

# Systematically Gathering Clinician Opinions: Linking User Needs to Health Care Innovation

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# Introduction to Q

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- ▶ Q-methodology
  - ▶ Mixed method technique
  - ▶ Dependency analysis
    - ▶ Multivariate analysis with no a priori variable definitions
  - ▶ Measures “significances” between people



# Audience Poll

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- ▶ #1: Are you familiar with **factor analysis**?
  - ▶ Yes
  - ▶ No
  
- ▶ #2: Have you ever heard of **Q-methodology**?
  - ▶ Yes
  - ▶ No



# History of Q

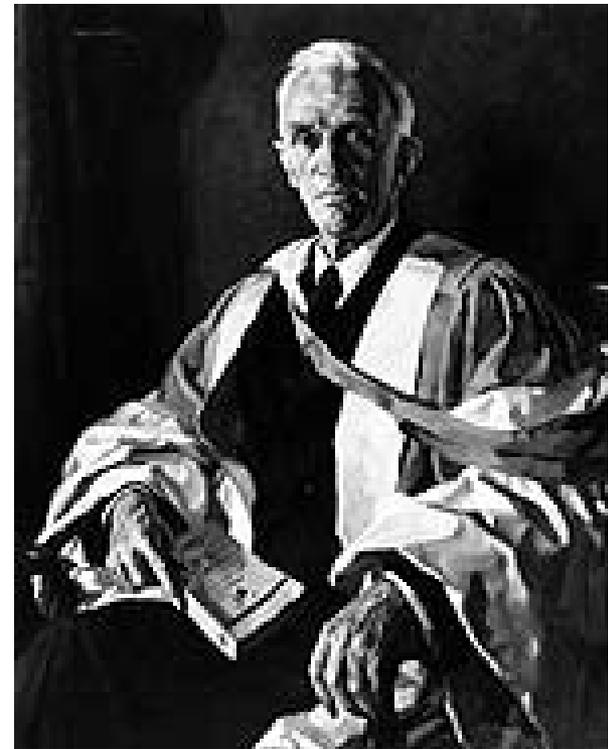
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- ▶ **William Stephenson**

- ▶ Technique of factor analysis. *Nature*, 1935: 136, 297.



Stephenson



Thomson

# Multidimensional Continuum of Research Projects

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<i>Quantitative Extreme (Post-positivist)</i>	<i>Mixed/Other</i>	<i>Qualitative Extreme (Constructivist)</i>
Objective purpose		Subjective purpose
Explanatory	Q	Exploratory
Numeric data	Q	Narrative data
Structured/close-ended	Q	Open-ended
Statistical analysis	Q	Thematic analysis
Probability sample	Q (sample is items)	Purposive sample
Deductive inference	Q (uses abductive reasoning)	Inductive inference
Value neutral	Q	Value rich

# Key Psychometric Distinctions

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Q	R
Dependency analysis	Interdependency analysis
Unit of Measure: Persons	Unit of Measure: Tests
Measures Wholes	Measures Characteristics
Population = Statements	Population = People
Similarities	Differences
No generality assumption	Generality assumption
Variates may interact	Variates do not interact
Requires forced choice	Avoids forced choice



