SOUTHERN ILLINOIS UNIVERSITY EDWARDSVILLE

Missouri Baptist MEDICAL CENTER
BJC HealthCare

A PROTOCOL TO MEASURE NURSING ELECTRONIC HEALTH RECORD USABILITY

SATISFACTION, EFFICIENCY, & EFFECTIVENESS

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DISCLOSURES AND LEARNING OBJECTIVES

Disclosures:

Drs. Lyerla and Durbin, who are faculty at the Southern Illinois University Edwardsville School of Nursing, have no real or apparent conflicts of interest to report. This study was funded by a Missouri Baptist Medical Center Nurse / Faculty Collaborative Grant.

Learning Objectives:

1. Identify the critical components of electronic health record usability from a nursing perspective;
2. Describe a method for measuring nursing usability of an electronic health record.

BACKGROUND

- American Recovery and Reinvestment Act (2009)

Hospital EHR Adoption	Percent of Hospitals with EHR						
	2008	2009	2010	2011	2012	2013	2014
All Hospitals with a Basic EHR with Clinician Notes	9%	12%	16%	28%	44%	59%	76%

HealthIT.gov, Digital Dashboard: Non-federal Acute Care Hospital Electronic Health Record Adoption Retrieved on June 14th 2015 from:

http://dashboard.healthit.gov/quickstats/pages/FIG-Hospital-EHR-Adoption.php

PROBLEM / PURPOSE

- Government mandates for meaningful use of electronic health records have resulted in wide-spread purchase of hospital information systems.
- Organizations are faced with the challenge of modifying existing systems or selecting new systems that meet their needs.
- A key contributor to safe and effective use of technology is Usability.
- Literature regarding nursing usability is minimal.
- The usability of an electronic health record from a nursing perspective has not been measured using a quantitative protocol when choices are made to acquire new or modify old information systems.

USABILITY

- The usability of an EHR is defined by the National Institute of Standards and Technology as the extent to which a product can be used to achieve the goals of **efficiency**, **effectiveness**, and user **satisfaction**. (Lowry et al, 2012)

Effectiveness: The accuracy and completeness with which a user can achieve task goals.

Efficiency: The speed with which a user can successfully accomplish the task at hand.

Satisfaction: A person's subjective response to their interaction with a system.

(Belden, 2009)

PARTNERSHIP

- Barnes Jewish Healthcare St. Louis Missouri
- Two Primary Facilities and Eight Community Hospitals including Missouri Baptist Medical Center
- Southern Illinois University Edwardsville School of Nursing

STUDY PHASES

- **Phase 1**: Nurse focus group sessions to identify usability concerns and select a **satisfaction** survey

- **Phase 2**: Develop a protocol that measures

  effectiveness, **efficiency, satisfaction**

CASE SCENARIOS

1. Pneumonia 2. CVA 3. CHF

Eight Tasks for Each Scenario

1. Results Look up
2. Care Organization
3. Assessment
4. Care Plan
5. Problem List
6. Medication Administration
7. Order Entry
8. Discharge

PARTICIPANTS (N=31)

	PN (n=15) Avg (Std Dev) Range	CHF (n=15) Avg (Std Dev) Range	CV (n=15) Avg (Std Dev) Range
Age	42.4 (12.9) 23-64	39.1 (12.2) 23-64	36.4 (7.9) 27-55
Years Using System	6.0 (3.0) 2-10	5.8 (3.1) 2-10	7.2 (2.2) 4-10
Years RN	11.9 (8.9) 2-30	9.8 (7.8) 2-28	10.7 (8.6) 3-35

PARTICIPANT TESTING EFFICIENCY: FOUR MEASURES

- TRACKED **TIME**, **KEYSTROKES**, **MOUSE CLICKS** AND **MOUSE MOVEMENT** FOR EACH PARTICIPANT FOR EACH MODULE
- TIME = sum of time tracked for each all eight tasks for each scenario

  (Task 1 time + Task 2 time + Task 3 time + Task 4 time + Task 5 time + Task 6 time + Task 7 time + Task 8 time)
- KEYSTROKES = sum of key strokes tracked for all eight tasks
- MOUSE CLICKS = sum of mouse clicks tracked for all eight tasks
- MOUSE MOVEMENT* = sum of mouse movement tracked for all eight tasks

