

An Empirical Investigation of Critical Success Factors for Continuous Improvement Projects in Hospitals

Fernando Gonzalez Aleu Gonzalez
Final Defense

June 29th, 2016

Agenda for presentation

1. Manuscript format
2. Reminder of methodology
3. Review results
4. Conclusions and limitations
5. Future work



Manuscript Format Requirements

<http://etd.vt.edu/guidelines/index.html>

1. Minimum of 2 manuscripts (papers): can be previously published, to be published, or in preparation for submission.
2. Manuscripts with multiple authors needs to detail the contribution of each author.
3. The graduate student provides the Graduate School with a letter of copyright release for previously published work.
4. Whether previously published or to be reviewed, the manuscript is formatted to fit all the Graduate School requirements for ETD submission.

Research Methodology

Phase I: Research Framing

Research Definitions and Scoping Study

Characterize the Literature

Critical Success factors for Continuous Improvement Projects

Continuous Improvement Projects in Hospitals

Phase II: Variable Reduction

Literature Survey

Frequency of factors per publications and Journal Impact Factor

Expert Survey

Researcher/Academics and Practitioners

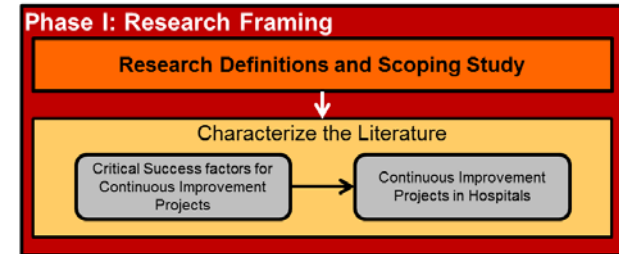
Phase III: Model Development and Testing

Operational Research Model Definition

Large Scale Field Study

Phase I: Research Framing

Research Definitions and Scoping Study



Dissertation motivation

Help hospitals improve the impact of their CIPs

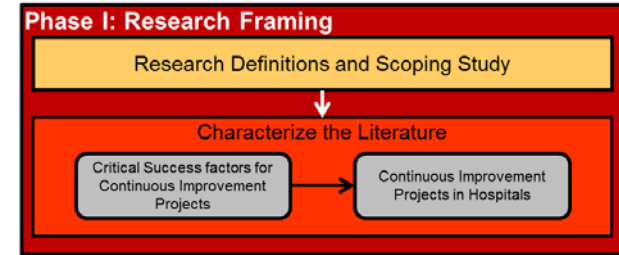


Purpose

Identify the CSFs related to CIP success for CIPs conducted in hospitals

Phase I: Research Framing

Characterize the Literature



Systematic literature review (SLR) methodology (adapted from Tranfield et al., 2003)

a. Problem Definition

b. Scoping Study

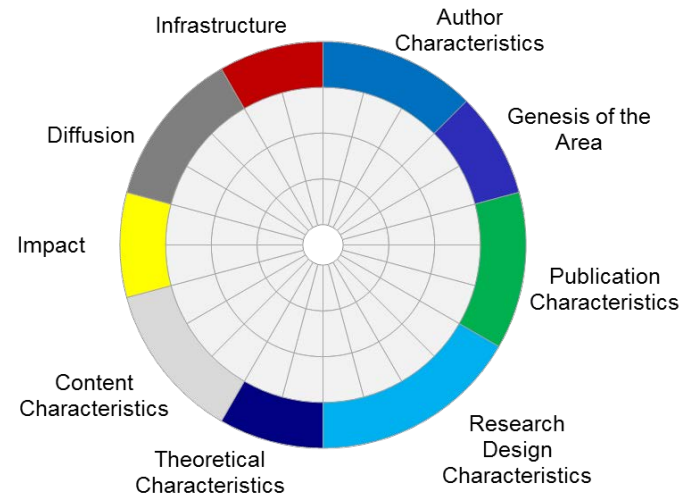
c. Search Strategy (23,704 initial results)

d. Apply Exclusion Criteria (123 final publication set)

e. Data Collection

f. Data Analysis

g. Reporting



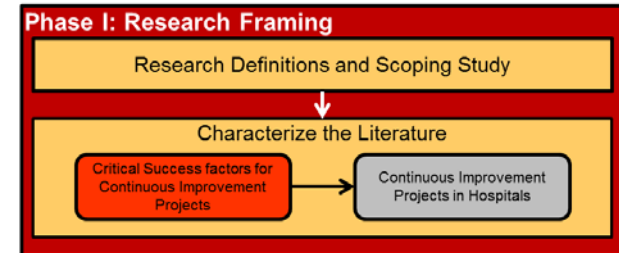
Manuscript #1:

- **Name:** “Proposed Framework for Assessing the Maturity of a Research Area”
- **Journal:** *Scientometrics* (IF = 2.2 - Q1)
- **Status:** Submitted (major changes requested); 1st draft in dissertation document
- **Author contribution:** Directly participated in the SLR and the development of the maturity assessment framework

Phase I: Research Framing

Characterize the Literature

CSFs for CIPs



SLR methodology (adapted from Tranfield et al., 2003)

a. Problem Definition

b. Scoping Study

c. Search Strategy (13,212 initial results)

d. Apply Exclusion Criteria (98 final publication set)

e. Data Collection

f. Data Analysis

g. Reporting

Extraction of factors from publication set

33 factors were identified from comprehensive frameworks described in 3 journal papers from the publication set

62 factors were extracted from 95 remaining publications

53 factors were defined after synthesis

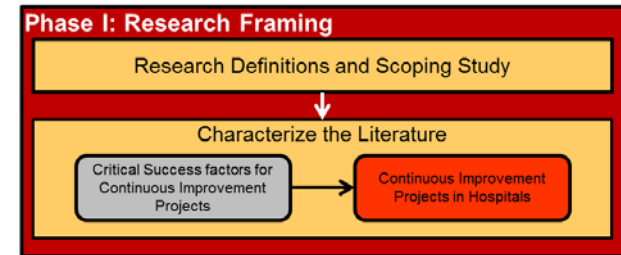
Manuscript #2:

- **Name:** "Systematic Literature Review of Critical Success Factors for Continuous Improvement Projects"
- **Journal:** *International Journal of LSS* (IF = 1.3 - Q3)
- **Status:** Accepted; final draft in dissertation document; will appear July 30, 2016
- **Author contribution:** Corresponding author

Phase I: Research Framing

Characterize the Literature

CIPs in hospitals



SLR methodology (adapted from Tranfield et al., 2003)

a. Problem Definition

b. Scoping Study

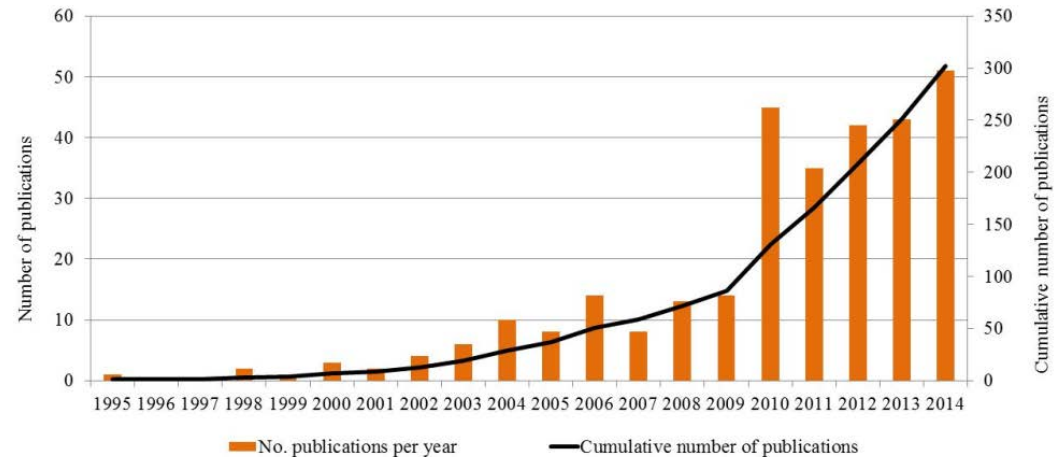
c. Search Strategy (**24,476** initial results)

d. Apply Exclusion Criteria (**302** final publication set)

e. Data Collection

f. Data Analysis

g. Reporting

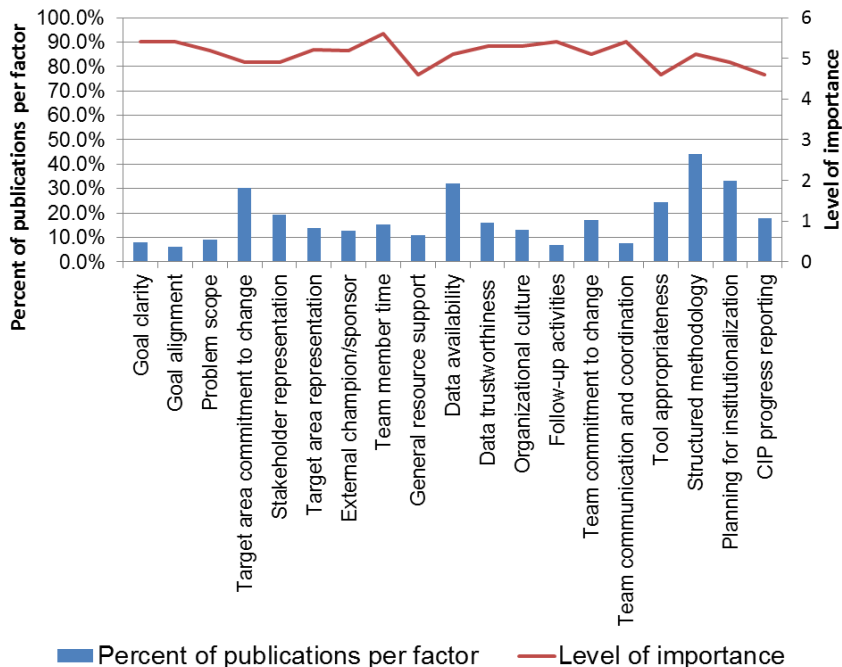
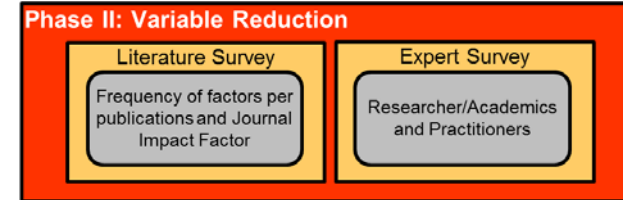


Manuscript #3:

- **Name:** "Bibliometric analysis of authorship in continuous improvement projects"
- **Journal:** *International Journal of Health care Quality Assurance* (IF = 0.9 - Q3)
- **Status:** Not submitted; 3rd draft in dissertation document
- **Author contribution:** Corresponding author