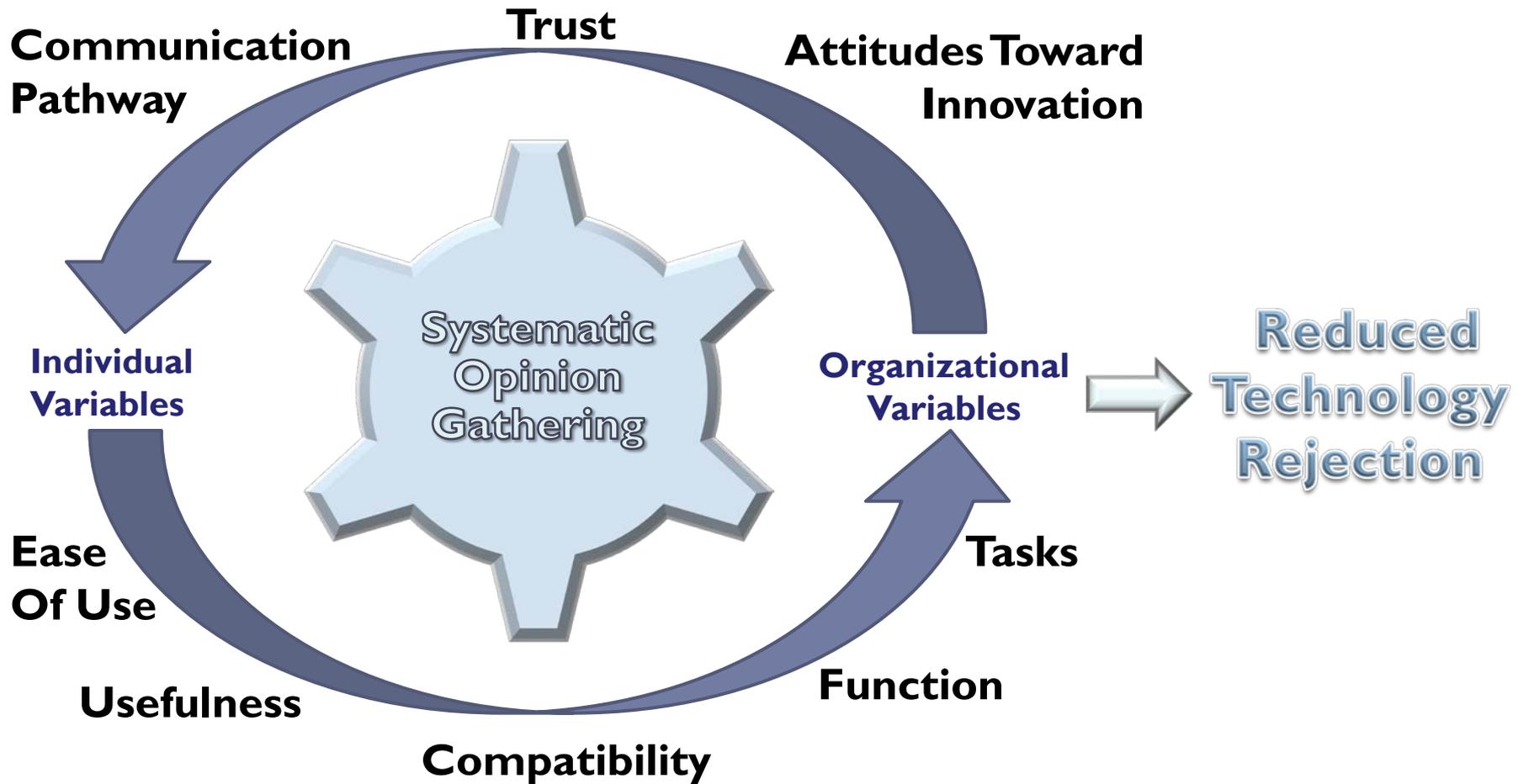
# Using Q to Study Health Care Innovation

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- ▶ Technology use in healthcare settings is a public health issue
- ▶ Technology Purchase  $\neq$  Technology Use



# Technology Adoption Variables



# Project Rationale

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Advocates for including clinician opinions in technology assessment:



**Institute of Medicine<sup>1</sup>**



**American College  
of Physicians<sup>3</sup>**

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<sup>1</sup> Donaldson M, Sox H. *Setting priorities for health technology assessment: A model process*. National Academies Press. 1992.

<sup>2</sup> Jones RJ. JAMA. 1983, 250(3) 387-388

<sup>3</sup> Feussner JR, White LJ. *Ann NY Acad Sci*. 1993 Dec 31;703:268-71.

# Research Questions

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1. Can clinician opinions be used to identify radical innovations?
2. Can clinician opinions guide prioritization of radical innovations?

**Radical Innovation** = major departures from standard practice that may **change workflow** or **professional roles**.

# Study Setting

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- ▶ **Advocate Christ Medical Center Emergency Department**
  - ▶ Situated within a 683-bed teaching hospital
  - ▶ Level I Trauma Center designation



 Advocate  
Christ Medical Center

# Study Design

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1. Concourse Development
2. Q-set/Condition of Instruction
3. Complete Q-sorts
4. Data Analysis





# Concourse To Q-set

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1. POC cardiac marker panel for 4 markers.



2. Ultrasound probes plug into Smartphones.



5. A portable head & neck CT scanner.

# Q-Set Excerpt

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1. POC cardiac marker panel for 4 markers.