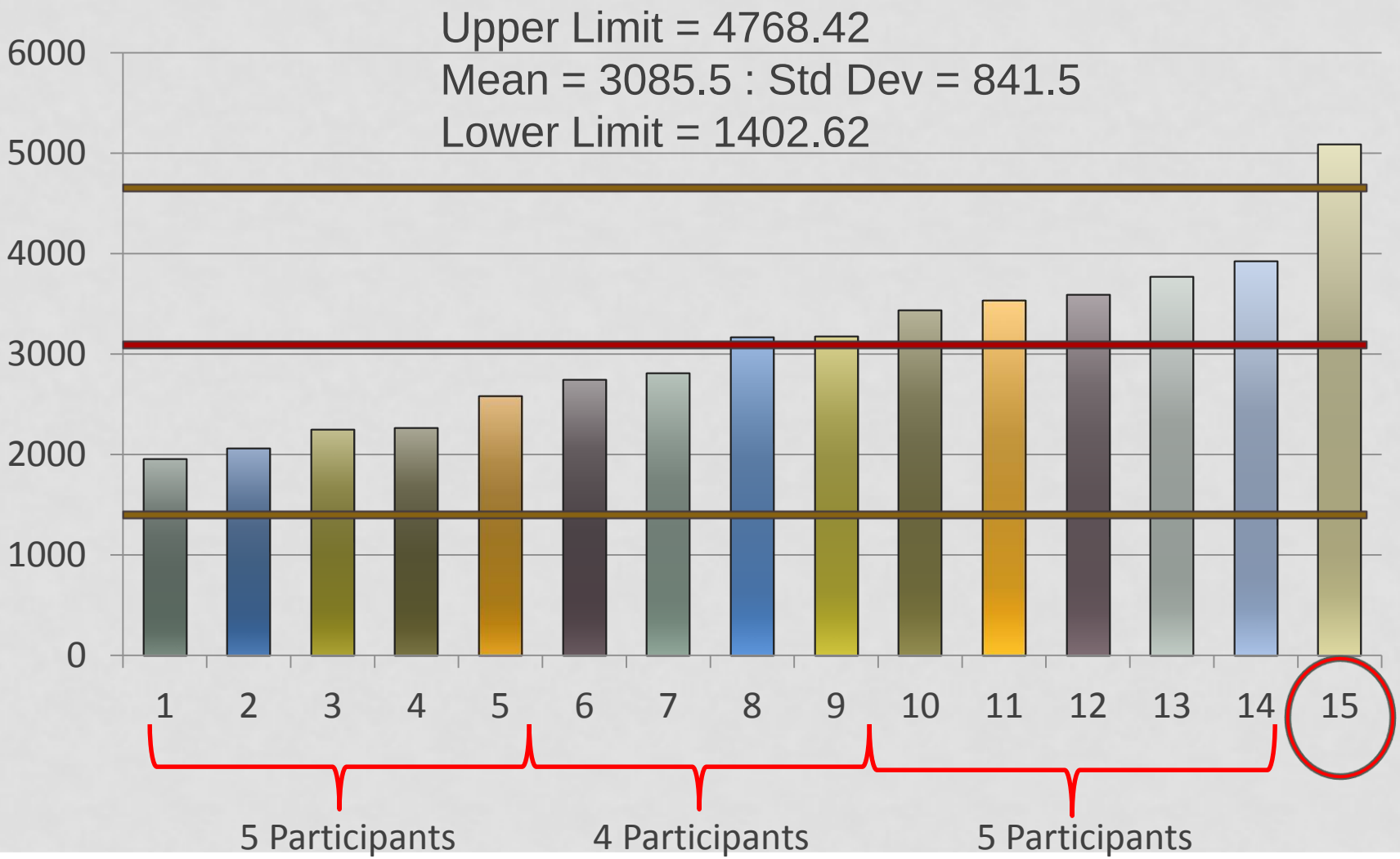
**Mouse Movement is Pixels*

EFFICIENCY CATEGORIZATION

- Rank order from lowest to highest (all four measures)
- Calculate Range (Highest – Lowest)
- Remove any participant's results with ± 2 std dev of the mean (outlier)
- Divide the Range into thirds (33.33%)
- Categorize participants based on whether they fall into
  - Not efficient – those in the highest third = 1 point
  - Efficient – those in the middle third = 2 points
  - Very efficient – those in the lowest third = 3 points

