

Data Use in Quality Improvement

Practical and “Social” Considerations

Rohit Bhalla, MD, MPH
Senior Vice President, Chief Clinical and Quality Officer
Stamford Health

Clinical Quality Fellowship Program
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**CLINICAL QUALITY
FELLOWSHIP PROGRAM**



Objectives

- Discuss “real life” issues
- Assess pros and cons of data utilization approaches
- Translate technical to actionable
- What we won't cover...

Logistic function, odds ratio, and logit [\[edit\]](#)

An explanation of logistic regression begins with an explanation of the **logistic function**, which always takes on values between zero and one.^[17]

$$F(t) = \frac{e^t}{e^t + 1} = \frac{1}{1 + e^{-t}},$$

and viewing t as a linear function of an **explanatory variable** x (or of a linear combination of explanatory variables), the logistic function can be written as:

$$\pi(x) = \frac{e^{\beta_0 + \beta_1 x}}{e^{\beta_0 + \beta_1 x} + 1} = \frac{1}{1 + e^{-(\beta_0 + \beta_1 x)}}.$$

This will be interpreted as the probability of the dependent variable equalling a “success” or “case” rather than a failure or non-case. We also define the inverse of the logistic function, the **logit**:

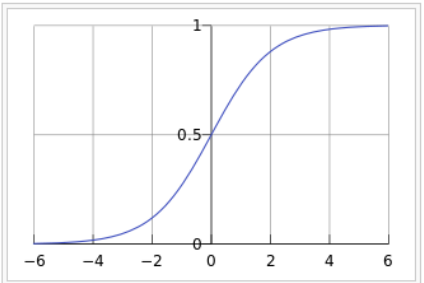
$$g(x) = \ln \frac{\pi(x)}{1 - \pi(x)} = \beta_0 + \beta_1 x,$$


Figure 1. The logistic function, with $\beta_0 + \beta_1 x$ on the horizontal axis and $\pi(x)$ on the vertical axis

Source: *Logistic Regression*. http://en.wikipedia.org/wiki/Logistic_regression





Gov. Andrew Cuomo demonstrates how a "bag valve mask" works at a press conference Saturday, March 28.
Governor's office, press conference

Coronavirus patients in New York will have to resort to using bag valve masks if the Empire State doesn't have enough ventilators, Gov. Andrew Cuomo said in a press conference on Saturday.

The state anticipates it will need [140,000 hospital beds and 30,000 ventilators](#) at its "highest point of need" – that is, when coronavirus infections are projected to hit their apex in 14 to 21 days, Cuomo said.

Failure to obtain these ventilators means that patients will need to have air pumped manually into their lungs with a bag valve mask, he said.

Source: [cnbc.com. https://www.cnbc.com/2020/03/28/coronavirus-new-york-orders-thousands-of-manually-operated-pump-ventilators.html](https://www.cnbc.com/2020/03/28/coronavirus-new-york-orders-thousands-of-manually-operated-pump-ventilators.html). March 28, 2020.

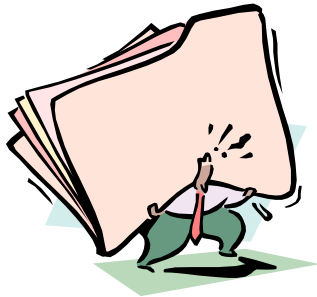
Do You Need Data To Take Action?

A screenshot of a CNN.com/HEALTH article. The page title is "Victim of botched transplant declared dead". The sub-headline is "Hospital: 'We very much regret these tragic circumstances'". The article is dated Sunday, February 23, 2003, and posted at 1:36 PM EST (1836 GMT). The main text reads: "DURHAM, North Carolina (CNN) -- Doctors at Duke University Hospital declared Jessica Santillan dead at 1:25 p.m. Saturday and removed her from a respirator soon after. The 17-year-old girl had two heart and lung transplants this month, the first of which used organs with the wrong blood type." A quote from a hospital spokeswoman says: "As of approximately 5 p.m., she is no longer on a respirator," a hospital spokeswoman told CNN. Santillan was declared dead by doctors after a series of tests determined she had no brain function, the hospital said in a statement. Another quote from Dr. William Fulkerson, chief executive of the hospital, says: "We want Jessica's family and supporters to know that we share their loss and their grief. We very much regret these tragic circumstances." The article includes a photo of family spokesman Mack Mahoney visiting Jessica Santillan in the hospital. The page also features a sidebar with navigation links like Home Page, World, U.S., Weather, Business, Sports, Politics, Law, Technology, Science & Space, Health, Entertainment, Travel, Education, and Special Reports. There are also links for SERVICES, Video, E-mail Newsletters, and a SEARCH box.

Source: [CNN.com/health. http://www.cnn.com/2003/HEALTH/02/22/transplant.error/](http://www.cnn.com/2003/HEALTH/02/22/transplant.error/). February 23, 2003.