Phase II: Variable Reduction

Literature Survey and Expert Survey



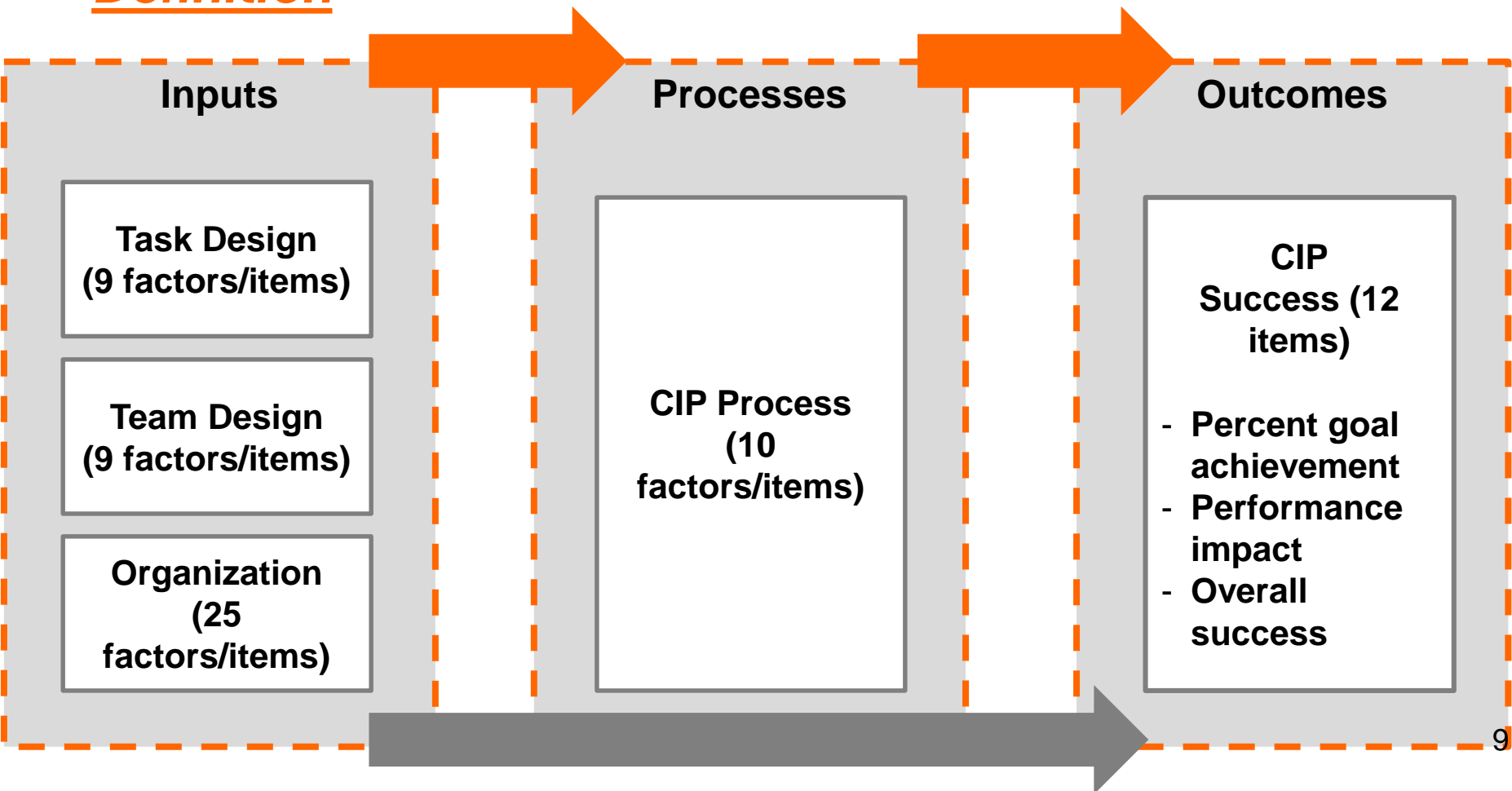
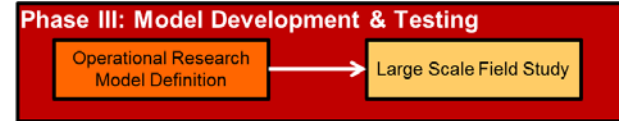
- Frequency of response (out of 53 factors)
 - 6.0 (Extremely important) = 0 factors
 - **5.0 – 5.9 (Very important) = 18 factors (34.0%)**
 - **4.0 – 4.9 (Moderately important) = 34 factors (64.2%)**
 - **3.0 – 3.9 (Somewhat important) = 1 factor (1.8%)**
 - 2.0 – 2.9 (Low importance) = 0 factors
 - 1.0 – 1.9 (Not at all important) = 0 factors
- According to experts' opinion, "software" was the lowest-rated factor (on importance for CIP goal achievement) (3.6/6.0)

Manuscript #4:

- **Name:** "Factors influencing the achievement of continuous improvement projects in hospitals: An expert study"
- **Journal:** *BMJ Quality and Safety* (4.4 - Q1)
- **Status:** Not submitted; 2nd draft in dissertation document
- **Author contribution:** Corresponding author

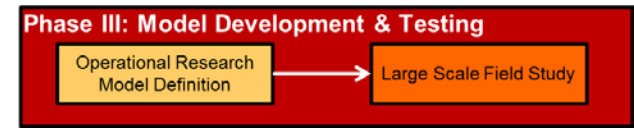
Phase II: Model Development and Testing

Operational Research Model Definition



Empirical Field Study

Data collection



Online survey questionnaire



Survey on Continuous Improvement Projects in Hospitals

Introduction and Background

You have been invited to participate in this survey because of your experience with Continuous Improvement Projects (CIPs) in hospitals. The purpose of this study is to determine the factors that most strongly relate to CIP success. **Before starting the survey, please carefully review the information below.**

- Introduction
- CIP overview
- CIP outcomes
- Factors related to CIP success (how important was each factor to CIP's success?)
- CIP leader/facilitator background

Recruitment methods

Support invitation to participate in Virginia Tech Study of Continuous Improvement Project Success in Hospitals

Dear [insert name],

We would like to invite your organization to participate in a large-scale field study to investigate the success factors related to the success of continuous improvement projects (CIPs) in hospitals. The purpose of the study is to identify the factors most strongly related to success for CIPs. We are inviting any hospital which has experience conducting CIPs within the last two years to participate in the study.

For the purpose of this study, we define a CIP to be a structured improvement project using a team of people, beyond representing different departments in the hospital, working to complete a process or area within the hospital (e.g., error, wait time, throughput, turnaround time, etc.). The terminology used for a CIP, which may include a period of months or longer of labor, may also apply to improvement projects, process improvement projects, quality events, Lean Six Sigma projects, or Six Sigma projects. We are interested in this topic because, despite the increased use of CIPs in hospitals, a significant proportion of them are reported to be unsuccessful in achieving project goals (e.g., improved quality, patient outcomes, patient satisfaction, efficiency, etc.).

Based on an extensive review of the published literature in this area, we have identified a comprehensive set of potential success factors. By collecting data on the actual experience with CIPs in hospitals, we aim to identify which factors most strongly influence CIP goal achievement. It is important to note that in this study, we are attempting to better understand the factors that most influence success in goal achievement - we are not trying to determine the factors that influence team member satisfaction, engagement, or skill development - investigating the factors that influence team types of outcomes will be relevant for future work.

To participate in this study, please do the following:

1. Step 1: Distribute this email invitation to anyone in your hospital who has led or coordinated a CIP completed within the last two years. We are only seeking the CIP team leader or facilitator complete the "Committee Survey" if it is not all team members, this is the survey respondents to select you as their most recent completed CIP in responding to the survey.
2. Step 2: Please email the study leader (Fernando Gonzalez-Aledo, fernando.gonzalez@vt.edu) to let us know many CIP leader/facilitators you sent this invitation to.

All participants in this study are required to receive an advance copy of the research results by including this in the survey or attaching the survey leader identity (fernando.gonzalez@vt.edu). Results from this survey will not be used for a brochure distribution and publications. Any sensitive information will be kept confidential by the research team; hospital names will not be identified in any publication (conference proceeding, journal paper, or dissertation).

If your organization is unable to participate, please let us know at your earliest convenience so that we may create another invitation. If you are aware of any other hospitals that may be interested in participating in this study, please send us an email with the following information: hospital name, contact name, and contact email. We would be glad to help you.

CIP team leader/facilitators should go to the link shown below to begin the survey.

Survey survey link

Thank you in advance for your assistance with this research. If you have any questions or concerns about this research, please contact us as indicated below.

Doctoral Research Study

An Empirical Investigation of Critical Success Factors for Continuous Improvement Projects in Hospitals

Who are we?
Student: Fernando Gonzalez Aledo
Advisor: Ellen M. Van Aken, Ph.D.
Virginia Tech

What do we need?
Hospitals interested in participating in this study

Are you interested?
More information is available in this flyer

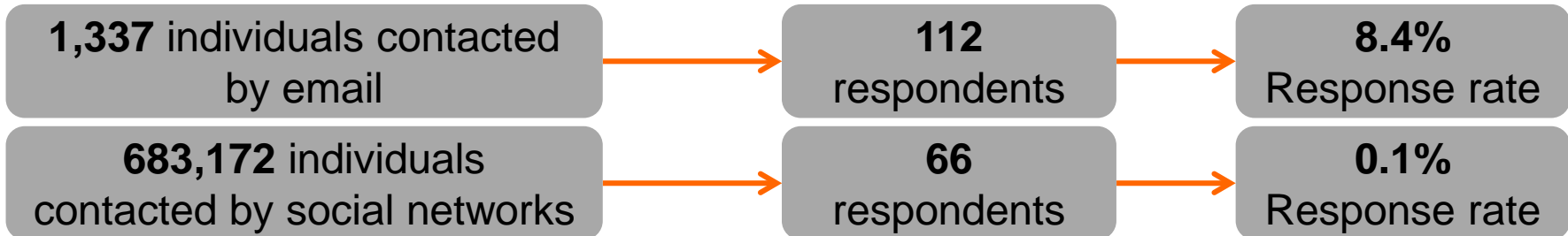
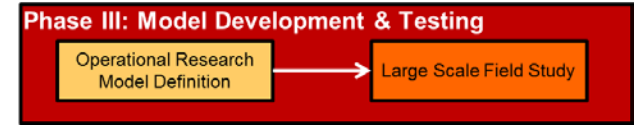
Research Team

Fernando Gonzalez Aledo, Ph.D. Candidate in the Grado School of the Department of Industrial and Systems Engineering at Virginia Tech. His research interests include the study of continuous improvement projects in hospitals, patient safety, and quality improvement. He is currently a Ph.D. student at Virginia Tech, where he is working on his dissertation titled "An Empirical Investigation of Critical Success Factors for Continuous Improvement Projects in Hospitals".

