laboratory tests from Corporate Data Warehouse (CDW)
- ❖ Outcome = Transfers directly out of the ICU
  - defined using hospital discharge disposition, bed-section, and bed-section discharge dates.

## Analysis methods

- Multi-level logit regression models were used to control for patient characteristics.
- Models also included:
  - 1) Flag for facilities that ever implemented TICU
  - 2) Flag representing admissions before or after TICU implementation
  - 3) Interaction between (1) and (2).

## Results: Relative odds of transfer out of ICU at end of observation relative to start

	Tele-ICU		Non-TICU		Relative Change	
	OR	P-value	OR	P- value	OR	P- value
<b>All</b>	1.1(0.9-1.3)	0.28	1.1(1-1.2)	0.01	1(0.8-1.1)	0.71

# Results: Relative odds of transfer out of ICU at end of observation relative to start

	Tele-ICU		Non-TICU		Relative Change	
	OR	P-value	OR	P- value	OR	P- value
<b>All</b>	1.1(0.9-1.3)	0.28	1.1(1-1.2)	0.01	1(0.8-1.1)	0.71
<b>By APACHE III Quartile</b>						
<b>1</b>	1(0.8-1.4)	0.8	0.9(0.8-1.1)	0.27	1.1(0.8-1.5)	0.4
<b>2</b>	0.8(0.6-1.2)	0.29	1(0.8-1.1)	0.61	0.9(0.6-1.2)	0.43
<b>3</b>	1.2(0.9-1.6)	0.35	1.3(1.1-1.6)	<.001	0.9(0.6-1.2)	0.33
<b>4</b>	1.3(1-1.8)	0.06	1.4(1.1-1.6)	<.001	1(0.7-1.3)	0.86

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# Standardized Clinical Note Template

- Challenge: The template was designed for medical, not research purposes
- Challenge: Though began the same, each VISN has since personalized the template

**No longer Identical!**

- The data is stored in the SQL Health Factors Table (on VINCI)

Reminder Dialog Template: IC/TELE-ICU PHYSICIAN PROGRESS NOTE

Routine interventions

Routine Orders  
Comments:

Review of line or tube placement film  
Comments:

Management of medications  
Comments:

Order renewals

Urinary catheter

Narcotics

Restraints

Comments:

Guideline Adherence

Urgent interventions

Critical interventions

Family communication

Interprofessional Communication

Other

The communication that initiated this note was initiated by:

Primary Site

TeleICU

Did this interaction result in a change in patient care?