5. A portable head & neck CT scanner.

2. Ultrasound probes plug into Smartphones.

6. Drug delivery through a patch.

3. POC test for sepsis risk.

7. POC metabolic panel.

4. A patient-controlled mobile health record.

8. A mobile app that assigns tasks.

9. A fully wireless 12-lead ECG.

# Condition of Instruction

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*When thinking about technology and techniques to support improving care in the emergency department, which of the following do you feel would be **most likely** / **most unlikely** to improve the care you provide?*



# Initial Sort

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Most Unlikely to  
Improve Care

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Most Likely to  
Improve Care

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I. POC cardiac marker  
panel for 4 markers.

# Final Sort

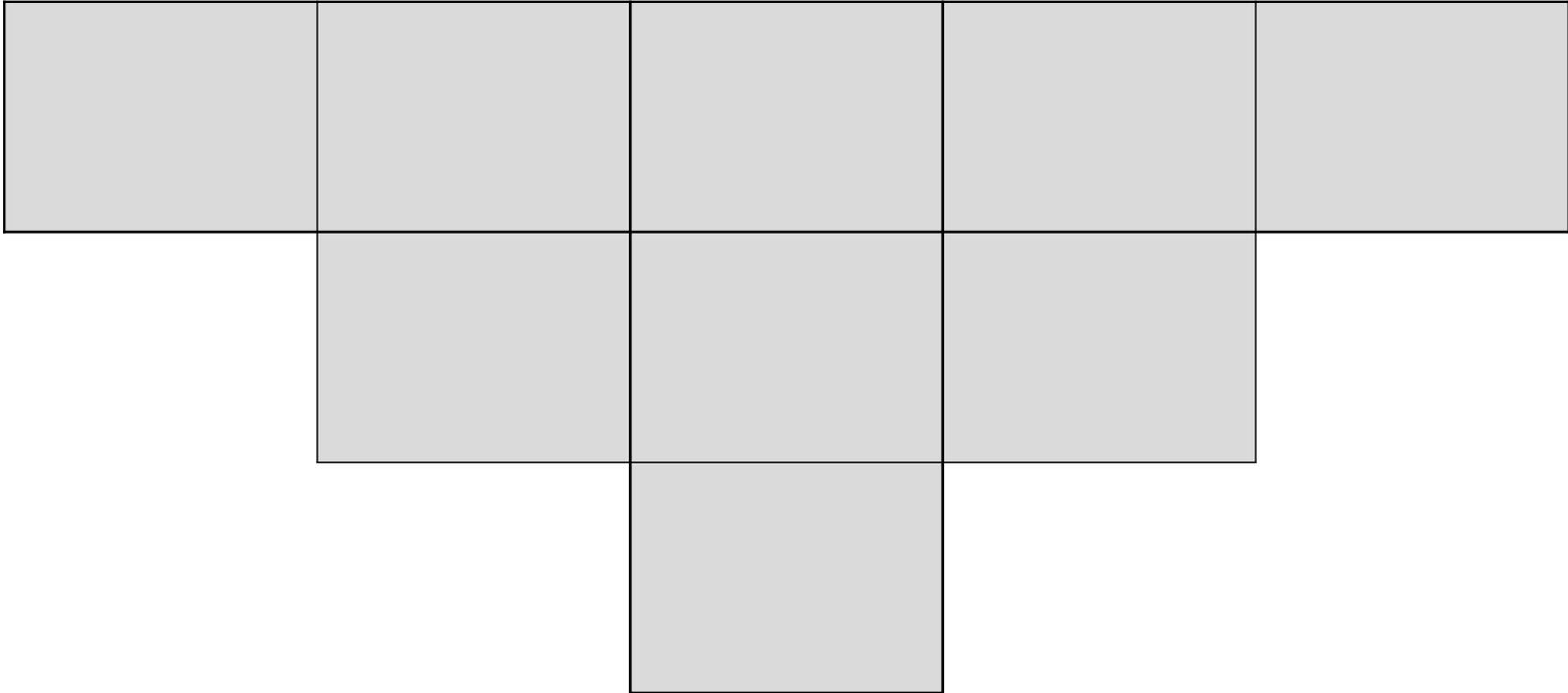
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**Most Unlikely to Improve Care**

7. POC metabolic panel.

6. Drug delivery through a patch.

**Most Likely to Improve Care**



# Correlation Matrix

		Person									
Sorts		1	2	3	4	5	6	7	8	9	10
Person	1	100	20	41	14	-11	24	18	-7	56	31
	2	20	100	24	10	21	-10	33	45	37	15
	3	41	24	100	-5	12	49	30	10	42	22
	4	14	10	-5	100	-26	-4	17	22	13	-4
	5	-11	21	12	-26	100	9	26	27	23	31
	6	24	-10	49	-4	9	100	35	8	39	49
	7	18	33	30	17	26	35	100	27	26	32
	8	-7	45	10	22	27	8	27	100	27	29
	9	56	37	42	13	23	39	26	27	100	35
	10	31	15	22	-4	31	49	32	29	35	100