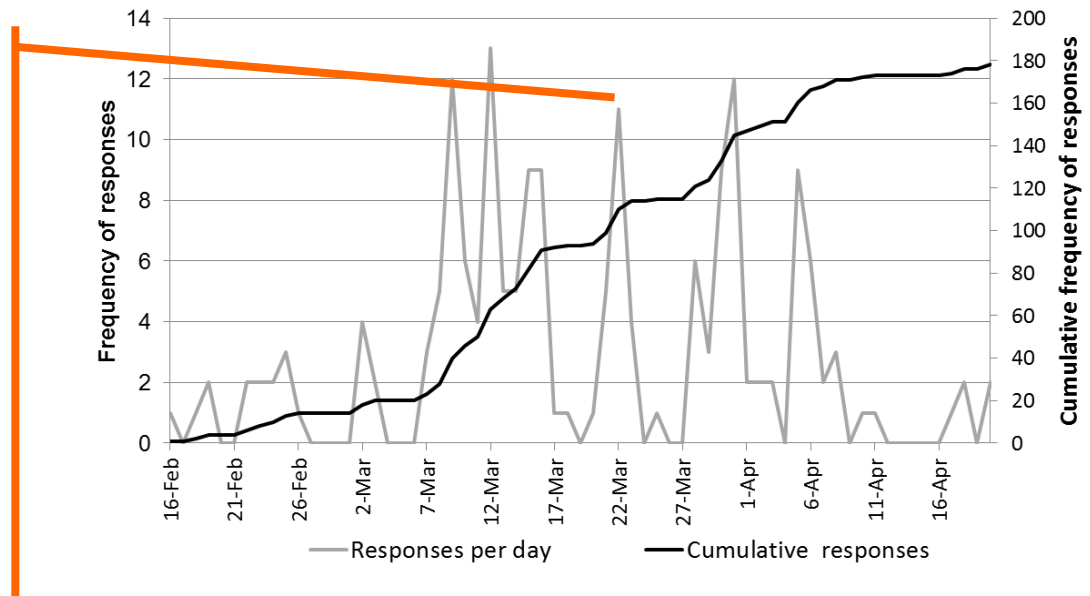
Ellen M. Van Aken, Ph.D., is a Professor and Assistant Department Head in the Grado School of the Department of Industrial and Systems Engineering at Virginia Tech. She is the Director of the Center for Health Systems Research and Analysis. Her research interests include the study of continuous improvement projects in hospitals, patient safety, and quality improvement. She is currently a Professor at Virginia Tech, where she is working on her research titled "An Empirical Investigation of Critical Success Factors for Continuous Improvement Projects in Hospitals".

Empirical Field Study

Data collection

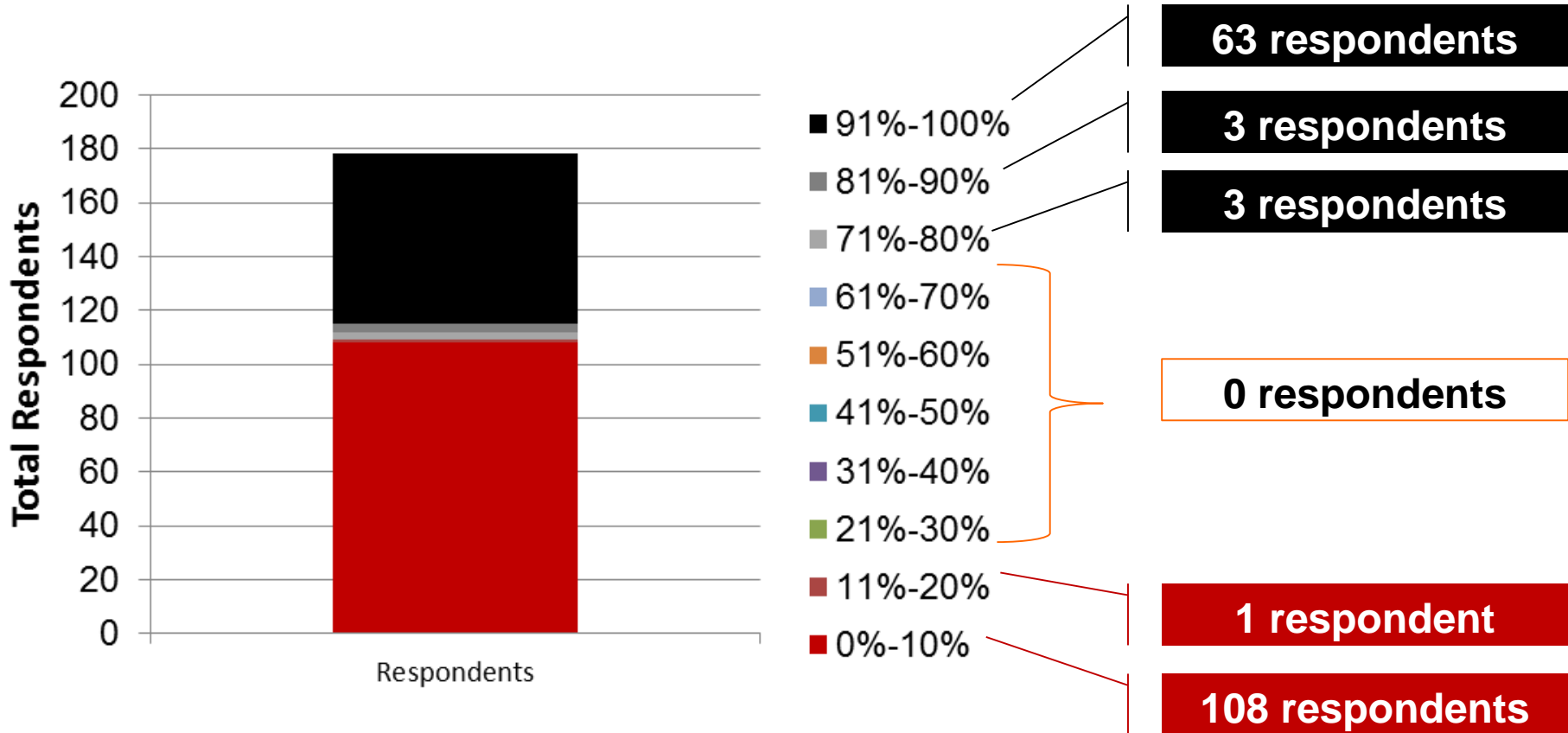
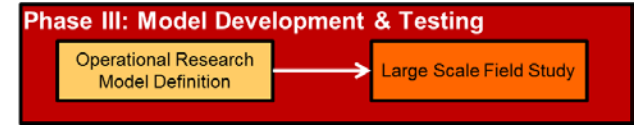


- 110 respondents at the time of progress meeting
- Actions after meeting:
 - Sent follow up emails to all respondents who had accepted invitation but had not responded
 - Emailed new contacts recommended by current respondents



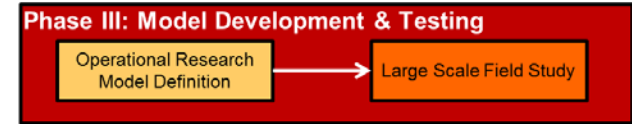
Empirical Field Study

Data screening – Missing data per respondent



Empirical Field Study

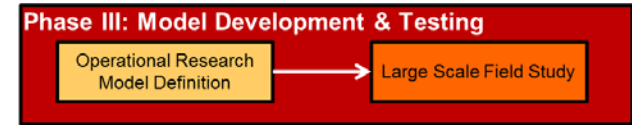
Data screening – Straight lining



- “Straight lining is when a respondent marks the same response for a high proportion of the questions. For example, if a 7-point scale is used to obtain answer and the response pattern is all 4s (the middle response), then that respondent in most cases should be removed from the data set” (Hair *et al.*, 2014, p.52)
- One respondent was removed
 - Respondent answered “5” for 63 questions (10 outcome questions + 52 factor questions, one question had no response)
- 108 respondents remained after screening

Empirical Field Study

Data screening – Missing data for questions/items



- “As a rule of thumb, we recommend using mean value replacement when there are less than 5% values missing per indicator” (Hair *et al.*, 2014, p.51)

4 out of 11 CIP outcome items had missing data

2 CIP outcome items had missing data for **1** respondent

2 CIP outcome items had missing data for **2** respondents

34 out of 53 factor items had missing data

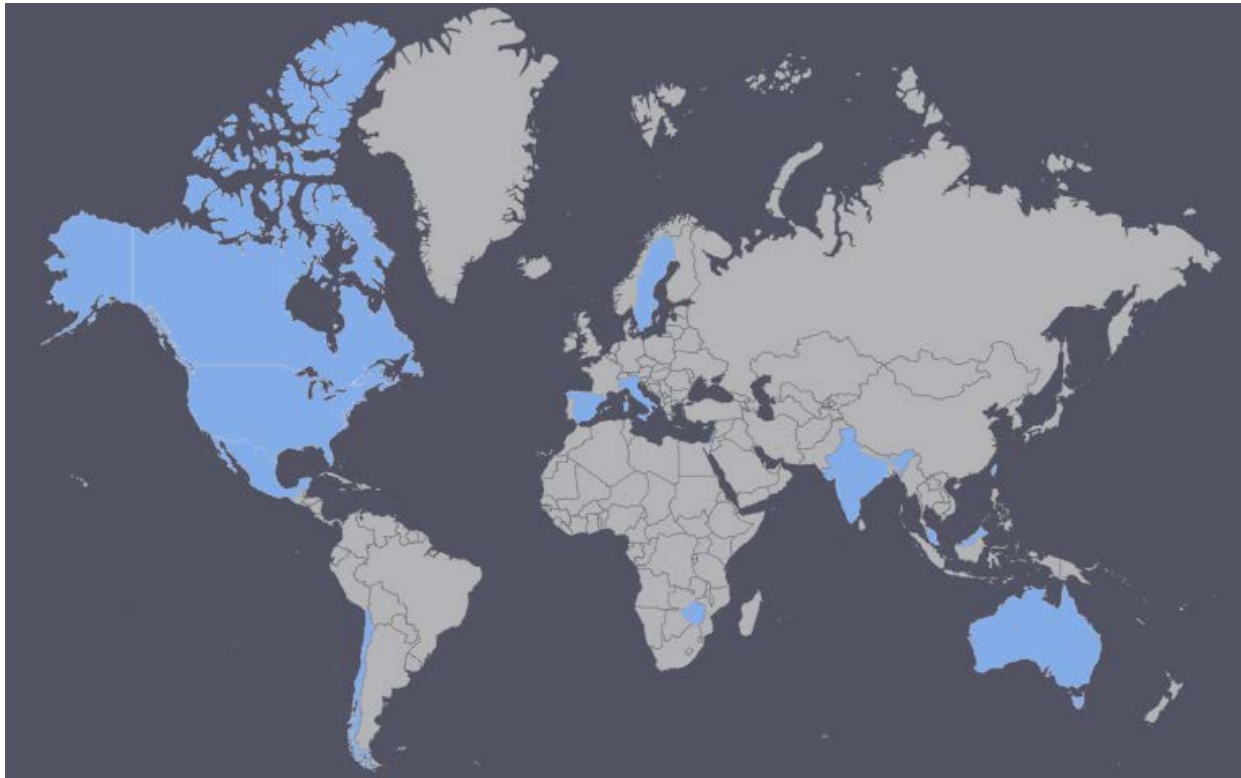
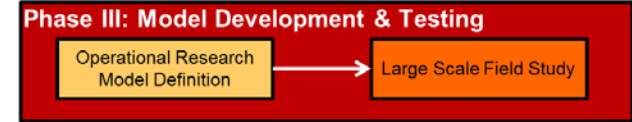
22 CIP factor items had missing data for **1** respondent