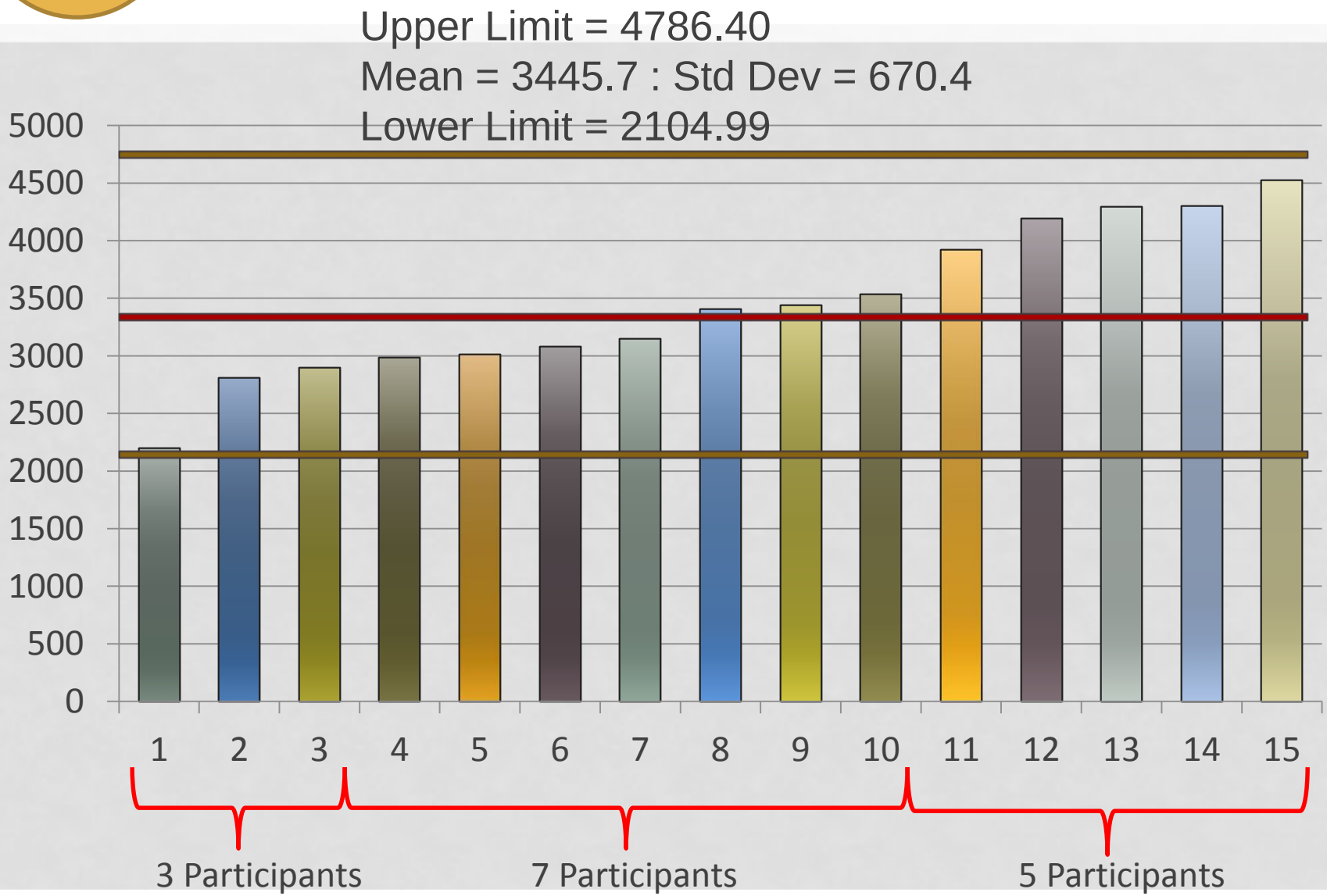
PN

EFFICIENCY: TIME



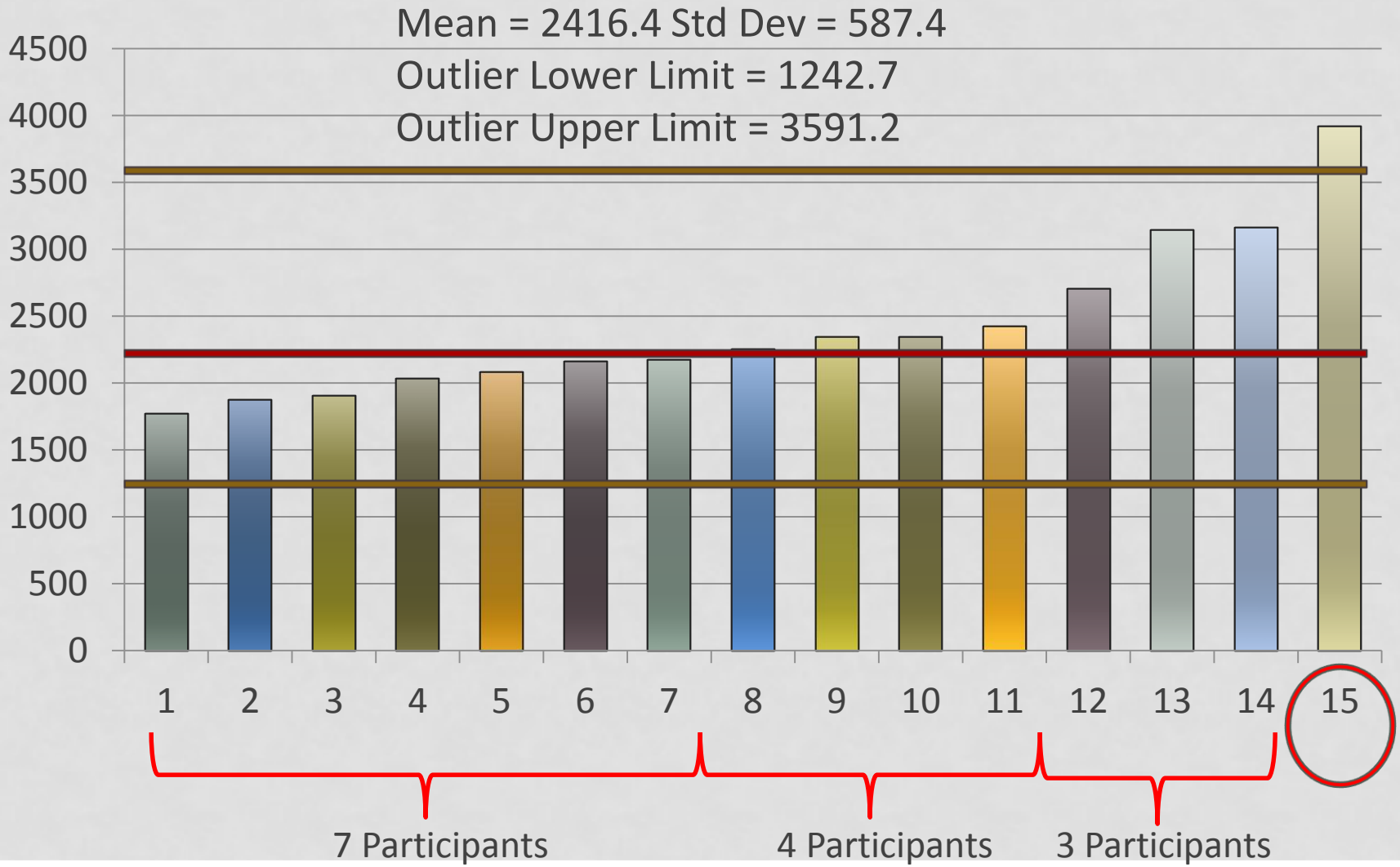
CVA

EFFICIENCY: TIME



CHF

EFFICIENCY: TIME



PN, CVA, CHF

EFFICIENCY SCORING (TIME)

- Determine the number of participants in each category and assign the appropriate value. Add the scores together and divide by the highest possible score and multiply by 3.
- Number of participants (N) multiplied by highest score possible which is 3 (Very Efficient).
- Example: Remove outlier from Total Time and our N = 14 for PN and CHF, N = 15 for CVA
- Multiply : (N) * 3 = (the highest score possible). ***(N) This Study: PN and CHF = 42, CVA = 45***
- **PN Score:** *Very efficient (3) = 5 participants, Somewhat (2) = 4, Not efficient (1) = 5*

  5 * 3 = (15) + 4 * 2 = (8) + 5 * 1 = (5) = 28/42 = 66.67 * 3 = **2.0**
- **CVA Score** *:* *Very efficient (3) = 3 participants, Somewhat (2) = 7, Not efficient (1) = 5*

  9+14+5=28/45 62.2 * 3 = **1.87**
- **CHF Score** *:* *Very efficient (3) = 7 participants, Somewhat (2) = 4, Not efficient (1) = 3*