PQMethod v 2.32

# Data Collection

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- ▶ **Convenience sample**
  - ▶ 40 participants
    - ▶ 13 MD, 24 RN, 3 undisclosed
  - ▶ At least 50% FTE
- ▶ **Recruitment strategy**
  - ▶ E-mail
  - ▶ In person



**Emergency Department  
Currency**

# Data Analysis

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- ▶ Factor solution

  - ▶ *A priori* conditions

    - ▶ Statistically convincing

Model	Significant Sorts	Senior Clinicians	Senior MDs	Variance Explained
4 Component PCA	<b>33</b>	<b>11</b>	<b>5</b>	<b>53</b>
3 Centroid Theoretical Rotation	<b>33</b>	<b>10</b>	<b>4</b>	<b>42</b>
3 Centroid Varimax Rotation	<b>30</b>	<b>11</b>	<b>4</b>	<b>42</b>
3 Component PCA	<b>29</b>	<b>10</b>	<b>3</b>	<b>46</b>

# Factor Demographics

Factor	Count			Seniority		Innovation Style				
	Total	MD	RN	Avg. Exp.	>10	IN	EA	EM		
1	11	3	8	10.6	5	2	3	5		
2	4	3	1	4.5	0	0	2	2		
3	8	1	6	8.6	3	1	0	5		
4	10	4	7	13.3	4	0	3	7		

- Physicians and nurses aligned together
- Senior Staff (>10 yrs experience) aligned to 3 of 4 factors
- Self-described innovation style in first half of adoption curve

# Individual Perspectives

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## ► Innovation Profiles

- Information Oriented (30%)
  - Highest priority: connectivity



**SPEED (33%)**



**HOLISM (12%)**



**ACUITY (24%)**



**INFO (30%)**

# Factor 1: Most **Likely** to Improve Care

Abbreviated Statements	Factor			
	1	2	3	4
A government-controlled health record.	3	2	-3	-1
A patient-controlled mobile health record.	3	2	0	3
POC cardiac marker panel.	3	-2	3	2
POC test for stroke risk.	3	-1	2	0
POC test for sepsis risk.	2	-3	1	2
POC test for ectopic pregnancy risk.	2	-1	-1	1
POC metabolic panel.	2	0	2	2
POC lactate monitor.	2	-1	2	1
POC test for H&H.	2	0	1	0
Lab-based test to confirm stroke.	2	-1	3	-1



# Factor 1: Most **Unlikely** to Improve Care

Abbreviated Statements	Factor			
	1	2	3	4
A fully wireless 12-lead ECG.	-3	-1	0	1
A cream that delivers drugs through the skin.	-3	1	-2	-1
The ED doesn't need new imaging technologies.	-3	-3	-3	-3
We don't need POC tests.	-3	0	-3	-3
Vest that transmits 5-lead ECG & vital signs.	-2	-1	-2	0
Drug delivery through a patch.	-2	-1	-2	-1
A needleless injection system.	-2	2	-1	0
A portable full body CT scanner.	-2	3	2	-2
Pocket ultrasounds carried by all ED physicians.	-2	2	0	-2
Robots that locate and retrieve equipment.	-2	-2	-3	-1



# Factor 1 Interpretation

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- ▶ **Speed Oriented**
  - ▶ Fast access to blood levels
    - ▶ Quantitative results
  - ▶ Fast access to history



## Factor 2: Most **Likely** to Improve Care

Abbreviated Statements	Factor			
	1	2	3	4
A portable full body CT scanner.	-2	3	2	-2
A portable head & neck CT scanner for the ED.	0	3	3	-3
A mobile app that assigns tasks.	1	3	-1	3
A mobile app that facilitates sharing charts.	1	3	0	3
A needleless injection system.	-2	2	-1	0
Pocket ultrasounds carried by all ED physicians.	-2	2	0	-2
A portable x-ray machine dedicated to the ED.	-1	2	0	-2
Ultrasound probes plug into Smartphones.	-1	2	3	3
A patient-controlled mobile health record.	3	2	0	3
A government-controlled health record.	3	2	-3	-1