Continuum of Data Quality

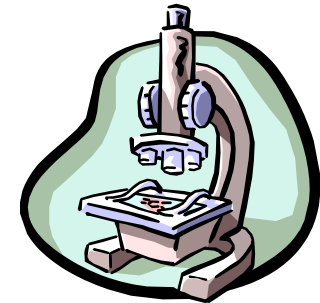
INCREASING DATA QUALITY



Unusable Data



**Real World
Information**



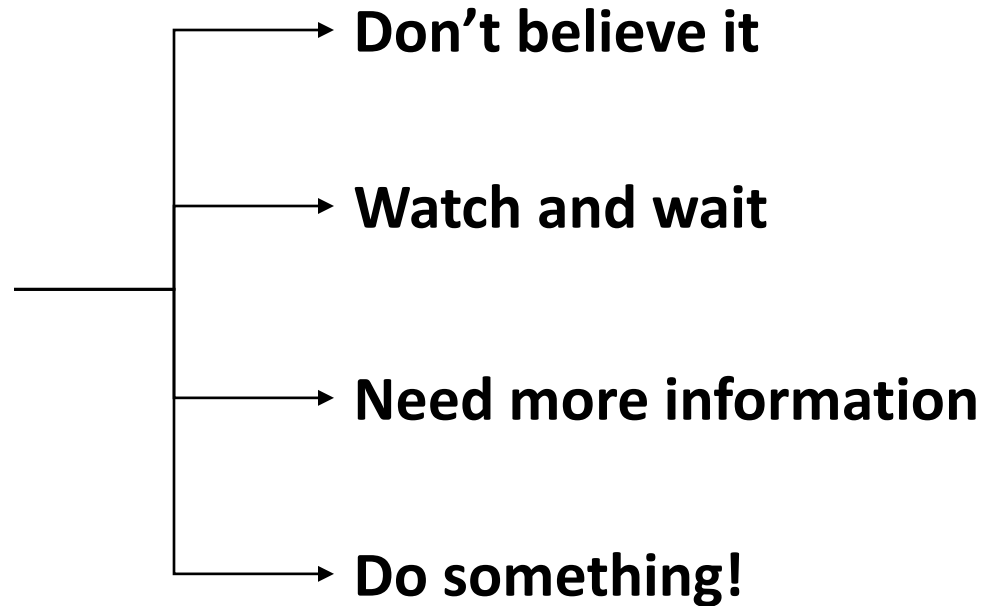
**Research Caliber
Information**

DECREASING ERROR



When Confronted with Data...

You...



Who Collects the Data?

- You
- Not you
 - He/she reports to you
 - He/she does not

Authority

Influence




Data Substrates

E.g., Operating Room Time Outs

Substrate	
Administrative:	<i>Number of coded wrong site surgeries</i>
Hybrid:	<i>Number of coded wrong site surgeries + occurrence reports</i>
Medical records:	<i>Percent of charts with time outs documented</i>
Surveys:	<i>Percent of surgeons reporting they always complete time outs</i>
Observation studies:	<i>Percent of OR cases where observer notes correct time out</i>
Qualitative:	<i>Focus group of OR Nurses</i>
Etc.	



What Data Collection Instrument Will You Use?


HOSPITAL SURVEY ON PATIENT SAFETY CULTURE

INSTRUCTIONS

This survey asks for your opinions about patient safety issues, medical error, and event reporting in your hospital and will take about 10 to 15 minutes to complete.

If you do not wish to answer a question, or if a question does not apply to you, you may leave your answer blank.

- An "event" is defined as any type of error, mistake, incident, accident, or deviation, regardless of whether or not it results in patient harm.
- "Patient safety" is defined as the avoidance and prevention of patient injuries or adverse events resulting from the processes of health care delivery.

SECTION A: Your Work Area/Unit

In this survey, think of your "unit" as the work area, department, or clinical area of the hospital where you spend most of your work time or provide most of your clinical services.

What is your primary work area or unit in this hospital? Mark ONE answer by filling in the circle.

a. Many different hospital units/No specific unit

b. Medicine (nonsurgical) g. Intensive care unit (any type) l. Radiology

c. Surgery h. Psychiatric/mental health m. Anesthesiology

d. Obstetrics i. Rehabilitation n. Other, please specify:

e. Pediatrics j. Pharmacy

f. Emergency department k. Laboratory

Please indicate your agreement or disagreement with the following statements about your work area/unit. Mark your answer by filling in the circle.

Think about your hospital work area/unit...	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
1. People support one another in this unit.....	1	2	3	4	5
2. We have enough staff to handle the workload.....	1	2	3	4	5
3. When a lot of work needs to be done quickly, we work together as a team to get the work done.....	1	2	3	4	5
4. In this unit, people treat each other with respect.....	1	2	3	4	5
5. Staff in this unit work longer hours than is best for patient care....	1	2	3	4	5
6. We are actively doing things to improve patient safety.....	1	2	3	4	5
7. We use more agency/temporary staff than is best for patient care.....	1	2	3	4	5
8. Staff feel like their mistakes are held against them.....	1	2	3	4	5
9. Mistakes have led to positive changes here.....	1	2	3	4	5
10. It is just by chance that more serious mistakes don't happen around here.....	1	2	3	4	5
11. When one area in this unit gets really busy, others help out.....	1	2	3	4	5
12. When an event is reported, it feels like the person is being written up, not the problem.....	1	2	3	4	5

1

- ← Background
- ← Definitions
- ← Instructions
- ← Stratification variables
- ← Categorical capture

AHRQ Hospital Patient Safety Culture Survey

Current Version 2.0 available at,
<https://www.ahrq.gov/sites/default/files/wysiwyg/sops/surveys/hospital/SOPS-Hospital-Survey-2.0-5-26-2021.pdf>



Useful Features of “Small” IT

- Microsoft® Excel
 - Data entry control
 - Pivot tables
 - Reporting
 - Graphing
 - Statistical functions
- Microsoft® Power Point
 - Flow diagrams
 - Table templates



What Measures Will You Use?

- They exist
 - Literature
 - National Quality Forum endorsed: e.g., Quality Positioning System™. <http://www.qualityforum.org/QPS>
 - Professional organizations: e.g., Society of Thoracic Surgeons
 - Niche/proprietary entities: e.g., National Perinatal Information Center
 - Others
- They do not



Benchmarks

- What is the goal?
 - Perfection
 - Near perfection
- Where does it come from?
- Who sets it?



Presenting the Message

You are the Messenger

- What you will say?
 - What is your message?
 - Who is the audience?
 - What are their sensibilities?
- What they will say...
 - Is this bad or good?
 - Shouldn't we be at 0?
 - How do we compare to others?
 - What do you plan to do about this?



Data Appearances Matter...