  21+8+3=32/42 = 76.2 * 3 = **2.29**

GRADING SCALE

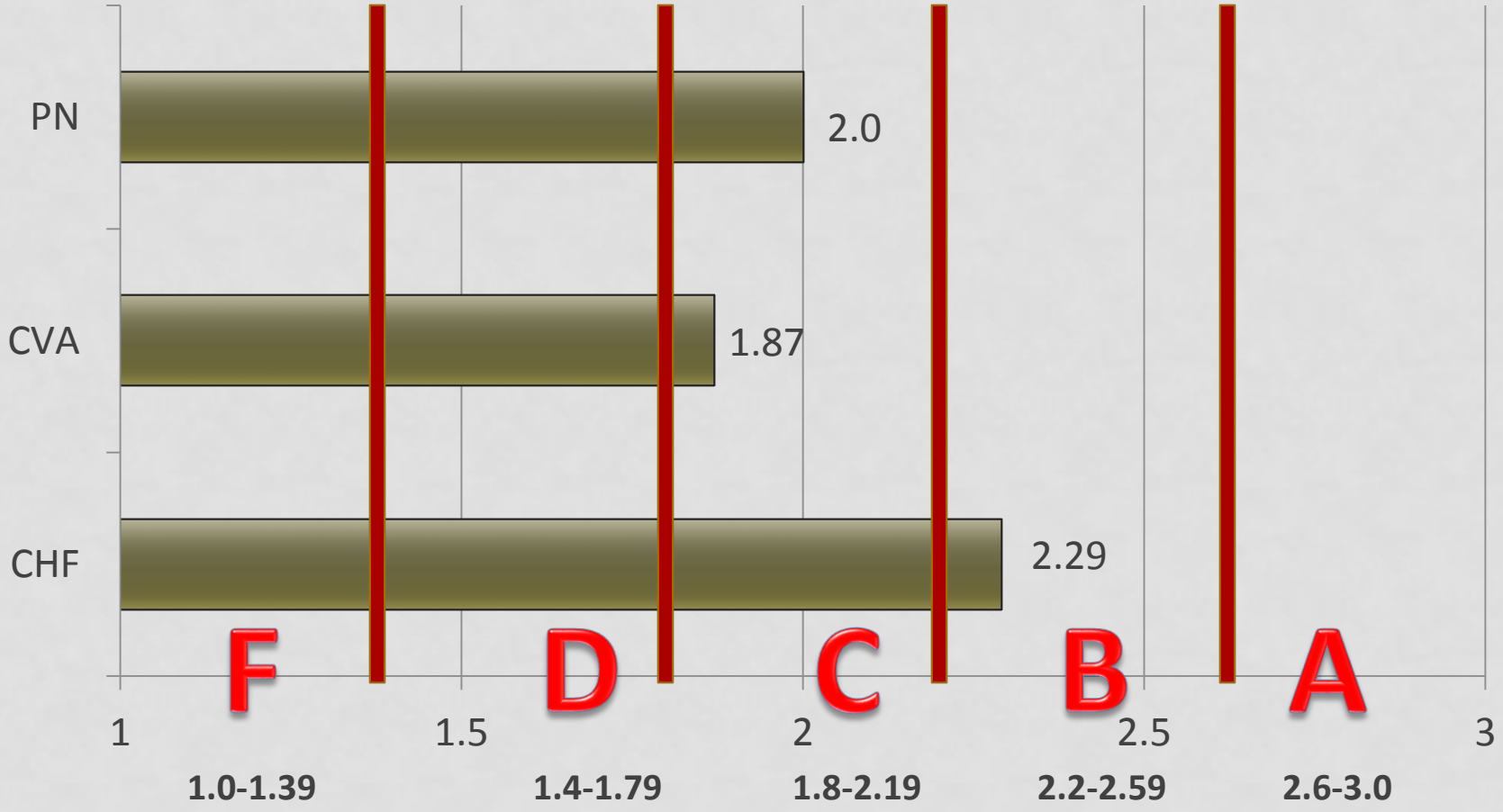
- Baseline scores were measured on Efficiency, Effectiveness, and Satisfaction but each of the scales for these variables was different.
- Efficiency was determined by combining overall time to complete the 8 tasks for each scenario, number of mouse clicks, number of keystrokes, and amount of mouse movement.
- Effectiveness was determined by counting the number of errors each participant made while documenting the requested information from the scenario.
- Satisfaction was determined by scoring a Likert satisfaction scale.
- We needed to be able to compare the results across the variables in order to make an assessment of the overall usability while retaining the individual variable measurement, hence a 4-point grading scale.