## Factor 2: Most **Unlikely** to Improve Care

Abbreviated Statements	Factor			
	1	2	3	4
Lab-based test definitive ectopic pregnancy dx.	0	-3	-1	-1
Lab-based test provides a definitive sepsis dx.	1	-3	1	1
POC test for sepsis risk.	2	-3	1	2
Robots that locate & retrieve shared equipment.	-2	-2	-3	-1
Video streaming of an EMS encounter.	-1	-2	2	2
A non-invasive sensor that measures H&H.	-1	-2	-1	0
A paper-based hand-off checklist.	0	-2	-2	-3
POC cardiac marker test for 1 marker.	1	-2	1	0
POC cardiac marker panel for 4 markers.	3	-2	3	2

# Factor 2 Interpretation

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- ▶ **Holism Oriented**
  - ▶ Fast access to imaging
    - ▶ Qualitative results
  - ▶ Fast access to patient history and other clinicians
  - ▶ Seek to decrease pain



## Factor 3: Most **Likely** to Improve Care

Abbreviated Statements	Factor			
	1	2	3	4
POC cardiac marker panel for 4 markers.	3	-2	3	2
Lab-based test to confirm stroke.	2	-1	3	-1
Ultrasound probes plug into Smartphones.	-1	2	3	3
A portable head & neck CT scanner for the ED.	0	3	3	-3
Video streaming of an EMS encounter.	-1	-2	2	2
POC lactate monitor.	2	-1	2	1
POC test for stroke risk.	3	-1	2	0
POC metabolic panel.	2	0	2	2
Mobile app receives real-time ECGs from EMS.	1	1	2	2
A portable full body CT scanner.	-2	3	2	-2

## Factor 3: Most **Unlikely** to Improve Care

Abbreviated Statements	Factor			
	1	2	3	4
The ED doesn't need new imaging technologies	-3	-3	-3	-3
Robots that locate and retrieve shared equipment	-2	-2	-3	-1
We don't need POC tests	-3	0	-3	-3
A government-controlled health record.	3	2	-3	-1
A paper-based hand-off checklist.	0	-2	-2	-3
Vest that transmits 5-lead ECG & vital signs.	-2	-1	-2	0
Drug delivery through a patch.	-2	-1	-2	-1
A website that provides physician contact info	1	0	-2	0
A cream that delivers drugs through the skin.	-3	1	-2	-1
Mobile app that supports video conferences	-1	1	-2	2

# Factor 3 Interpretation

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## ▶ Acuity Oriented

- ▶ Faster diagnosis and monitoring for the “sickest”
- ▶ Improved monitoring of EMS activity



## Factor 4: Most **Likely** to Improve Care

Abbreviated Statements	Factor			
	1	2	3	4
A mobile app that assigns tasks	1	3	-1	3
A mobile app that facilitates sharing charts	1	3	0	3
A patient-controlled mobile health record.	3	2	0	3
Ultrasound probes plug into Smartphones.	-1	2	3	3
Mobile app that supports video conferences.	-1	1	-2	2
Video streaming of an EMS encounter.	-1	-2	2	2
Mobile app receives real-time ECGs from EMS.	1	1	2	2
POC test for sepsis risk.	2	-3	1	2
POC metabolic panel.	2	0	2	2
POC cardiac marker panel for 4 markers.	3	-2	3	2

## Factor 4: Most **Unlikely** to Improve Care

Abbreviated Statements	Factor			
	1	2	3	4
A paper-based hand-off checklist.	0	-2	-2	-3
We don't need POC tests.	-3	0	-3	-3
A portable head & neck CT scanner for the ED.	0	3	3	-3
The ED doesn't need new imaging technologies.	-3	-3	-3	-3
Blood purification system removes cytokines.	0	0	0	-2
Blood purification system removes endotoxin.	0	1	-1	-2
A portable x-ray machine dedicated to the ED.	-1	2	0	-2
A handheld x-ray machine.	-1	0	1	-2
A portable full body CT scanner.	-2	3	2	-2
Pocket ultrasounds carried by all ED physicians.	-2	2	0	-2

# Factor 4 Interpretation

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- ▶ **Information Oriented**
  - ▶ “Real-time” collaboration
  - ▶ Faster diagnostics, even when slower tests are definitive



# Departmental Perspective

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## ▶ “Consensus” Innovations