Colorful vs. Meaningful

PEDIATRICS OVERVIEW

LWOBS=Left without being seen | LOS=Length of stay
 The clustering below identifies frequent short-stay patients (green cluster) vs. extended-stay patients (yellow cluster)

135,113
Admissions

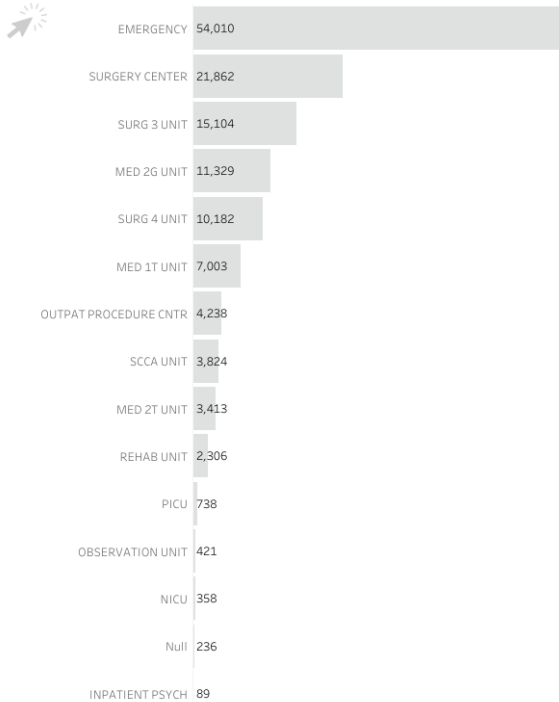
133,769
Discharges

1,013
Patients LWOBS

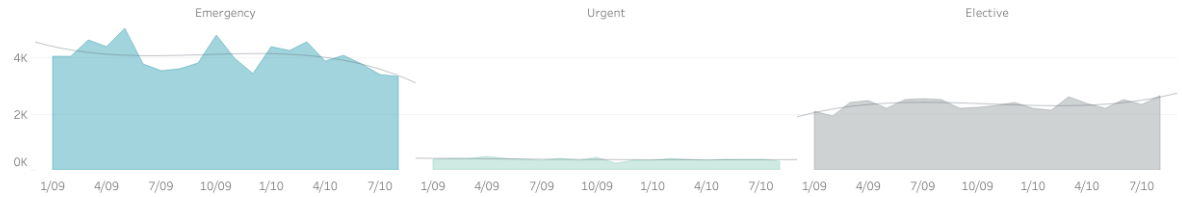
0.7%
% LWOBS

3.5
Avg. Hospital LOS Bed Days

Encounters by Department



Monthly Encounters



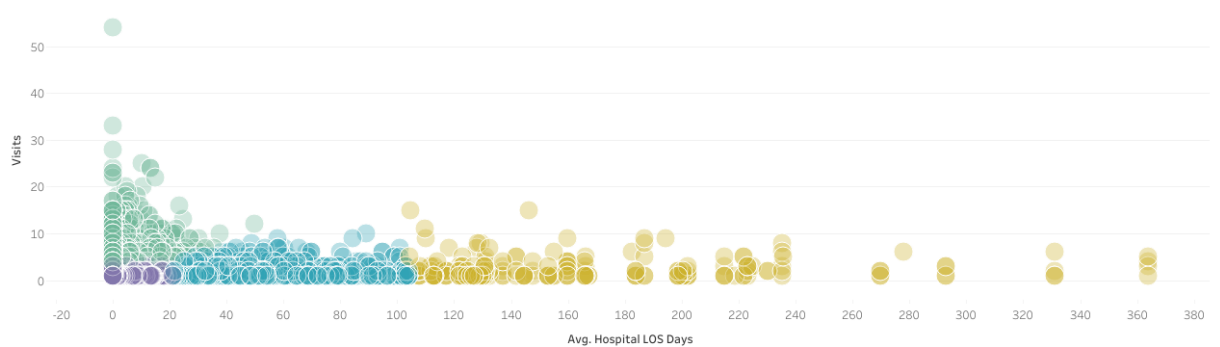
52,382
Cluster 1

2,422
Cluster 2

493
Cluster 3

45
Cluster 4

Patients by Visits & Length of Stay



Design | Bridget Cogley

tableau

Navigation icons

Tableau. <http://www.tableau.com/stories/gallery>. Tableau Viz Gallery. Accessed February 10, 2023

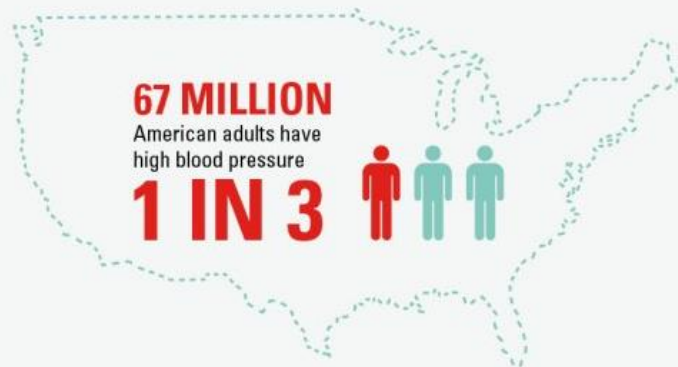


A SNAPSHOT: BLOOD PRESSURE IN THE U.S.

Make Control Your Goal

High blood pressure is a major risk factor for heart disease and stroke, the first and fourth leading causes of death for all Americans.

◀ HIGH BLOOD PRESSURE BASICS ▶

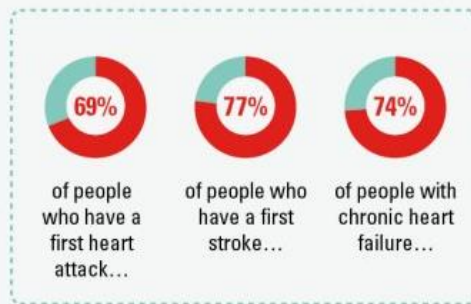


High blood pressure
contributes to
~1,000
DEATHS/DAY

When your blood pressure is **high**:

You are **4x** more likely to die from a stroke

You are **3x** more likely to die from heart disease



**HAVE
HIGH
BLOOD
PRESSURE**

Annual estimated costs associated with high blood pressure:

\$51 BILLION

\$47.5 BILLION
in direct medical expenses



Infographics



It's Best to Keep it Simple...