EFFICIENCY SCORE (TIME) BY SCENARIO

Letter	GP Range
A	3.5-4.0
B	2.5-3.4
C	1.5-2.4
D	1.0-1.4
F	0.0-0.9

- Pneumonia: 2.0 Grade = C GP = 2.0
- CVA: 1.86 Grade = C GP = 2.0
- CHF: 2.29 Grade = B GP = 3.0

EFFICIENCY GRADING SCALE (TIME)



PN, CVA, CHF

EFFICIENCY SCORING (TIME/KEYSTROKES/MOUSE CLICKS/MOUSE MOVEMENT)

	Time	Keystrokes	Mouse Clicks	Mouse Mvt
PN	2.0	2.07	2.14	2.29
CVA	1.86	2.21	2.33	1.86
CHF	2.29	2.13	2.27	2.29

GRADE (GRADE POINTS)

	Time	Keystrokes	Mouse Clicks	Mouse Mvt	Combined GPA (4.0 scale)
PN	C (2)	C (2)	C (2)	B (3)	**2.25 = C**
CVA	C (2)	B (3)	B (3)	C (2)	**2.50 = B**
CHF	B (3)	C (2)	B (3)	B (3)	**2.75 = B**

EFFECTIVENESS

- TRACKED THE NUMBER OF ERRORS ACROSS ALL EIGHT TASKS. TWO TYPES OF ERROR:

  (1) Failure to complete and (2) Interpretation

- OPERATIONALIZED: PARTICIPANTS CATEGORIZED BASED ON SUM OF ALL ERRORS FOR ALL 8 TASKS

  NOT EFFECTIVE = 2 or more ERRORS

  SOMEWHAT EFFECTIVE = 1 ERROR

  VERY EFFECTIVE = 0 ERRORS

EFFECTIVENESS RESULTS (N=15)

	Zero Errors (3 points)	One Error (2 points)	Two or More Errors (1 point)
PN	12 participants	1 participants	2 participants
CVA	7 participants	7 participants	1 participants
CHF	7 participants	6 participants	2 participants

PN, CHF, CVA

EFFECTIVENESS SCORING

- Determine the number of participants in each category and assign the appropriate value. Add the scores together and divide by the highest possible score and multiply by 3.
- Add the total number of errors committed for each participant for each scenario

**Note: Level of error severity was not calculated due to subjective nature of the calculation*

- **Use the scale below to determine score**
- **PN Score:** *Very effective (3) = 12 participants, Somewhat (2) = 1, Not effective (1) = 2*

  36+2+2 = 40/45 = 88.89 * 3 = 2.67
- **CVA Score** *:* *Very effective (3) = 7 participants, Somewhat (2) = 7, Not effective (1) = 1*

  21+14+1 = 36/45 = 80.00 * 3 = 2.40
- **CHF Score** *:* *Very effective (3) = 7 participants, Somewhat (2) = 6, Not effective (1) = 2*