10 CIP factor items had missing data for **2** respondents

2 CIP factor items had missing data for **3** respondents

Empirical Field Study

Demographic results – Country of repondents

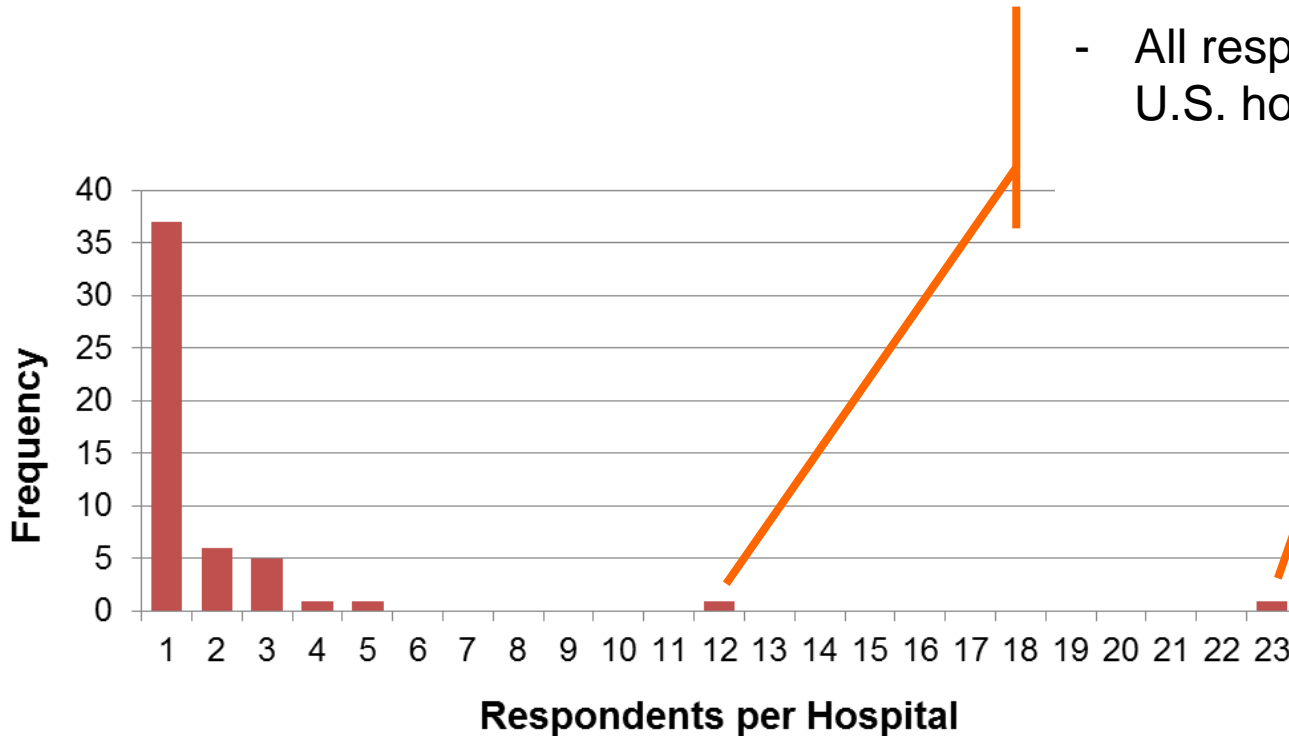
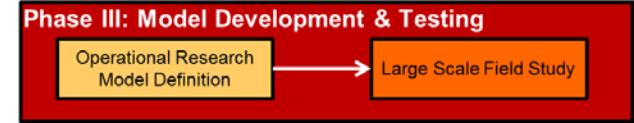


52 different hospitals in 14 countries represented:

- Australia (1)
- Canada (1)
- Chile (1)
- Israel (1)
- Italy (1)
- Malaysia (1)
- Singapore (1)
- Spain (1)
- Sweden (1)
- Zimbabwe (1)
- **India (2)**
- **Mexico (2)**
- **U.S. (38)**

Empirical Field Study

Demographic results – Number of respondents per hospital

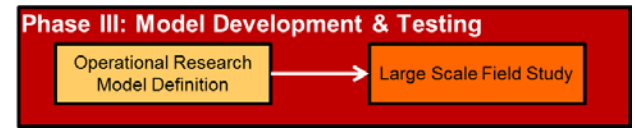


- All respondents from the same U.S. hospital

- All respondents from the same 2,000-bed hospital in Singapore

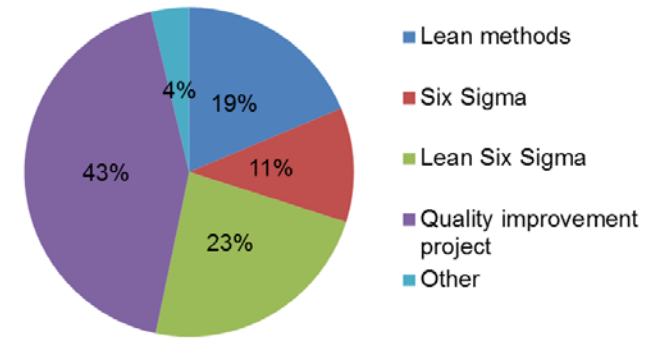
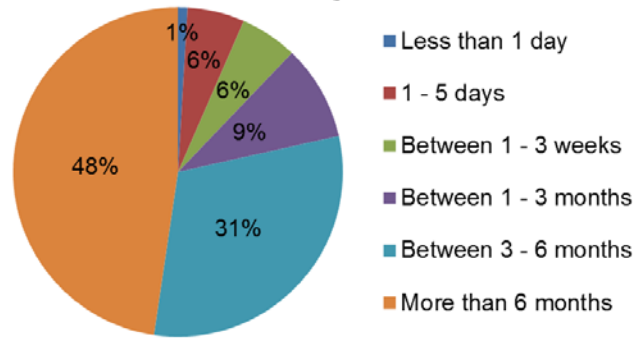
Empirical Field Study

Demographic results – CIP duration, CIP completed, CIP types, and day-to-day roles



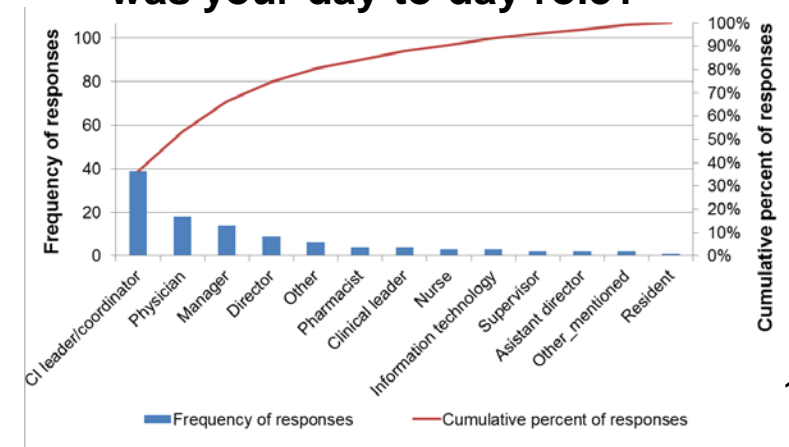
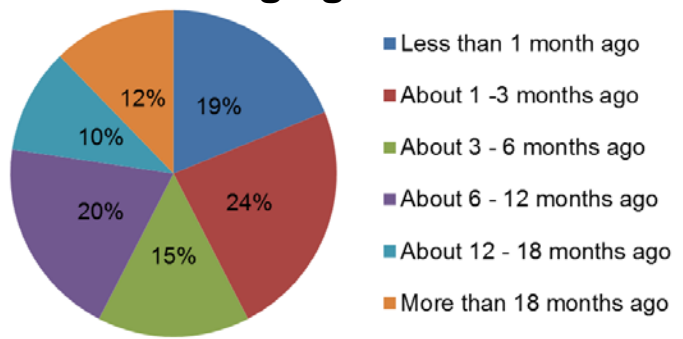
Which of the following best describes the primary improvement process?

About how long did this CIP last?



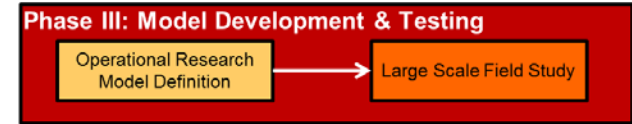
At the time you led/facilitated this CIP, what was your day-to-day role?

About how long ago was this CIP completed?



Empirical Field Study

Manuscript #5 and #6



Perceptual CIP outcomes

Manuscript #5:

- **Name:** “Empirical investigation of success factors for continuous improvement projects in hospitals”
- **Journal:** *Journal Healthcare Quality* (IF = 1.1 - Q2)
- **Status:** Not submitted; 1st draft in dissertation document
- **Author contribution:** Corresponding author

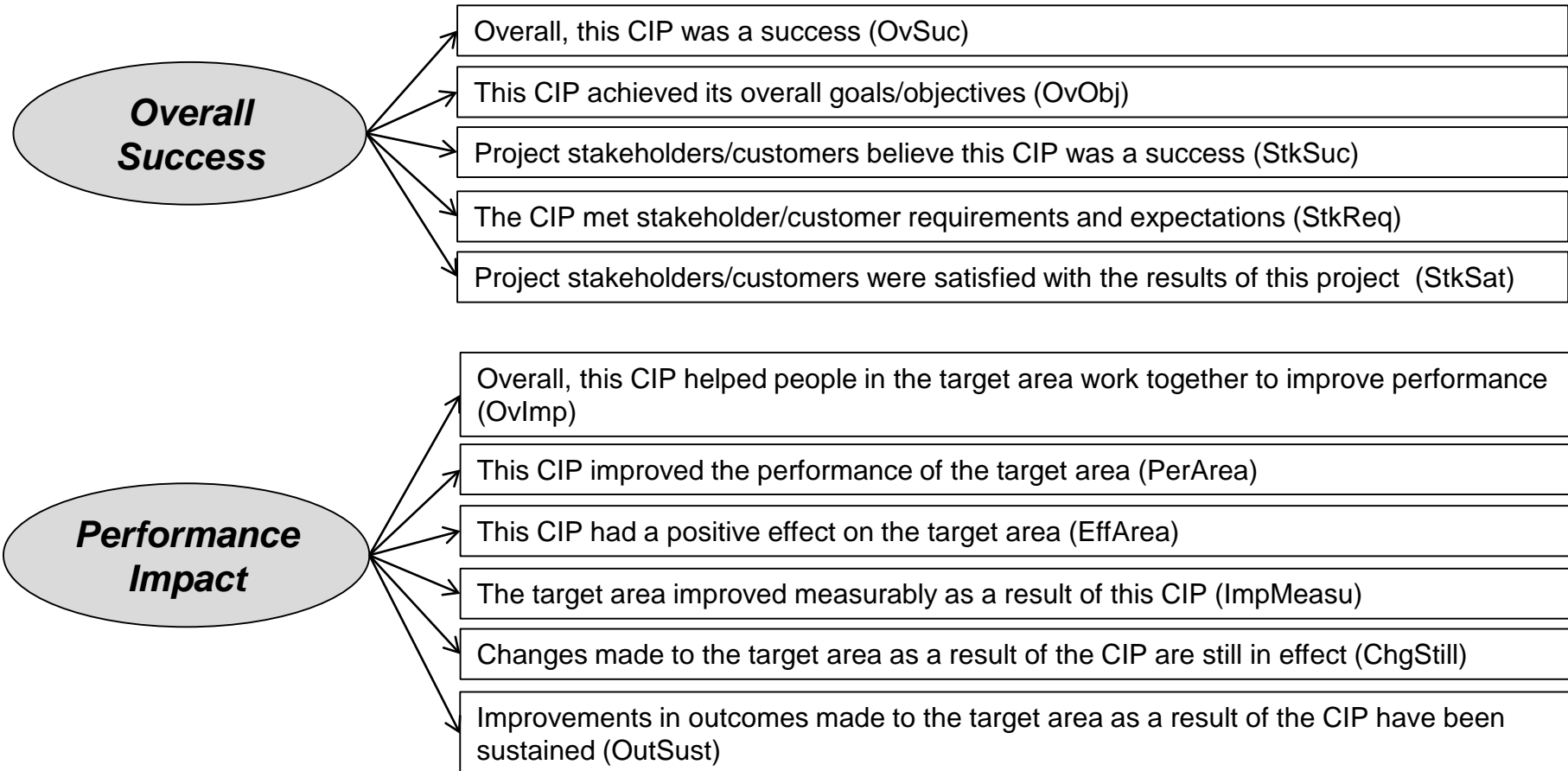
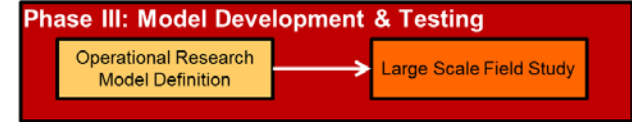
Percent goal achievement