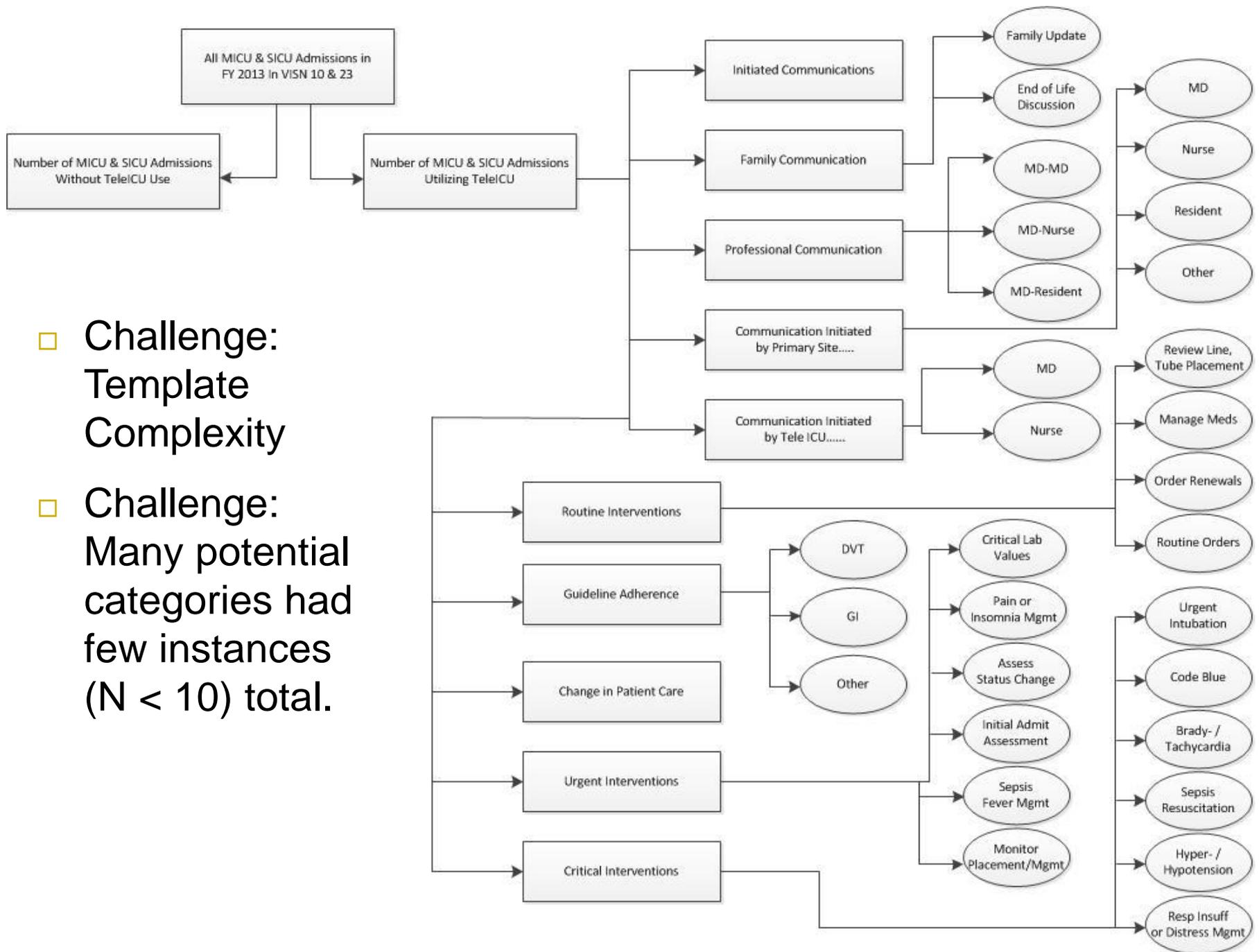
No

Yes

# How is the template data stored?

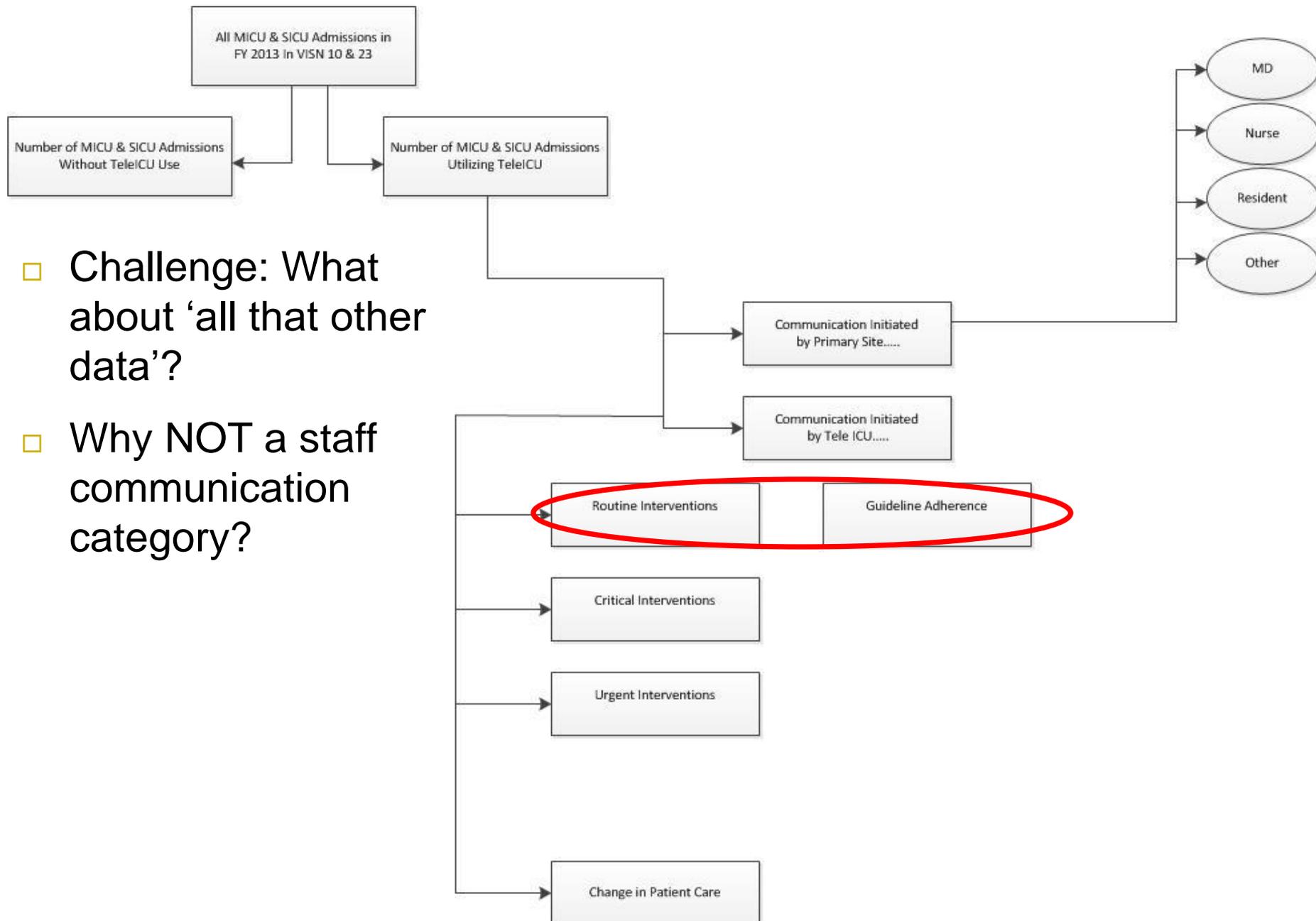
- Challenge: This data is text; not numeric
  - How do you ensure all relevant data found?
  - How do you code it for analysis?
- The Health Factors data is a single entry per item selected.
  - How do you combine data collected at the same time?
  - Do you even need to?