### ▶ Positive

- ▶ Ranked “Likely” (+2 or +3) to improve care by at least 2 Factors
- ▶ Ranked neutrally (-1 to +1) by remaining Factors

### ▶ Negative

- ▶ Ranked “Unlikely” (-2 or -3) to improve care by at least 2 Factors
- ▶ Ranked neutrally (-1 to +1) by remaining Factors

# Positive Consensus Technologies

Abbreviated Statements	Factor			
	1	2	3	4
A mobile app that assigns tasks.	1	3	-1	3
Mobile app receives real-time ECGs from EMS.	1	1	2	2
Mobile app that facilitates sharing charts.	1	3	0	3
A patient-controlled single health record	3	2	0	3
POC metabolic panel.	2	0	2	2
POC lactate monitor.	2	-1	2	1
POC test for stroke risk & odds of tPA efficacy.	3	-1	2	0
Lab-based test confirm stroke & tPA efficacy.	2	-1	3	-1
Ultrasound probes plug into Smartphones	-1	2	3	3

# Negative Consensus Technologies

Category	Item #	Product Inspiration	Factor			
			1	2	3	4
<b>Abbreviated Statements</b>			<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
		A paper-based hand-off checklist.	0	-2	-2	-3
		We don't need POC tests	-3	0	-3	-3
		Vest that transmits 5-lead ECG & vital signs.	-2	-1	-2	0
		Robots that locate and retrieve equipment.	-2	-2	-3	-1
		A cream that delivers drugs through the skin.	-3	1	-2	-1
		Drug delivery through a patch.	-2	-1	-2	-1
		The ED doesn't need new imaging technologies	-3	-3	-3	-3

# Applying the Results

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- ▶ Departmental perspective
  - ▶ Innovation strategy
- ▶ Individual profiles
  - ▶ Change management (communication)



# Potential Applications in VA Women's Health Research

Design 1: Prioritization/Strategy

Design 2: Significance to Individuals

Design 3: Longitudinal

# Sources

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1. Yano EM, et al. (2011) “Using Research to Transform Care for Women Veterans: Advancing the Research Agenda and Enhancing Research–Clinical Partnerships”. *Women's Health Issues* **21-4S**, S73–S83.
2. Bean-Mayberry B, et al. (2011) “Systematic Review of Women Veterans’ Health: Update on Successes and Gaps”. *Women's Health Issues* **21-4S**, S84–S97.
3. Yano EM, et al. (2009) “Integration of Women Veterans into VA Quality Improvement Research Efforts: What Researchers Need to Know”. *J Gen Intern Med* 25(Suppl 1):56–61.

# Benefit to VA Women's Health Research

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- ▶ Answer to the “Efficiency” Argument
  - ▶ Q is multivariate analysis **without** *a priori* variable definitions
  - ▶ Evaluating similarities, not differences
    - ▶ No null hypothesis to reject
      - Power is irrelevant
      - Smaller sample sizes are acceptable (as in qualitative studies)

# Q Applications in VA Health Research Agenda

*Excerpted from Table 4: E.M.Yano et al. / Women's Health Issues 21-4S (2011) S73–S83)*

Main Topic	Research Priorities
Access to care and rural health	<ul style="list-style-type: none"> <li>• Assess factors related to women veterans' trust of VA and other providers and clinic environments.</li> </ul>
Primary care and prevention	<ul style="list-style-type: none"> <li>• Evaluate VA comprehensive women's primary care models (e.g., patient satisfaction, patient ratings of care)</li> </ul>
Mental health	<ul style="list-style-type: none"> <li>• Examine structure and care models that support the patient-centered medical home.</li> <li>• Understand similarities/differences between male and female Veterans with military sexual trauma, including barriers, needs and outcomes.</li> <li>• Understand impact of mental health on sexual health and reproductive health over the lifetime.</li> <li>• Determine barriers to caring for women who attempt/complete suicide.</li> <li>• Identify risk factors for suicide among women Veterans.</li> <li>• Evaluate variations in mental health care needs, use and outcomes of subgroups of women Veterans (e.g., racial–ethnic minorities).</li> </ul>
Post deployment health	<ul style="list-style-type: none"> <li>• Evaluate functional status, quality of life, and resilience post-deployment, in addition to physical and mental health.</li> <li>• Evaluate impacts of multiple deployments on women Veterans and their families.</li> <li>• Develop combat exposure measure(s) that reflect women Veterans' experiences.</li> </ul>
Complex chronic conditions/aging and long-term care	<ul style="list-style-type: none"> <li>• Understand the aging issues of women Veterans including needs, use, and preferences.</li> <li>• Evaluate needs and care for disabled women Veterans.</li> <li>• Determine reproductive health needs of women Veterans .</li> </ul>
Reproductive health	<ul style="list-style-type: none"> <li>• Examine impacts of first experiences with reproductive health services (e.g., on perceptions of care, on later use).</li> </ul>