Manuscript #6:

- **Name:** “Are continuous improvement projects in hospitals achieving their goals?”
- **Journal:** *2017 Industrial and Systems Engineering Research Conference* (IF = NA)
- **Status:** Not submitted; 1st draft in dissertation document
- **Author contribution:** Corresponding author

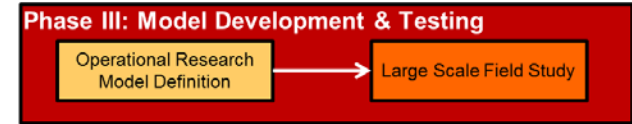
Manuscript 5

Data reduction – Proposed CIP outcomes



Manuscript 5

Data reduction – CIP outcomes



- **EFA criteria**

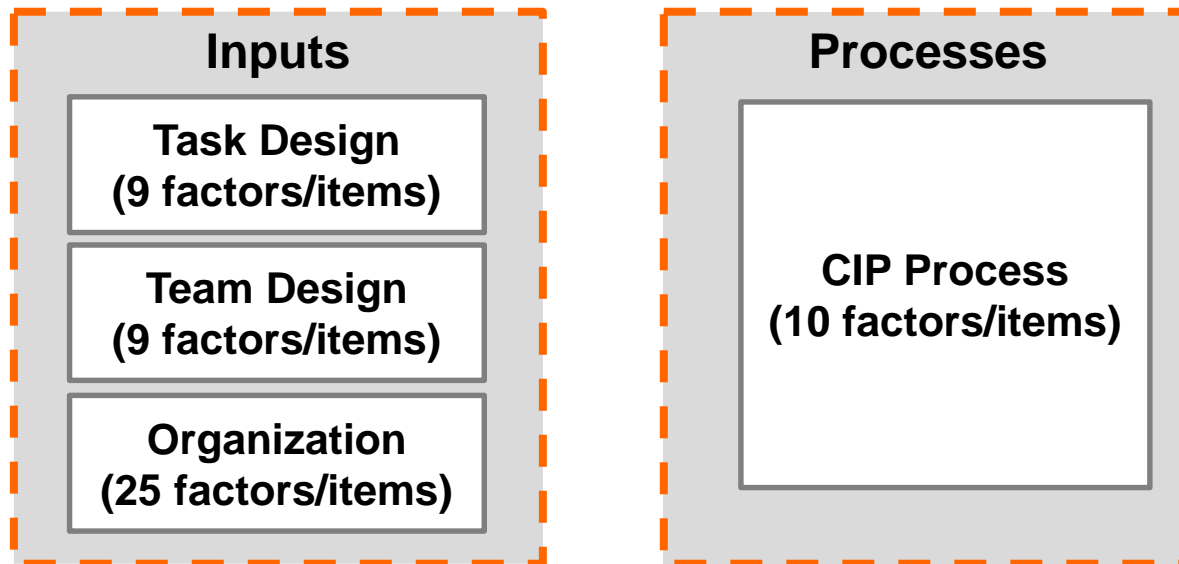
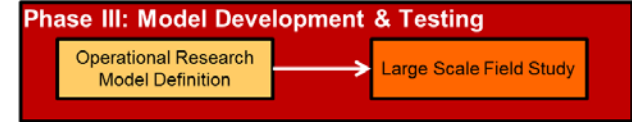
- Factor loading 0.55 or higher
- Cross-loading higher than 0.3
- Communality lower than 0.4

- Outcome variable renamed
- Mix of items from initial two proposed constructs
- Factor renamed
- Same items that initial model
- A new construct not previously identified

Construct variables	Items	Factor loadings	Communality	Cronbach's alpha
Performance Impact	OvImp05	0.953	0.714	0.910
	PerArea07	0.855	0.788	
	OvObj06	0.718	0.790	
	OvSuc04	0.704	0.729	
	EffArea08	0.485	0.734	
Stakeholder Satisfaction	StkSuc09	0.944	0.820	0.885
	StkReq11	0.924	0.831	
	StkSat13	0.895	0.850	
	ImpMeasu10	0.511	0.792	
Sustainable Improvement	ChgStill12	0.985	0.927	0.902
	OutSust14	0.885	0.894	

Manuscript 5

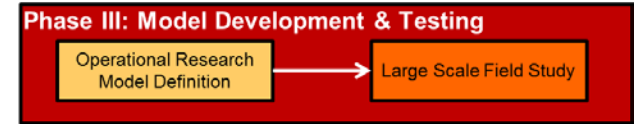
Data reduction – Factors related to CIP success



- A minimum sample size of 265 is recommended to conduct an exploratory factor analysis – **Requirement is not met**
- A minimum sample size of 125 is recommended to conduct an exploratory factor analysis for each category – **Requirement almost met**

Manuscript 5

Data reduction – Factors related to CIP success



Task design

Goal Characteristics (3 items)

Goal clarity

Goal alignment

Goal development process

Target area understanding of CI

Project Scope (3 items)

Problem scope

Project duration

Target area routineness

Target area commitment to change

Goal difficulty

Team design

Stakeholder Involvement (items)

Target area representation

Stakeholder representation

Cross-functionality

Expert champion/sponsor

Team Structure (items)

Team improvement skills

Team size

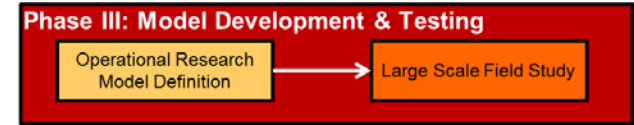
Internal team roles

Team member experience

Team autonomy

Manuscript 5

Data reduction – Factors related to CIP success



Organization

Intangible Resources (2 items)

Team member time

General management support

CIP infrastructure (8 items)

CIP planning

Facilitation

Data availability

Support from CI program

Follow-up activities

Project identification and selection

Data trustworthiness

Management involvement

Training

Organization

Organizational Process (3 items)

CIP priority

Organizational policies and procedures

Organizational structure

Organizational culture

Management understanding of CI

Tangible Resources (3 items)

Financial resources

Materials and equipment

Software

General resource support

Performance Review Process (3 items)

Recognition and rewards

Performance evaluation/review

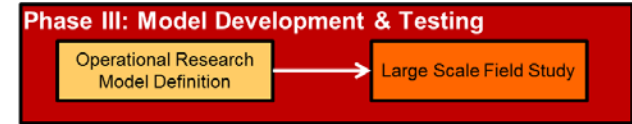
Lessons learned

Information from previous CIP

Deployment of changes

Manuscript 5

Data reduction – Factors related to CIP success



CIP process

Team Operation (3 items)

Team commitment to change
Team communication and coordination
Team harmony

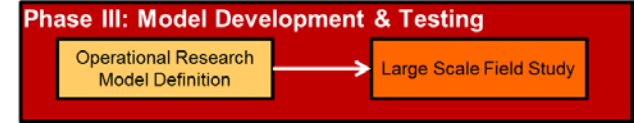
Improvement Process (3 items)

Structured methodology
Tool appropriateness
CIP technical documentation
CIP progress reporting
Planning for institutionalization
Solution iterations
Action orientation

- 3 CIP outcomes were formed
- 11 variables were formed
- Next step in a data reduction consist to analyse if there are statistical significant difference between three groups:
 - 23 CIPs from the hospital in Singapore
 - 12 CIPs from the hospital in U.S.
 - 73 CIPs remaining

Manuscript 5

Data reduction – Constrasting hospitals



CIP outcome	(I) Hosp_groups	(J) Hosp_groups	Mean difference(I-J)	Sig.
Performance Impact	HospGroup_A	HospGroup_B	-0.449	0.136
	HospGroup_A	HospGroup_C	0.349	0.130
	HospGroup_B	HospGroup_C	0.798	0.010
Stakeholder Satisfaction	HospGroup_A	HospGroup_B	-0.440	0.130
	HospGroup_A	HospGroup_C	0.300	0.198
	HospGroup_B	HospGroup_C	0.740	0.014
Sustainable improvement	HospGroup_A	HospGroup_B	-0.384	0.394
	HospGroup_A	HospGroup_C	0.527	0.055
	HospGroup_B	HospGroup_C	0.911	0.021

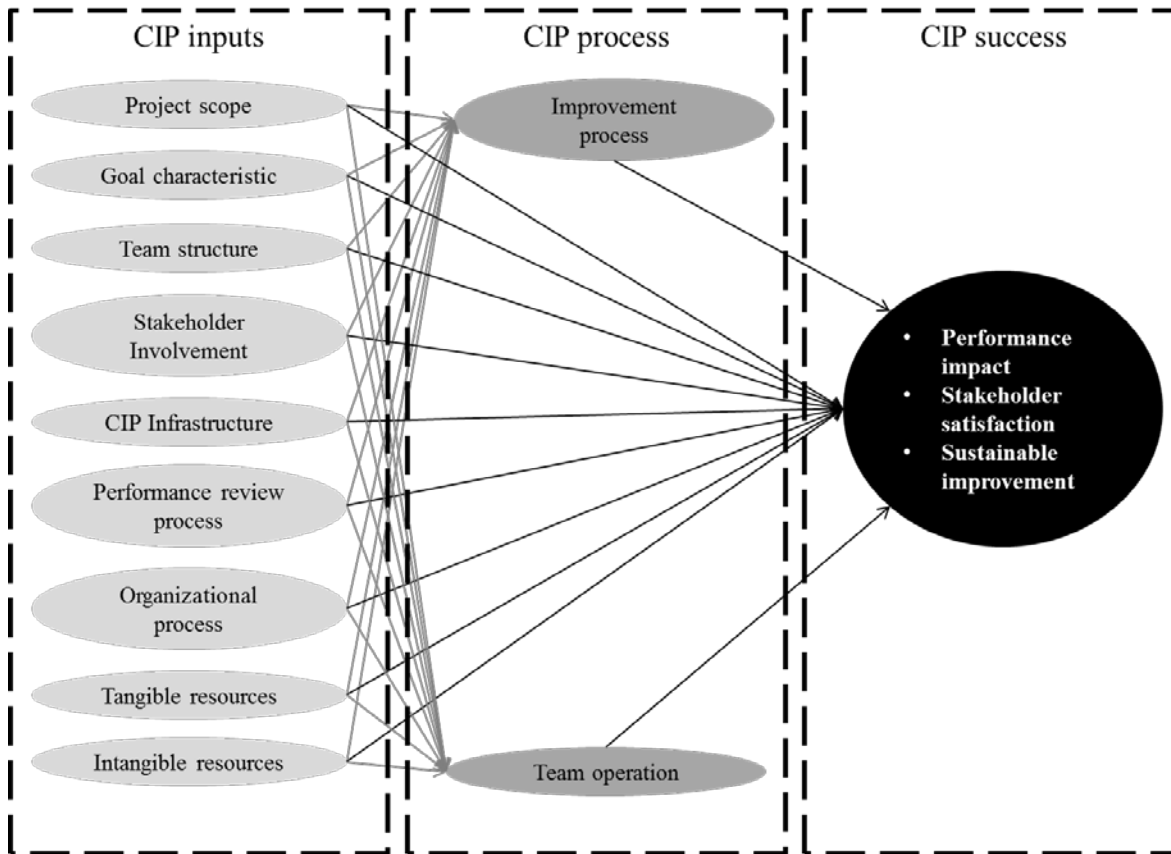
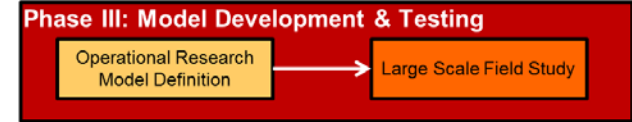
- The 3 CIP outcomes shows significant difference for Groups B (12 CIPs) and Group C (23 CIPs)
 - Group B evaluated higher than Group C