The image shows a screenshot of a medical form with a yellow background. At the top right, there is a tab labeled 'Visit Info'. Below the tab, the text reads: 'Routine interventions', 'The communication that initiated this note was initiated by:', and 'Did this interaction result in a change in patient care?'. In the 'Health Factors' section, the text 'TELE ICU COMM INITIATED, TELE ICU ROUTINE INTERVENTIONS' is circled in red. At the bottom left, there is a note: '\* Indicates a Required Field'.



□ Challenge: Template Complexity

□ Challenge: Many potential categories had few instances (N < 10) total.



- Challenge: What about 'all that other data'?
- Why NOT a staff communication category?

# Analysis Complexities

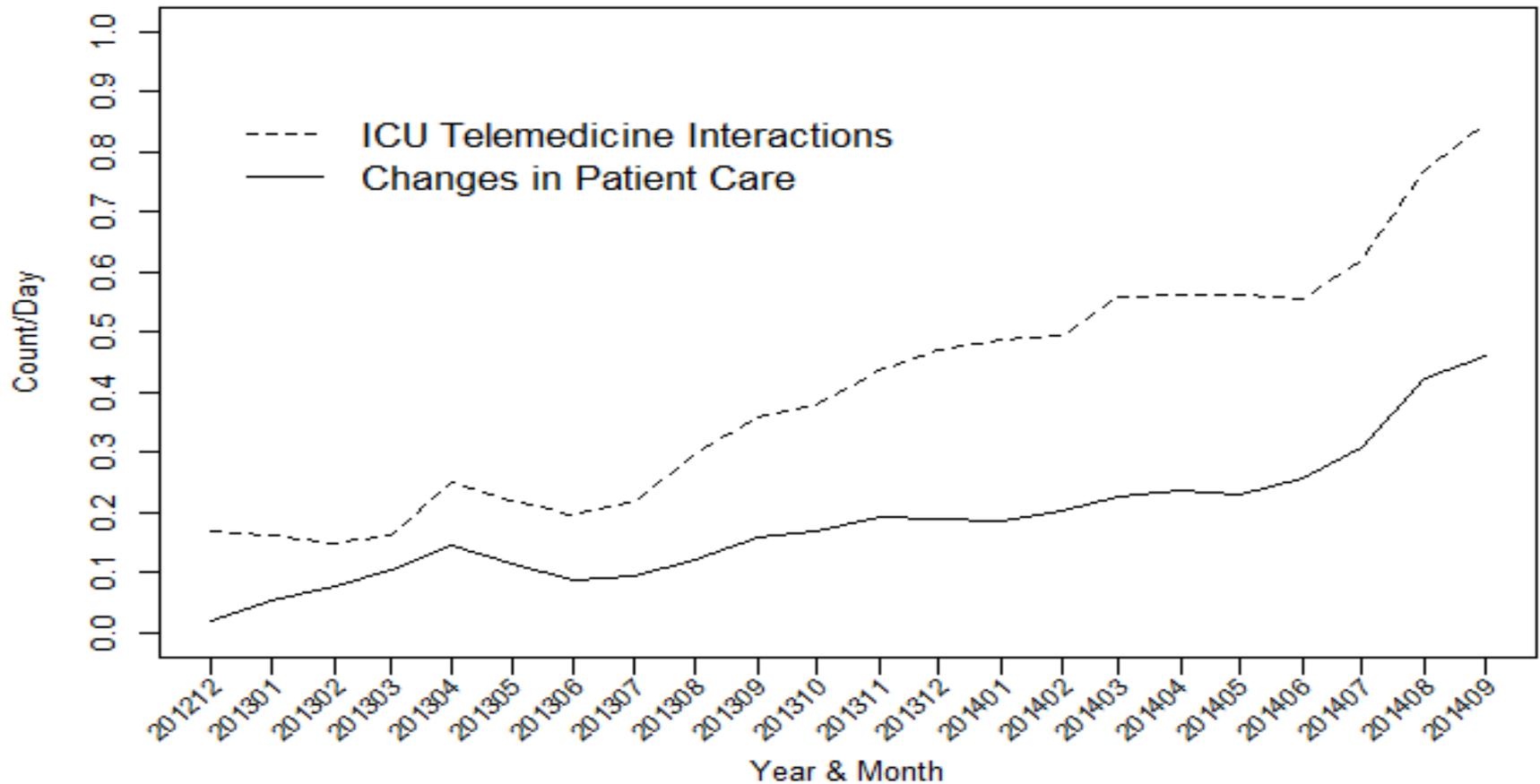
- Intensivist Support Hours Varied by VISN
  - Intensivist Available 24x7
  - Intensivist Available Nights 7pm – 7am
- Needed to consider patient's 'exposure' to the teleintensivist over course of their ICU stay
  - Contacts / Admission vs.
  - Contacts / week of teleintensivist exposure