# Design 1: Prioritization/Strategy

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- ▶ **Goal: Discover user profiles and group needs**
  - ▶ Similar to the Health Innovation study presented earlier
- ▶ **Q-concourse**
  - ▶ All possible interventions, structures, features, etc.
    - ▶ Sources: literature, current practice, interviews
- ▶ **Q-set**
  - ▶ Generic descriptions of interventions, structures, features, etc.
- ▶ **Condition of Instruction**
  - ▶ Most needed/least needed, Most useful/least useful

# Design 1: VA Women's Health Research Priorities

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Main Topic	Research Priorities
Access to care and rural health	
Primary care and prevention	<ul style="list-style-type: none"> <li>• Evaluate VA comprehensive women's primary care models (e.g., patient satisfaction, patient ratings of care)</li> </ul>
Mental health	<ul style="list-style-type: none"> <li>• Examine structure and care models that support the patient-centered medical home.</li> <li>• Evaluate variations in mental health care needs, use and outcomes of subgroups of women Veterans (e.g., racial-ethnic minorities).</li> </ul>
Post deployment health	
Complex chronic conditions/aging and long-term care	<ul style="list-style-type: none"> <li>• Understand the aging issues of women Veterans including needs, use, and preferences.</li> <li>• Evaluate needs and care for disabled women Veterans.</li> <li>• Determine reproductive health needs of women Veterans .</li> </ul>
Reproductive health	



# Design 2: Significance to Individuals

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- ▶ **Goal: Discover “ideal-types” within a population**
  - ▶ Use these to develop/tailor interventions
- ▶ **Q-concourse**
  - ▶ Experiential themes (derived from interviews, focus groups)
- ▶ **Q-set**
  - ▶ Inductive design (mix and match across themes)
- ▶ **Condition of Instruction**
  - ▶ Most like/most unlike me

# Design 2: VA Women's Health Research Priorities

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Main Topic	Research Priorities
Access to care and rural health	<ul style="list-style-type: none"><li>• Assess factors related to women veterans' trust of VA and other providers and clinic environments.</li></ul>
Primary care and prevention	
Mental health	<ul style="list-style-type: none"><li>• Understand similarities/differences between male and female Veterans with military sexual trauma, including barriers, needs and outcomes.</li><li>• Determine barriers to caring for women who attempt/complete suicide.</li><li>• Identify risk factors for suicide among women Veterans.</li></ul>
Post deployment health	<ul style="list-style-type: none"><li>• Develop combat exposure measure(s) that reflect women Veterans' experiences.</li></ul>
Complex chronic conditions/aging and long-term care	
Reproductive health	