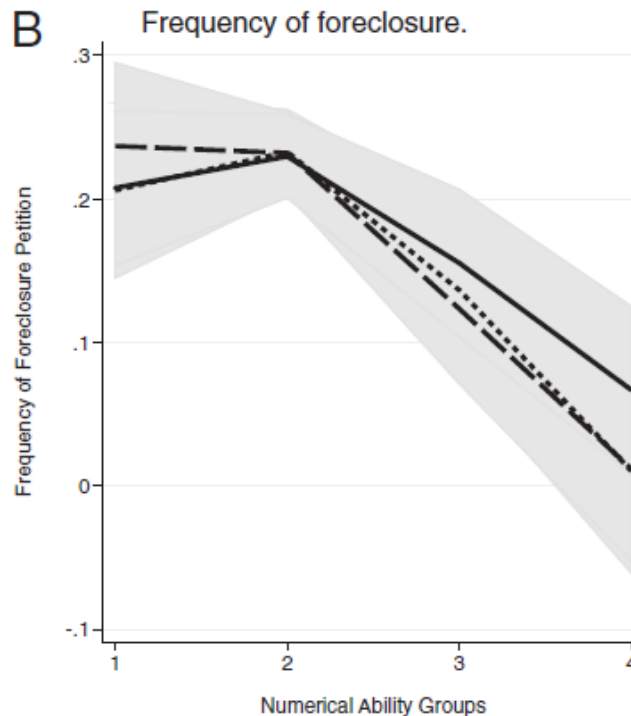
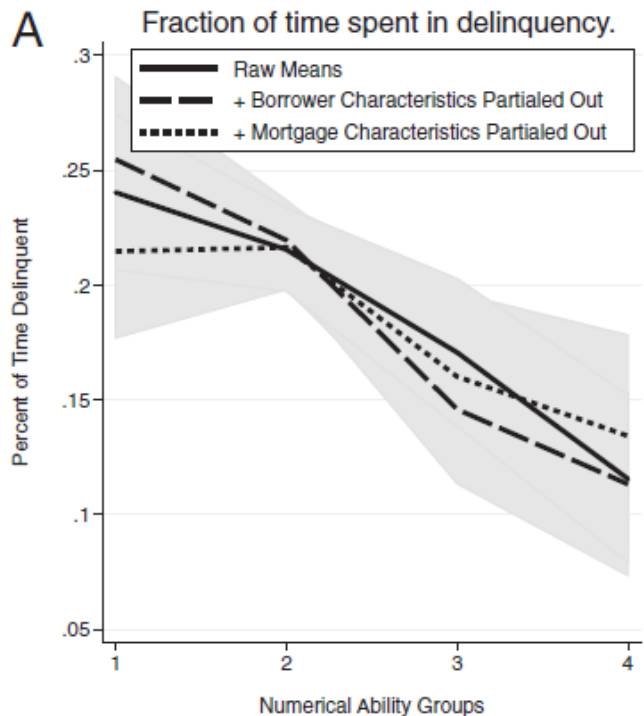


Data Literacy Has Consequences

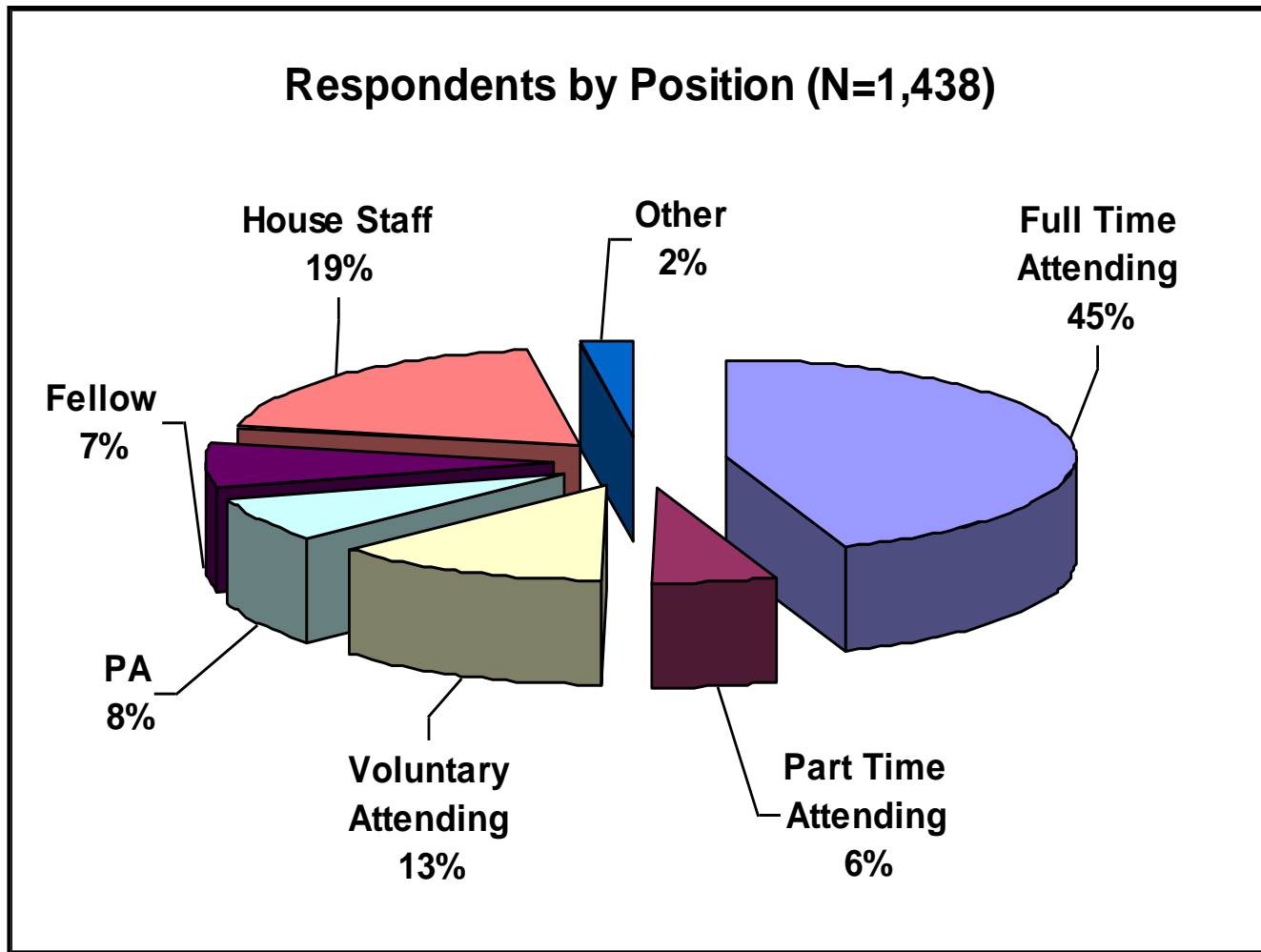
Numerical ability predicts mortgage default

- Financial literacy question examples:
 - “If 5 people all have the winning numbers in the lottery and the prize is \$2 million, how much will each of them get?”
 - Let's say you have \$200 in a savings account. The account earns ten per cent interest per year. How much will you have in the account at the end of two years?”