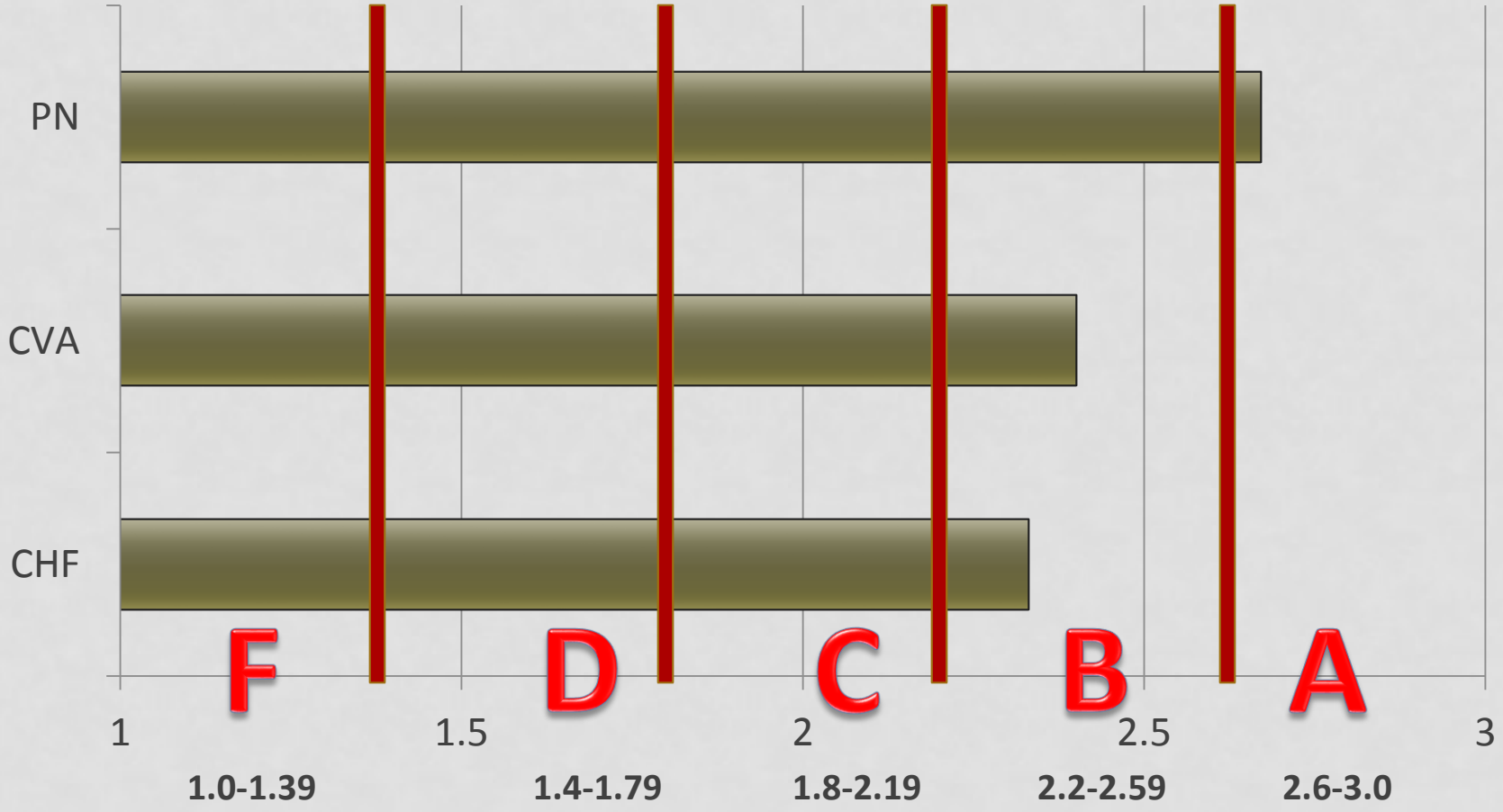
  21+12+2 = 35/45 = 77.78 * 3 = 2.33

EFFECTIVENESS SCORE BY SCENARIO

Letter	Grade Point Scale
A	3.5-4.0
B	2.5-3.4
C	1.5-2.4
D	1.0-1.4
F	0.0-0.9

- Pneumonia: 2.67 Grade = A GP = 4.0
- CVA: 2.40 Grade = B GP = 3.0
- CHF: 2.33 Grade = B GP = 3.0

EFFECTIVENESS GRADING SCALE



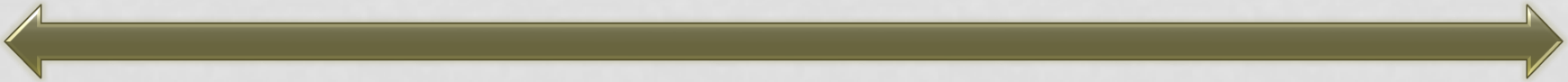
SATISFACTION SCALE

System Usability Scale (SUS) (John Brooke, 1986)

- Free
- Simple (10 items)
- Researchers report it to be valid and reliable
- Produces a score (0-100) representing a composite measure of the overall usability of the system being studied
- Good fit with focus group findings (Phase I)

SATISFACTION (SUS)

- **TEN QUESTIONS MAKE UP OVERALL SATISFACTION**
  1. I THINK THAT I WOULD LIKE TO USE THIS SYSTEM FREQUENTLY
  2. I FOUND THE SYSTEM UNNECESSARILY COMPLEX
  3. I THOUGHT THE SYSTEM WAS EASY TO USE
  4. I THINK THAT I WOULD NEED THE SUPPORT OF A TECHNICAL PERSON TO BE ABLE TO USE THIS SYSTEM
  5. I FOUND THE VARIOUS FUNCTIONS IN THIS SYSTEM WERE WELL INTEGRATED
  6. I THOUGHT THERE WAS TOO MUCH INCONSISTENCY WITH THIS SYSTEM
  7. I WOULD IMAGINE THAT MOST PEOPLE WOULD LEARN TO USE THIS SYSTEM VERY QUICKLY
  8. I FOUND THE SYSTEM VERY CUMBERSOME TO USE
  9. I FELT VERY CONFIDENT USING THE SYSTEM
  10. I NEEDED TO LEARN A LOT OF THINGS BEFORE I COULD GET ALONG WITH THIS SYSTEM