# Analysis Complexities

- Ideally wanted to compare TICU utilization between the two support centers
  - Both operated at NIGHT, but not during the DAY
  - What about all the DAY data?
- Also wanted to consider overall utilization trends over time
  - Moving Average Plots for sets of data variables

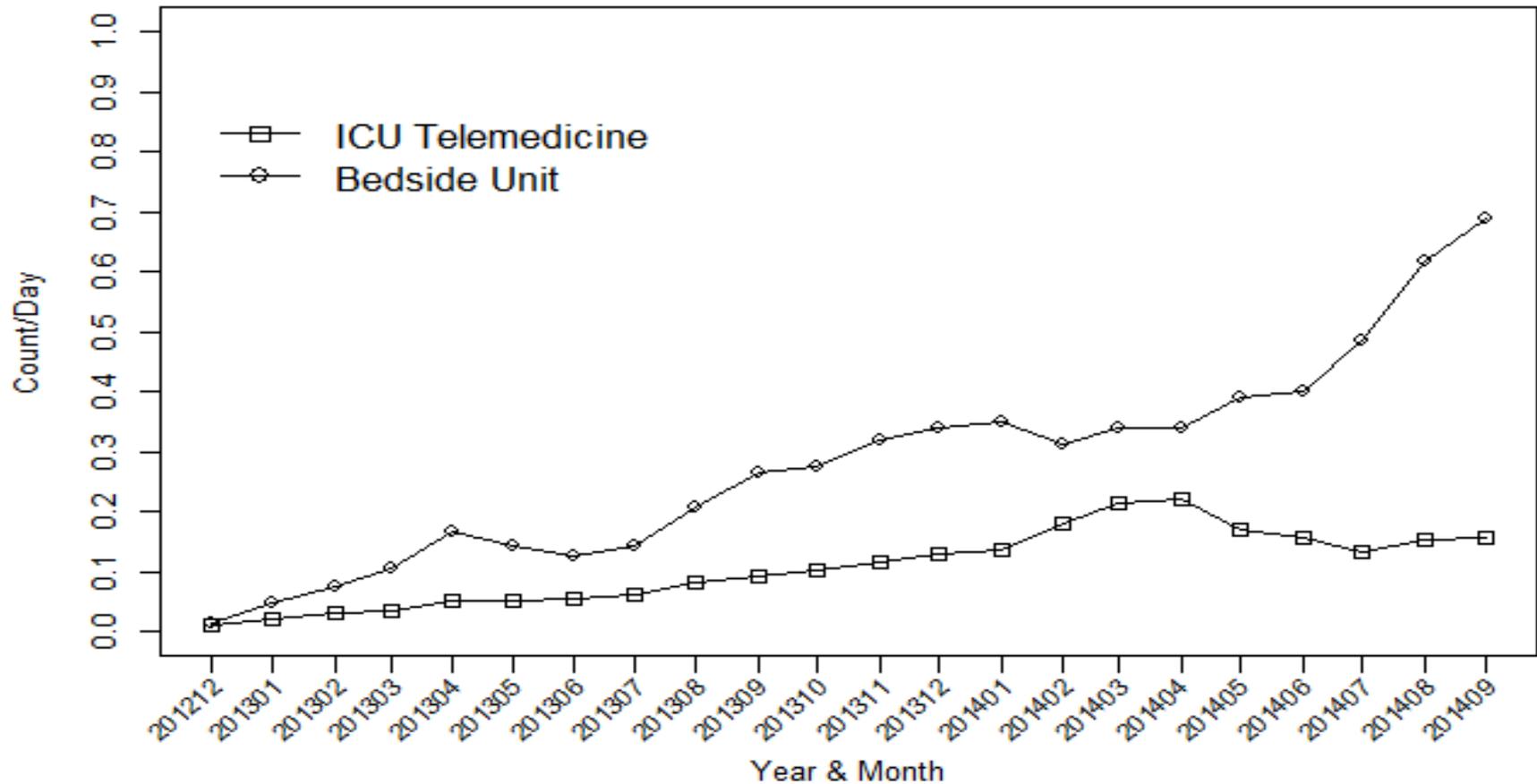
# For Fun: Utilization Trends Plots

## Part A: ICU Telemedicine Interactions & Changes in PatientCare



# For Fun: Utilization Trends Plots

## Part D: Telemedicine Initiation Site



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# Lessons Learned

- Transition to VINCI was easier than anticipated
- Corporate Data Warehouse data messy but rich
- Implementation work is messy
- Study design can be greatly affected by the data you have available, as well as the data you cannot attain
- Study questions should be updated based on data limitations

# Resources

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# VIReC options for specific questions

## HSRData Listserv

- Community knowledge sharing
- ~1,200 VA data users
- Researchers, operations, data stewards, managers
- Subscribe by visiting <http://vaww.virec.research.va.gov/Support/HSRData-L.htm> (VA Intranet)



## HelpDesk

- Individualized support



[virec@va.gov](mailto:virec@va.gov)

(708) 202-2413

## Quick links for VA data resources

*Quick Guide: Resources for Using VA Data*

<http://vaww.virec.research.va.gov/Toolkit/QG-Resources-for-Using-VA-Data.pdf> (VA Intranet)

VIReC: <http://vaww.virec.research.va.gov/Index.htm> (VA Intranet)

VIReC Cyberseminars: <http://www.virec.research.va.gov/Resources/Cyberseminars.asp>

VHA Data Portal: <http://vaww.vhadataportal.med.va.gov/Home.aspx> (VA Intranet)

VINCI: <http://vaww.vinci.med.va.gov/vincicentral/> (VA Intranet)

Health Economics Resource Center (HERC): <http://vaww.herc.research.va.gov> (VA Intranet)

CDW: <https://vaww.cdw.va.gov/Pages/CDWHome.aspx> (VA Intranet)

Archived cyberseminar: What can the HSR&D Resource Centers do for you?

[http://www.hsrdr.research.va.gov/for\\_researchers/cyber\\_seminars/archives/video\\_archive.cfm?SessionID=101](http://www.hsrdr.research.va.gov/for_researchers/cyber_seminars/archives/video_archive.cfm?SessionID=101)

## Contact information

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**FY '17 Good Data Practice Cyberseminar Series**  
**Tuesdays and Thursdays in February, 2017**  
**1:00-2:00 PM (ET)**

Visit our Education page for more information & registration links.

[www.virec.research.va.gov](http://www.virec.research.va.gov)

Date	Topic	Presenter
Tuesday, February 14, 2017	Incorporating Genomics in Routine Care for Veterans with Colon Cancer: Study Design and Data Decisions	Sara Knight
Thursday, February 16, 2017	Data Use and Data Decisions in a Mixed Methods Study about Hand Hygiene	Heather Reisinger
Tuesday, February 21, 2017	Data Decisions and Quantitative Analysis in a Study Investigating the Impact of Remote ICU Monitoring in VA Hospitals	Mary Vaughan-Sarrazin Amy O'Shea
Thursday, February 23, 2017	Capstone Discussion: The Influence of Research Design on Data Decisions	Discussant: Neil Jordan

**Next session:  
February 23, 2017**

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*Capstone Discussion: Focusing on the interaction  
between research design and data decisions*

Neil Jordan, PhD

Center of Innovation in Complex Chronic Healthcare (CINCCH)

Edward J. Hines, Jr. VA Hospital

February 23, 2017