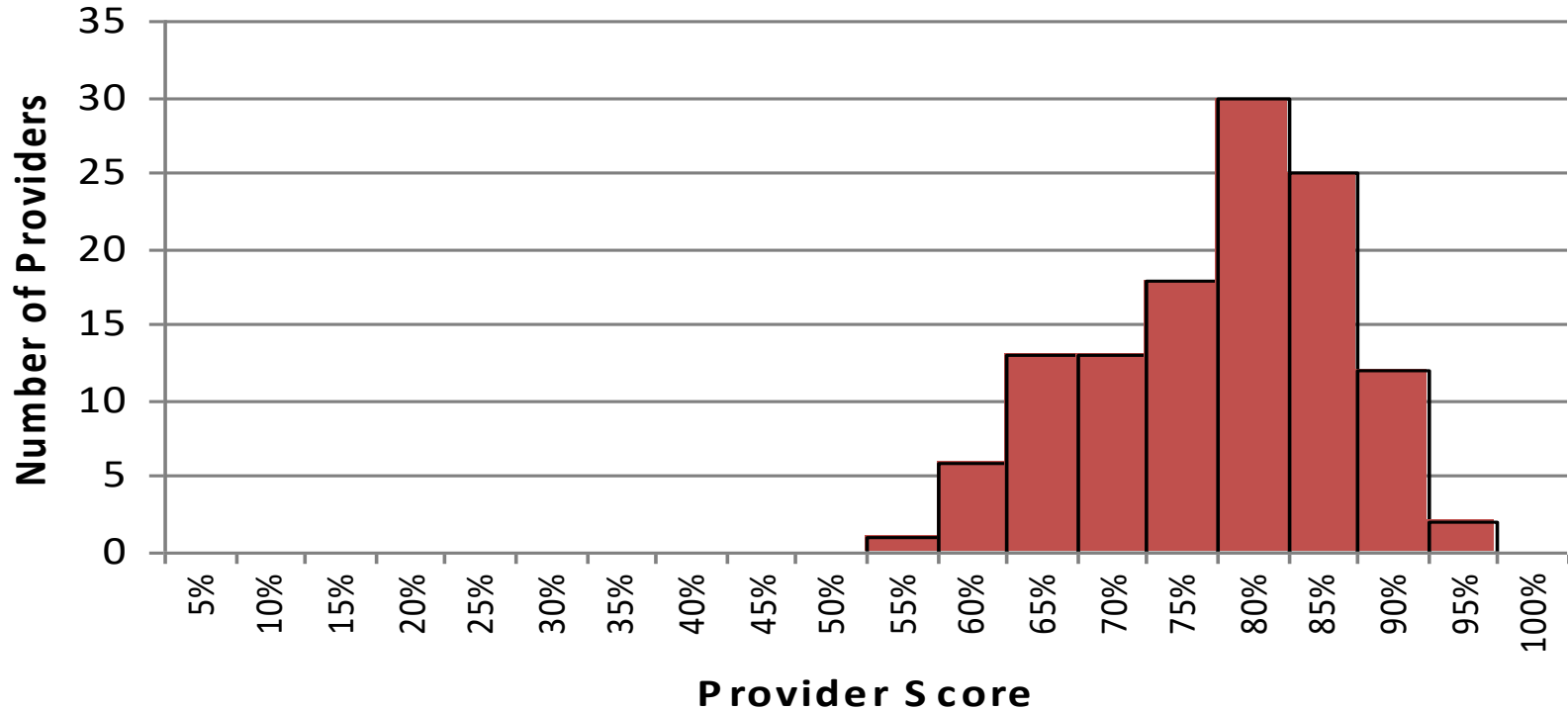
Gerardi K, et al. *Proceedings of the National Academy of Sciences*. 2013;110(28):11267–11271