Variables	(I) Hosp_groups	(J) Hosp_groups	Mean difference (I-J)	Sig.
Stakeholder Involvement	HospGroup_A	HospGroup_B	-0.336	0.249
	HospGroup_A	HospGroup_C	0.591	0.001
	HospGroup_B	HospGroup_C	0.927	0.001
Intangible Resources	HospGroup_A	HospGroup_B	-0.313	0.293
	HospGroup_A	HospGroup_C	0.339	0.09
	HospGroup_B	HospGroup_C	0.652	0.02

- 2 out of 11 variables shows significant difference

Manuscript 5

Research model tested

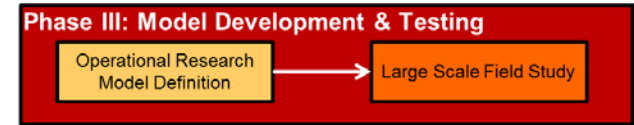


- **H1:** The level of importance of all CIP input constructs has an effect on the level of importance **Improvement Process**.
- **H2:** The level of importance of all CIP input constructs has an effect on the level of importance of **Team Operation**.
- **H3:** The level of importance of all CIP input constructs has an effect on CIP success constructs.
- **H4:** The level of importance of all CIP process constructs has an effect on CIP success.

Manuscript 5

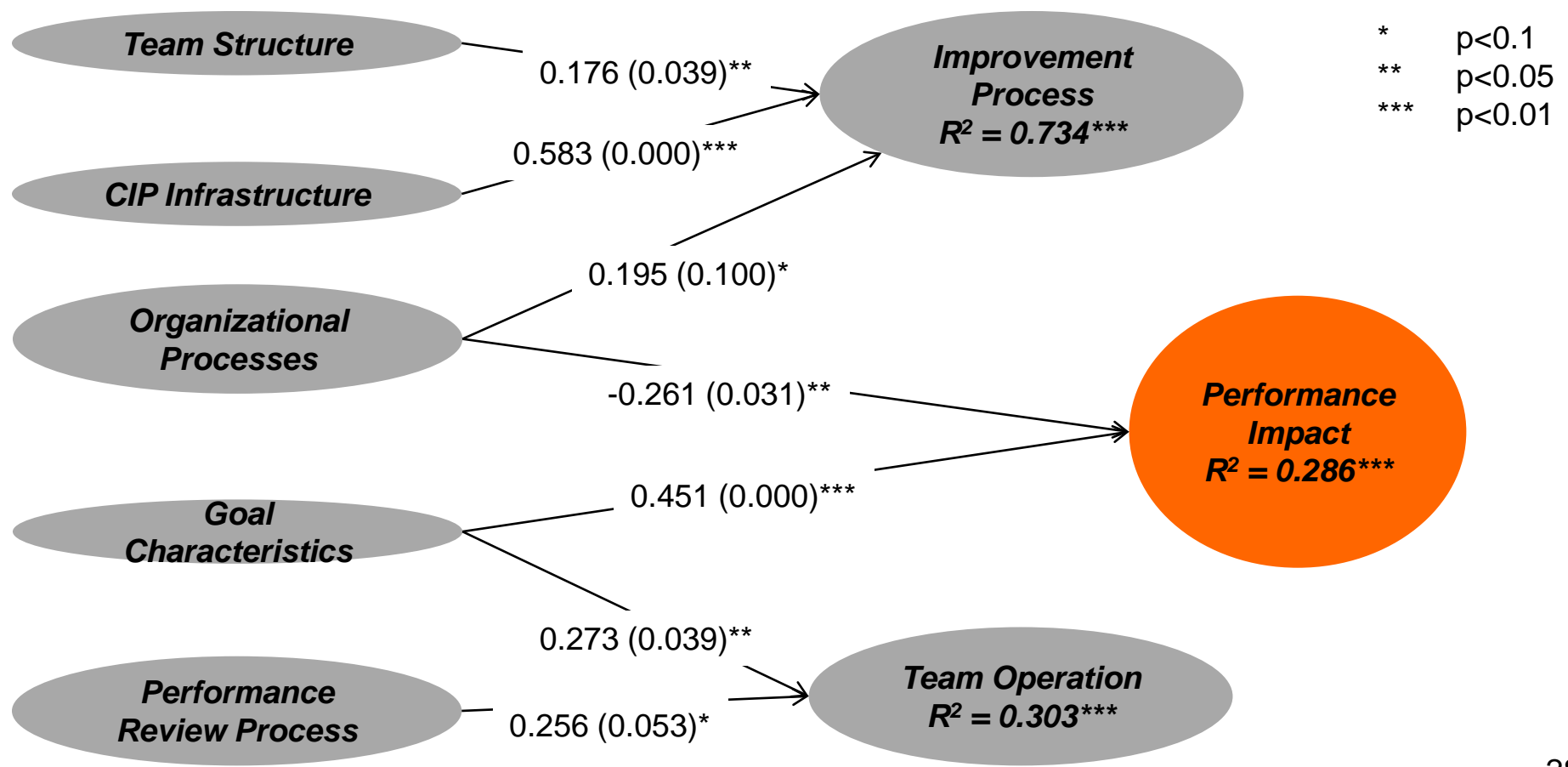
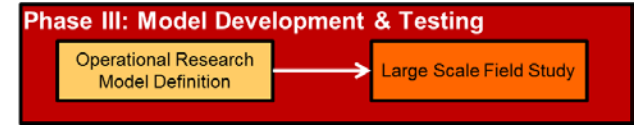
Research model tested – Partial Least Squares

- Develop theories
- In exploratory research
- Small sample size required
- Nonparametric method
- Construct variable could be created using single or multiple items



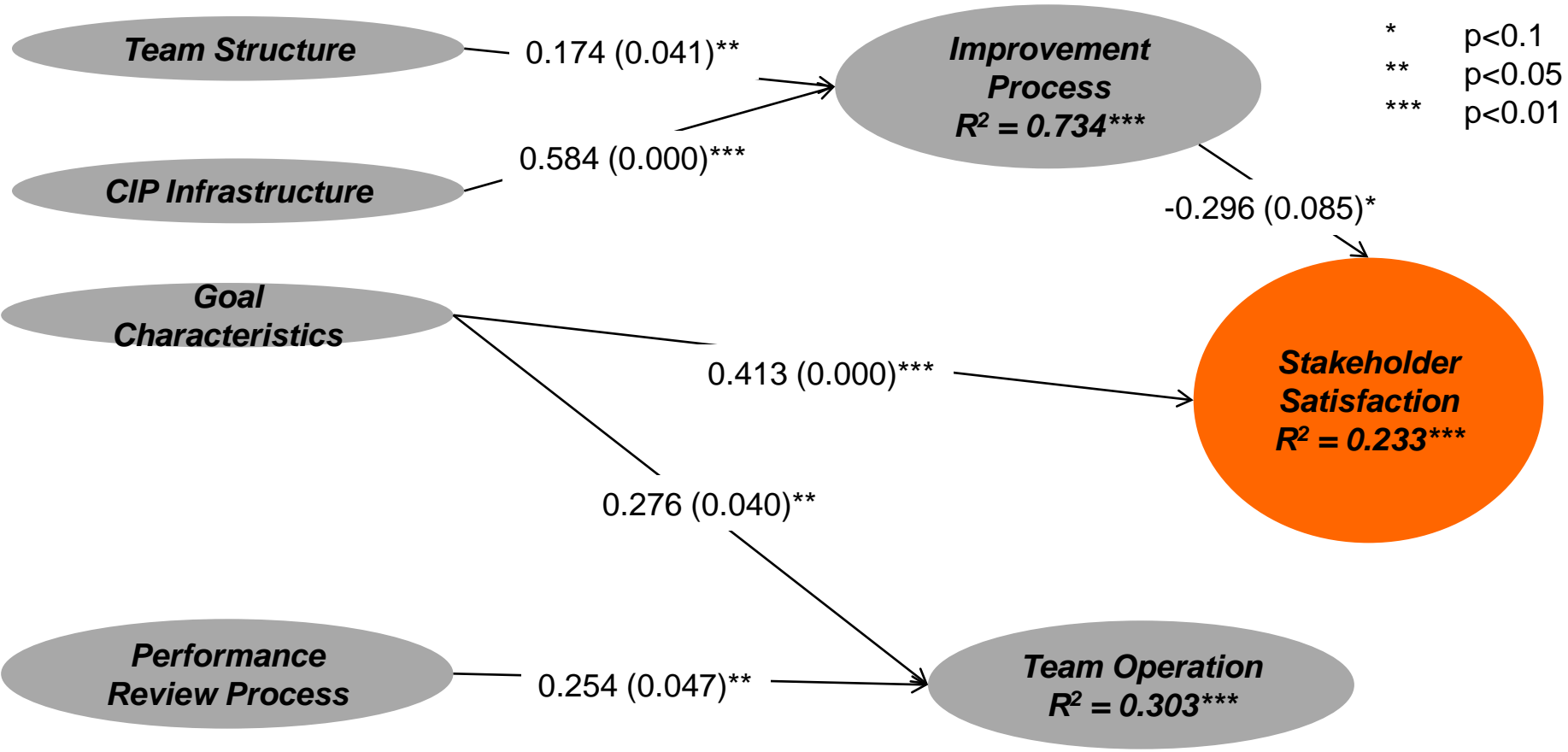
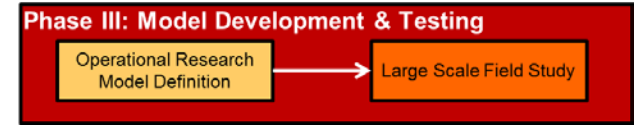
Manuscript 5