STRONGLY DISAGREE	DISAGREE	NEITHER	AGREE	STRONGLY AGREE
1	2	3	4	5

SCORING THE SUS

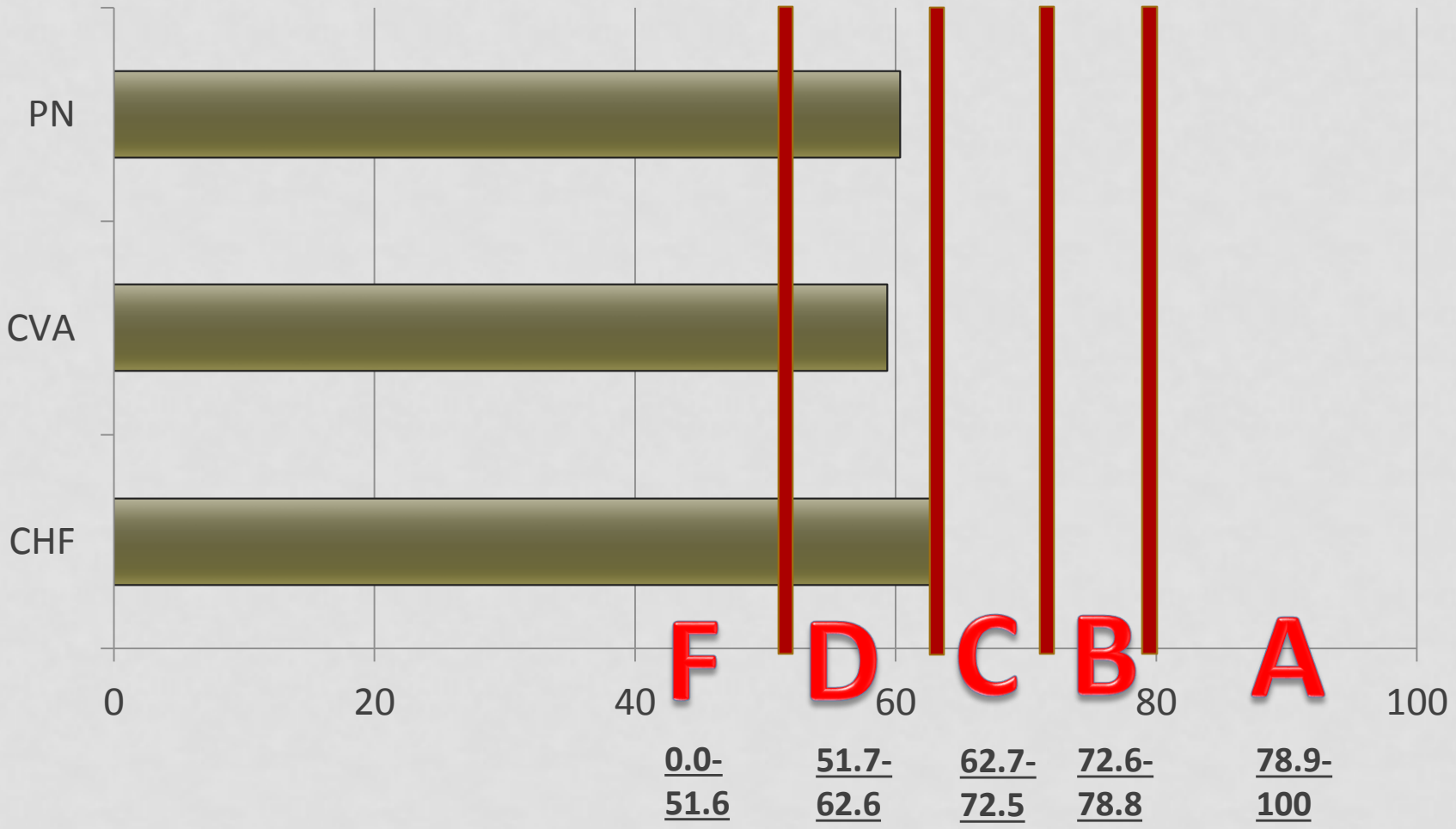
SUS Score	Percentile	Grade
78.9 - 100	85 – 100	A
72.6 - 78.8	65 – 84	B
62.7 - 64.9	35 – 64	C
51.7 - 62.6	15 - 34	D
0 – 51.6	0 – 14	F

CONVERSION SCALE: (SAURO J, 2011)

SATISFACTION SCORE BY SCENARIO

- Pneumonia: 60.33 Grade = D GP = 1.0
- CVA: 59.33 Grade = D GP = 1.0
- CHF: 62.67 Grade = D GP = 1.0

OVERALL SATISFACTION GRADE BY SCENARIO



PN, CVA, CHF

OVERALL USABILITY GRADE

	Efficiency	Effectiveness	Satisfaction	Combined GPA
PN	C (2.0)	A (4.0)	D (1.0)	**C (2.33)**
CVA	B (3.0)	B (3.0)	D (1.0)	**C (2.33)**
CHF	B (3.0)	B (3.0)	D (1.0)	**C (2.33)**

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