Simple Data is OK



“Raw” Data can be Useful

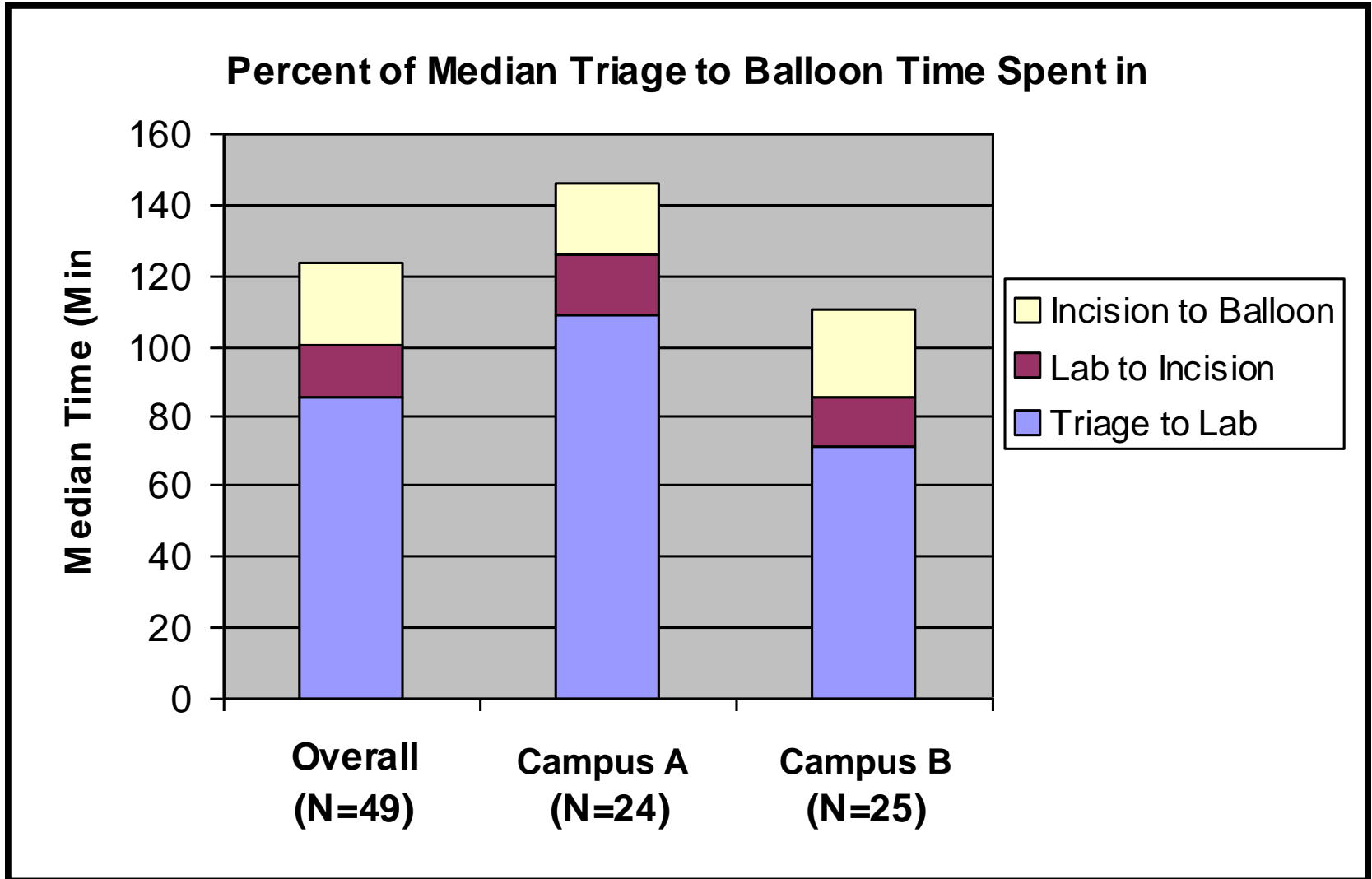


Total number of providers = 120

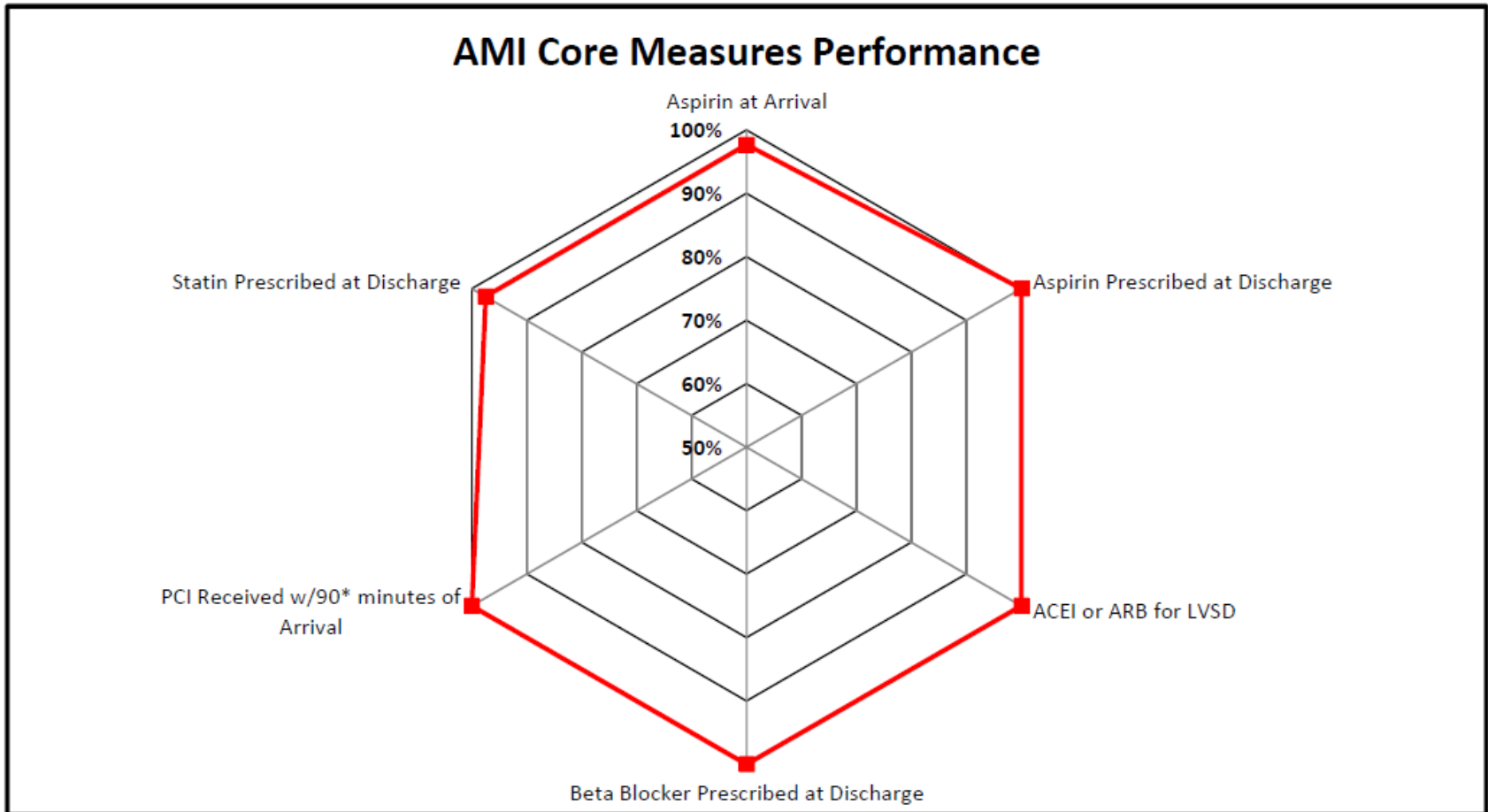
- **Mean provider score: 76%**
- **Median provider score: 78%**
- **Standard deviation: 9%**
- **Provider score range: 54% - 91%**