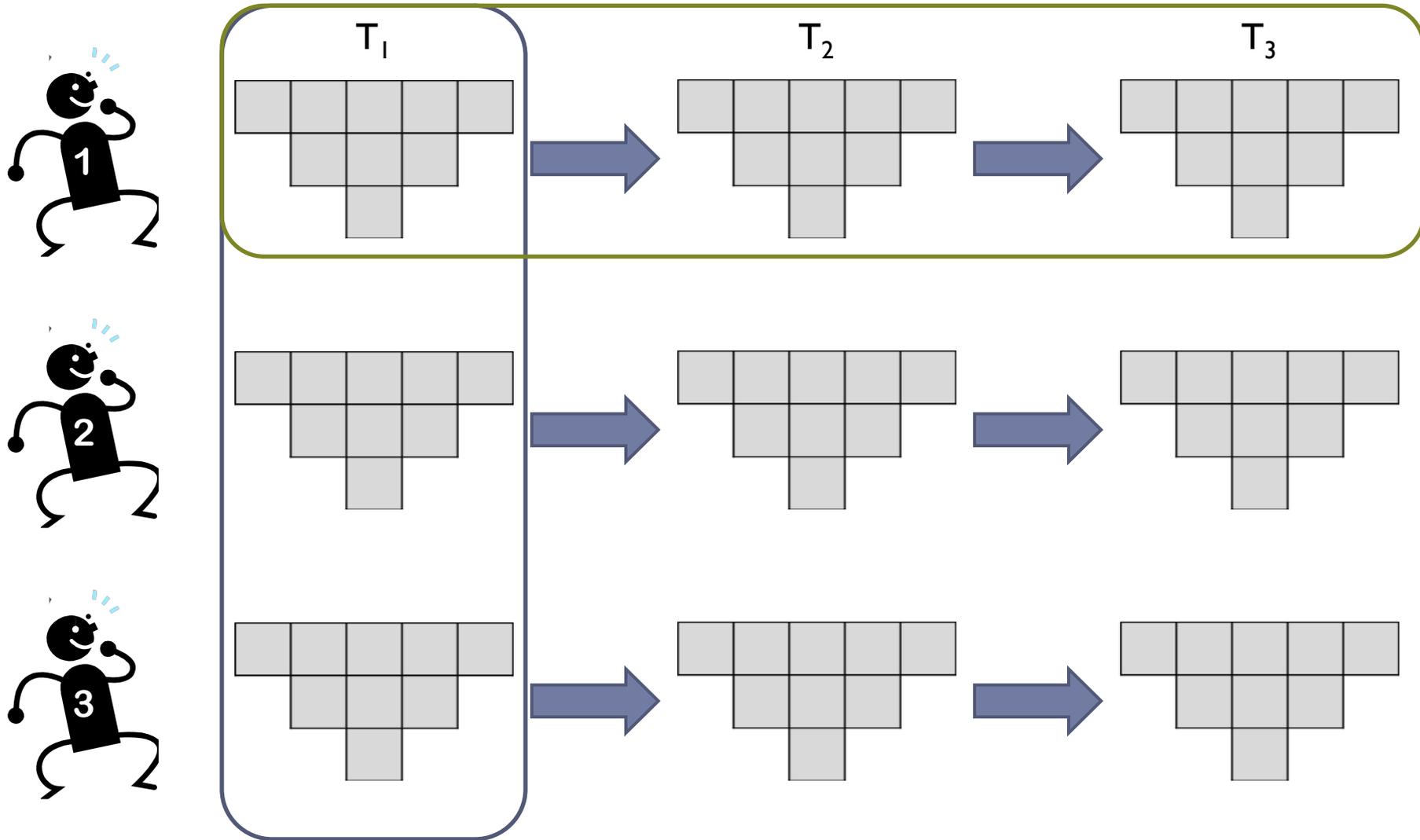


# Design 3: Longitudinal

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- ▶ **Goal: Observe changes in perception/beliefs over time**
  - ▶ Combine with demographic data, analyze group and individual across time
- ▶ **Q-concourse**
  - ▶ Metrics of function (existing measures, preferably validated)
- ▶ **Q-set**
  - ▶ Deductive design (to reflect population of metrics)
- ▶ **Condition of Instruction**
  - ▶ Best Describes/Least Describes Me
- ▶ **Data collection**
  - ▶ Repeat Q-sort over intervals

# Longitudinal Data Collection



# Design 3:

## VA Women's Health Research Priorities

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Main Topic	Research Priorities
Access to care and rural health	
Primary care and prevention	
Mental health	<ul style="list-style-type: none"><li>• <b>Understand impact of mental health on sexual health and reproductive health over the lifetime.</b></li></ul>
Post deployment health	<ul style="list-style-type: none"><li>• <b>Evaluate functional status, quality of life, and resilience post-deployment, in addition to physical and mental health.</b></li><li>• <b>Evaluate impacts of multiple deployments on women Veterans and their families.</b></li></ul>
Complex chronic conditions/aging and long-term care	
Reproductive health	<ul style="list-style-type: none"><li>• <b>Examine impacts of first experiences with reproductive health services (e.g., on perceptions of care, on later use).</b></li></ul>



# Audience Poll

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- ▶ **#3: Are you interested in using Q in the future?**
  - ▶ Yes (you had me at the Star Trek reference)
  - ▶ Maybe
  - ▶ No

# Thank you!

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- ▶ Contact information:

- ▶ Email: [mnaima1@uic.edu](mailto:mnaima1@uic.edu)
- ▶ Phone: 312-355-0078

- ▶ Additional Reading

- ▶ [Doing Q Methodological Research: Theory, Method & Interpretation](#) by Simon Watts and Paul Stenner
- ▶ [Q Methodology \(Quantitative Applications in the Social Sciences\)](#) by Bruch McKeown and Dani Thomas