Research model tested – Performance Impact



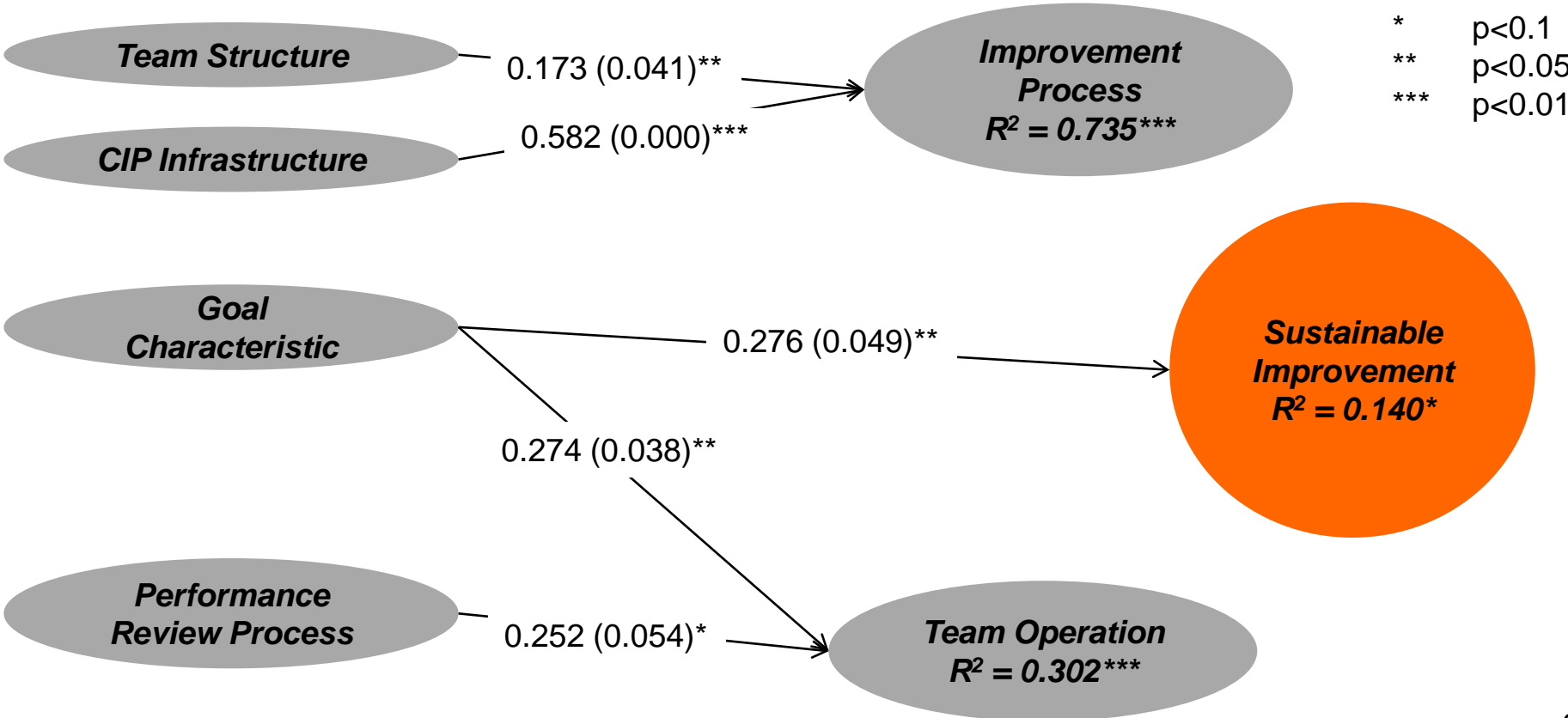
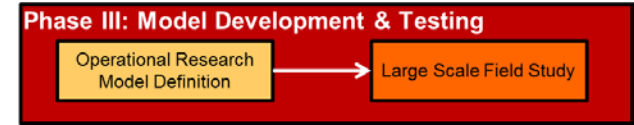
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Research model tested – Stakeholder Satisfaction



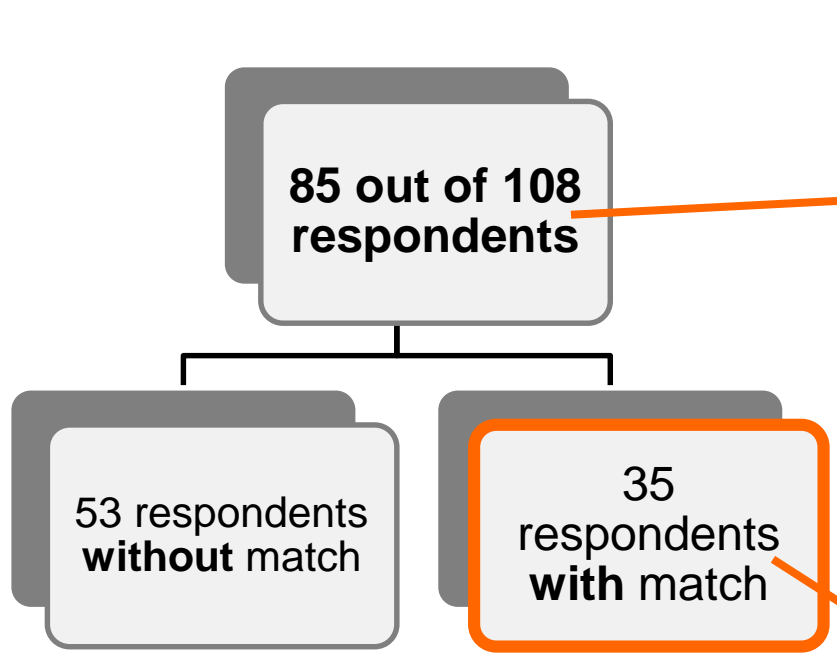
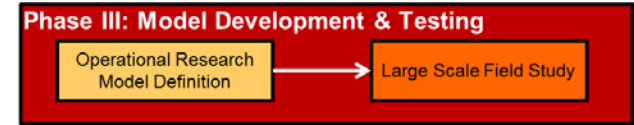
Manuscript 5

Research model tested – Sustainable Improvement



Manuscript 6

Data screening – Percent Goal Achievement



Questions about CIP goals

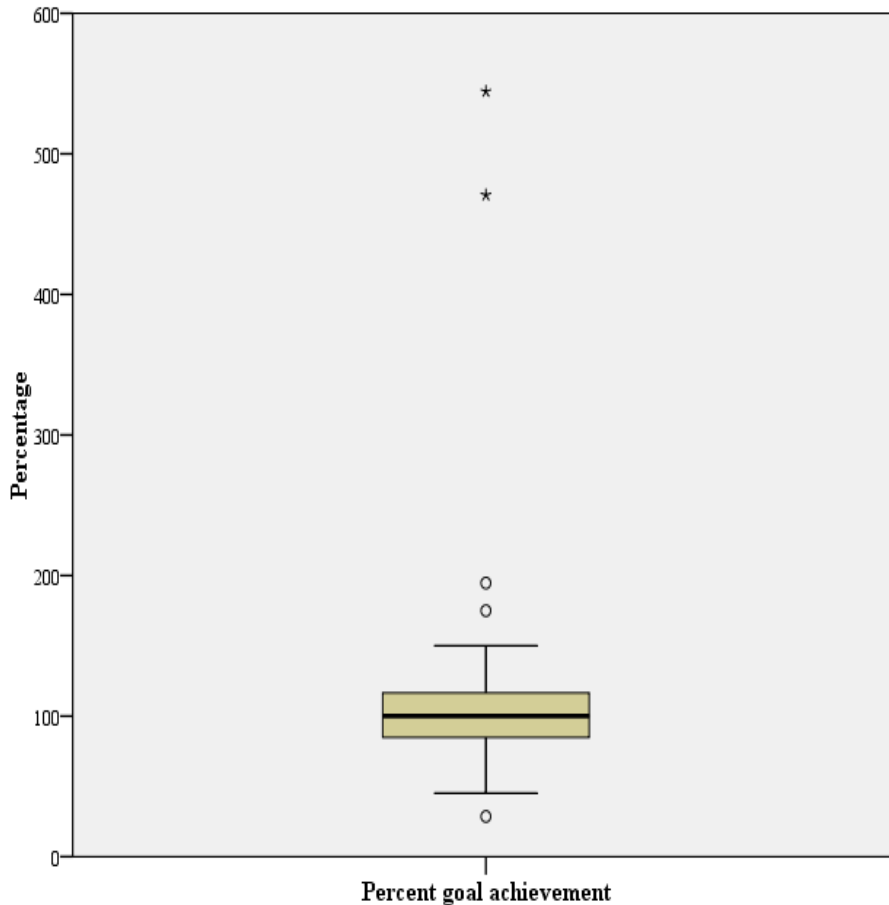
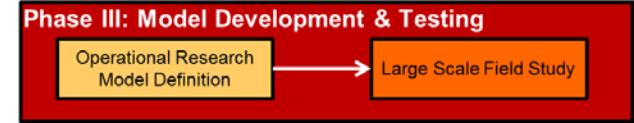
- Percent goal achievement
- Performance metric before
- Performance metric after
- CIP target or goal

Respondent calculations:

- 11 CIPs did not achieve the CIP goal
- 24 CIPs achieved or exceeded the CIP goal

Manuscript 6

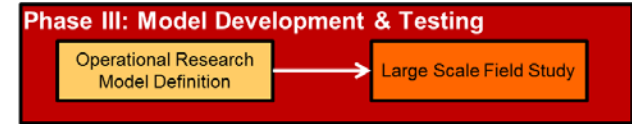
Percent Goal Achievement



- The minimum percent goal achievement was reported for a project related to reducing surgery cancellations caused by facility problems (28.6%).
- The maximum percent goal achievement was obtained in a CIP related to increasing the percentage of patient discharges before noon (544.4%).