Data Drives Group Dynamics



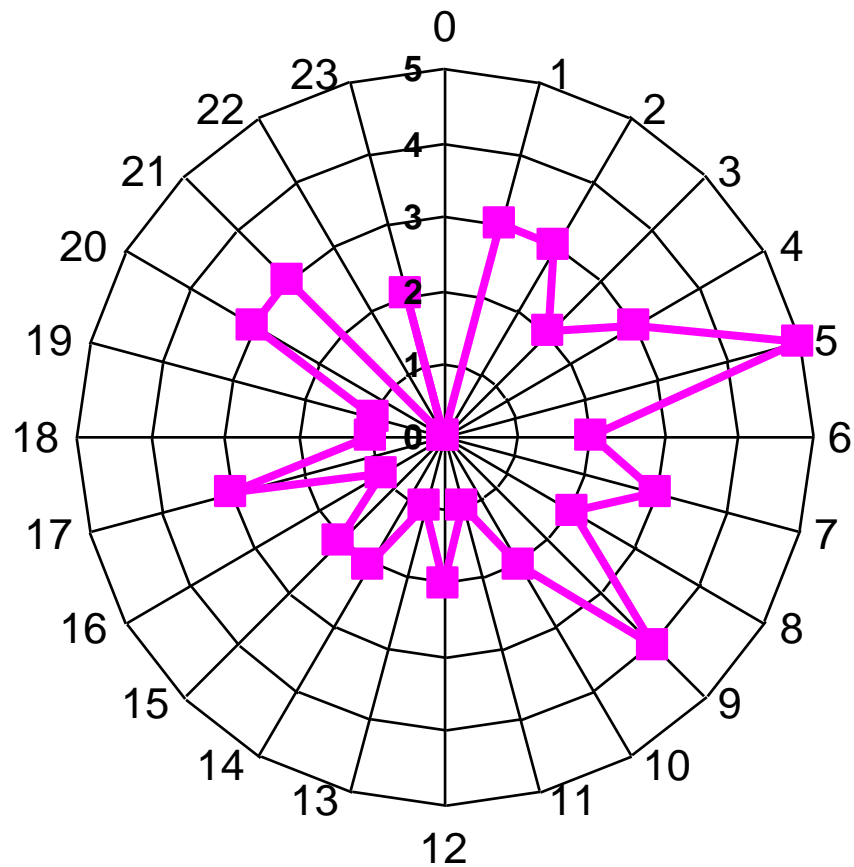
Data and “Simplification”



Source: Organizational Clinical Effectiveness Group, Stamford Health



Falls by Hour of Day



A Brief Case Study

“Since the Spring of 2023, we’ve placed a great emphasis on interdisciplinary teamwork, standardized care processes, and re-educated physicians on best practices. As a result, our cesarean rates have dropped significantly.”

Is this true?



Cesarean Delivery Rates*

Year	Month	C-Rate	Year	Month	C-Rate
2022	Jan	32.3%	2023	Jan	35.6%
	Feb	33.4%		Feb	34.4%
	Mar	31.7%		Mar	34.7%
	Apr	30.8%		Apr	35.1%
	May	33.5%		May	31.9%
	Jun	34.8%		Jun	30.7%
	Jul	35.7%		Jul	32.3%
	Aug	33.7%		Aug	31.4%
	Sep	33.2%		Sep	31.9%
	Oct	32.8%		Oct	32.0%
	Nov	32.2%		Nov	32.2%
	Dec	31.9%		Dec	31.7%

**Fictitious data*

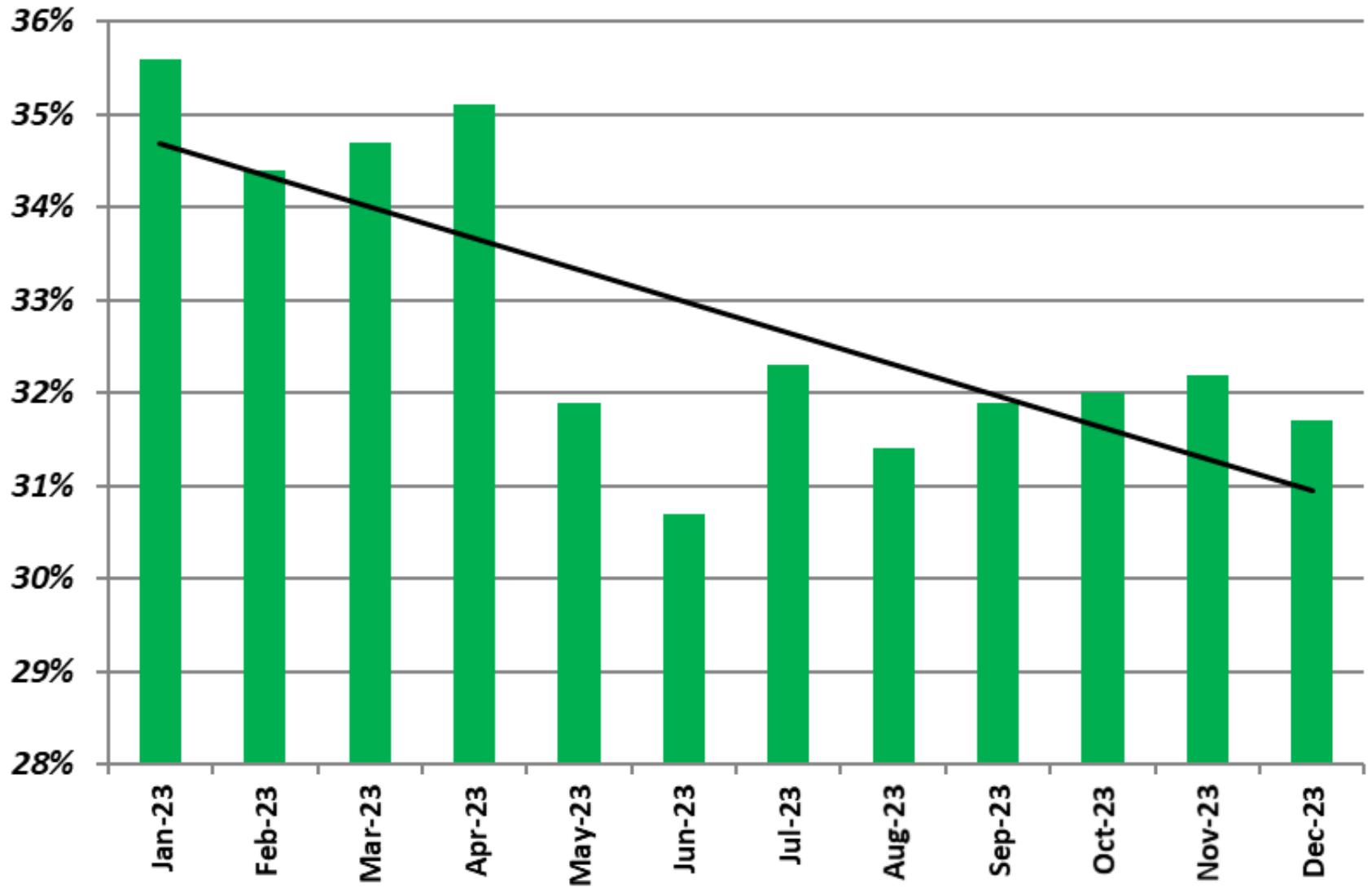


Cesarean Delivery Rates

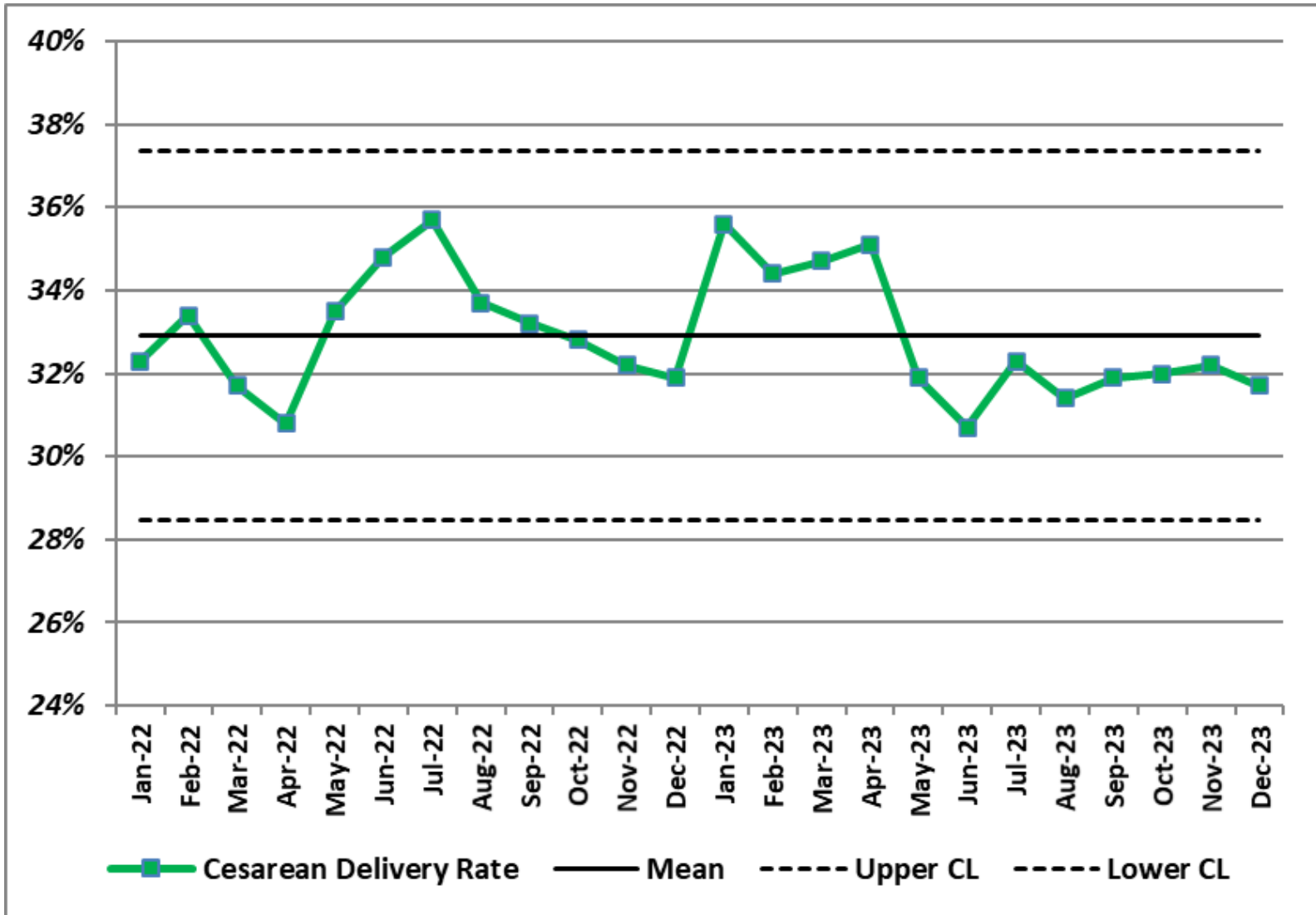
Year	Month	C-Rate	Year	Month	C-Rate
2022	Jan	32.3%	2023	Jan	35.6%
	Feb	33.4%		Feb	34.4%
	Mar	31.7%		Mar	34.7%
	Apr	30.8%		Apr	35.1%
	May	33.5%		May	31.9%
	Jun	34.8%		Jun	30.7%
	Jul	35.7%		Jul	32.3%
	Aug	33.7%		Aug	31.4%
	Sep	33.2%		Sep	31.9%
	Oct	32.8%		Oct	32.0%
	Nov	32.2%		Nov	32.2%
	Dec	31.9%		Dec	31.7%



Cesarean Delivery Rate, 2023



“Control Chart”



Summary Considerations

- Data sources
 - Drive divergent conclusions
 - Suboptimal data can be better than nothing
- Numbers
 - Large N not always needed for action
 - Adequate subgroup n can be a big “saver”
- Results
 - You shape the take home message
 - Statistics not always helpful
- Display
 - Influences perception
 - Keep it simple
 - Beware of the red / yellow / green tyranny



Data Use is a Continuous Learning Process