Manuscript 6

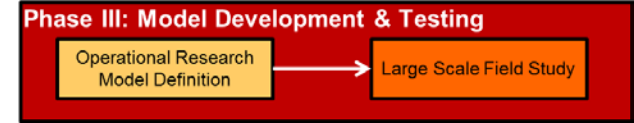
Percent Goal Achievement – Analyses



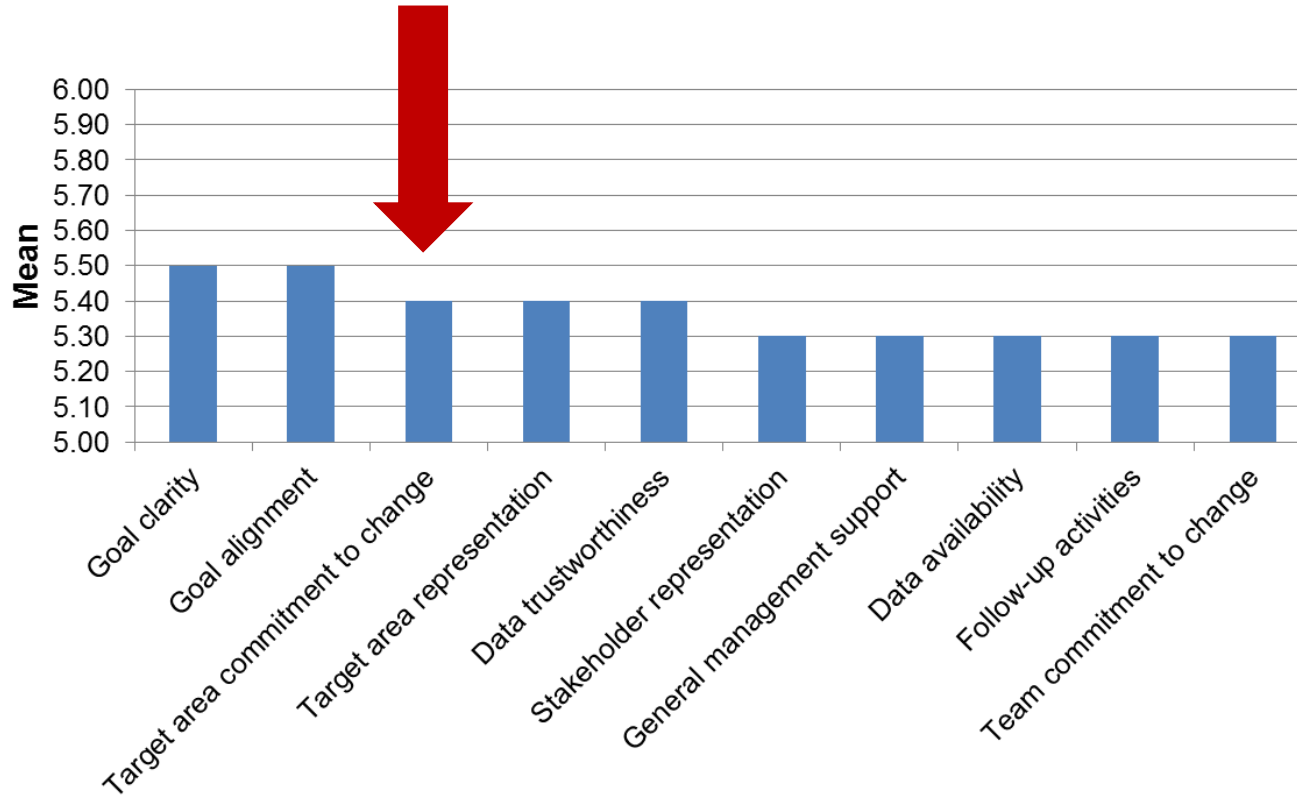
- Identify the top ten factors related to **Performance Goal Achievement** according to field study
- Comparing three studies focused on identify factors related to CIP success
 - Frequency of publications per paper
 - Experts' opinions
 - Field study
- Identify factors with statistical difference between
 - 24 CIP Achieved or exceeded goal
 - 11 CIP Not achieved
- Create a regression model

Manuscript 6

Top ten factors related to Percent Goal Achievement

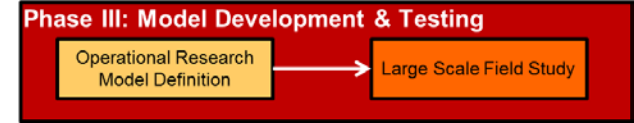


Factors removed during the EFA in manuscript 5



Manuscript 6

Comparing studies focused on identify factors related to CIP success

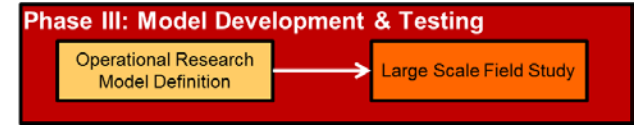


Category	Factor related to CIP success
Task design	Goal clarity ^{b, c}
	Goal alignment ^{b, c}
	Target area commitment to change ^{a, c}
Team design	Stakeholder representation ^{a, c}
	Target area representation ^{b, c}
Organization	General management support ^c
	Data availability ^{a, c}
	Data trustworthiness ^{a, b, c}
	Follow-up activities ^{b, c}
CIP process	Team commitment to change ^{a, c}

Notes: ^a Top ten frequency in publications per factor, ^b Top ten factors per experts' opinions, ^c Top ten factors in this research.

Manuscript 6

Comparing two groups: Achieved or exceeded goal vs. Not achieved



Factors related to percent goal achievement	Sig.
Software	0.042
Facilitation	0.008
Follow up activities	0.065
CIP technical documentation	0.072

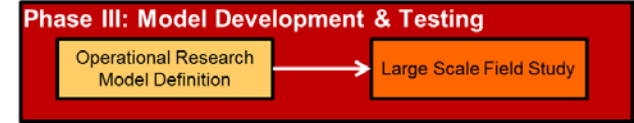
- Most of the factors that are different between groups (achieved or exceeded vs. Not achieved) came from organization category

Manuscript 6

Regression model

Factor related to percent goal achievement

- Goal clarity ^{b, c}
- Goal alignment ^{b, c}
- Target area commitment to change ^{a, c}
- Stakeholder representation ^{a, c}
- Target area representation ^{b, c}
- Data availability ^{a, c}
- Data trustworthiness ^{a, b, c}
- Follow-up activities ^{b, c, d}
- Team commitment to change ^{a, c}
- Software ^d
- Facilitation ^d
- CIP technical documentation ^d

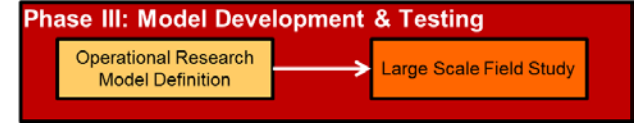


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**Log transformation
of percent goal
achievement**

Manuscript 6

Regression model



Factor related to percent goal achievement	B	t	P-value
Target area commitment to change ^{a, c}	-0.147	-2.213	0.038
Data availability ^{a, c}	0.149	2.405	0.012
Facilitation ^d	0.145	2.743	0.012

=

Log transformation of percent goal achievement
 $R^2 = 0.76$
P-value = 0.029

Conclusions and Limitations

- PLS has been used in different field such as business, marketing, and operation management. Five publications focused on identify barriers and factors used a sample size between 66 and 145 survey respondents.
 - This study in this range of respondents
- At factor level
 - There is not enough publications related to CSFs for CIPs in hospitals, difficulty a process of variable reductions, were other methods such as meta-analysis or meta-evaluations could be used.
 - During the EFA, several factors that were previous identified as critical in CIP for manufacturing organizations were removed, but also new factors were included in this study.
 - The number of respondents in this research could be considered a limitation to improve the results obtained from the EFA.

Conclusions and Limitations

- At variable level this study support other research findings, but also question the generalization of those investigation:
 - **Goal Characteristics, Improvement Process, and Organizational Process** are CSF related to CIP success in hospitals.
 - Other variables related to CIP success in manufacturing organizations such as cooperation, proactive improvement and action orientation were not identified as CSF in this study.
- The lack of similar number of factors that integrate the 11 variables was a limitation to conduct a hierarchical PLS, which could help us to obtain a different perspective of this results

Future works

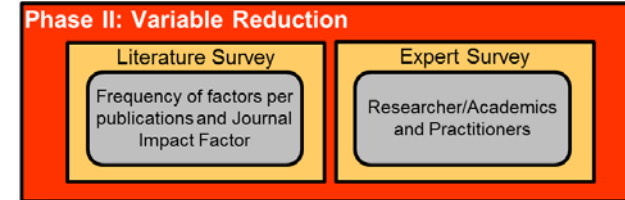
- Conduct studies focused to explain the negative relationship identified in the three CIP outcome research model tested
- Identify the impact of 23 Singapore hospitals and 12 U.S. hospitals in CIP outcome research model tested
- Identify the percent of goal achievement on those publications describing the application of CIP in hospitals
- Apply the same data collection instrument in ongoing CIPs in hospitals, including the collection of information from team members
- Conduct a similar study in manufacturing companies or other service organizations (e.g. banking and government) and contrast results with the current study

Questions?



Phase II: Variable Reduction

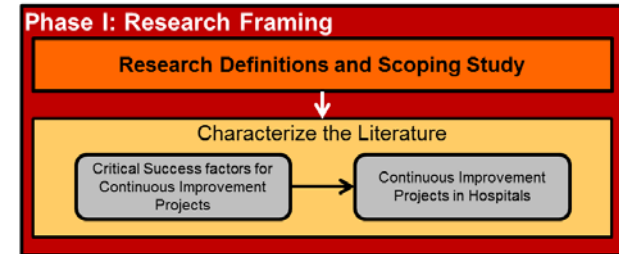
^a Literature Survey and ^b Expert Survey



Factor name	Frequency of publications per factor (out of 175 publications)	Experts' opinions	
		n	Mean (SD)
Goal clarity ^b	14	10	5.40 (0.52)
Goal alignment ^b	11	10	5.40 (0.84)
Problem scope ^b	16	10	5.20 (0.79)
Target area commitment to change ^a	53	10	4.90 (1.45)
Stakeholder representation ^a	34	10	4.90 (1.29)
Target area representation ^b	24	9	5.22 (1.30)
External champion/sponsor ^b	22	10	5.20 (0.79)
Team member time ^b	27	10	5.60 (0.70)
General resource support ^a	19	10	4.60 (0.97)
Data availability ^a	56	10	5.10 (0.57)
Data trustworthiness ^{a, b}	28	10	5.30 (0.48)
Organizational culture ^b	23	10	5.30 (0.82)
Follow-up activities ^b	12	10	5.40 (0.70)
Team commitment to change ^a	30	10	5.10 (0.57)
Team communication and coordination ^b	13	10	5.40 (0.52)
Tool appropriateness ^a	43	10	4.60 (0.52)
Structured methodology ^a	77	10	5.10 (0.88)
Planning for institutionalization ^a	58	10	4.90 (0.74)
CIP progress reporting ^a	31	10	4.60 (0.97)

Phase I: Research Framing

Research Definitions and Scoping Study



A **CIP** is a **structured improvement project** using a **team of people**, typically representing **different departments and units** in the organization, working to **improve a process or area** over a **relatively short period of time**. For example: Kaizen event, LSS, SS, QIP



A **CSF** are **those variables** highly important to **CIP success** (percent goal achievement, performance impact, stakeholder satisfaction, and sustainable improvement)

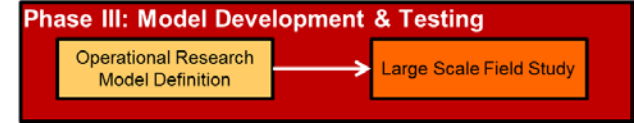
Why hospitals?



- CIP are **relatively new** in hospitals (1980s)
- Hospitals are **complex organizations with human interactions**, where a lot of things can go wrong (“To Err is Human”)
- **13% to 20%** of hospital cost are results of **inefficient practices**
- Other investigations in CIPs and CSFs suggested future work on **identify new CSFs** and conduct **investigations in service organizations**

Phase II: Model Development and Testing

Empirical Field Study



Demographic Results – Improvement approach vs. Duration

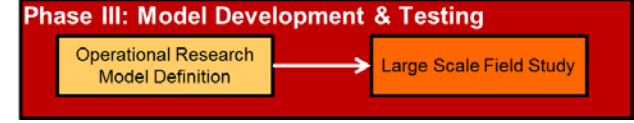
Improvement approach vs. duration	LM	SS	LSS	QIP	Other	Total
Less than 1 day	0	0	0	0	1	1
1 - 5 days	2	1	2	1	0	6
Between 1 - 3 weeks	2	0	3	1	0	6
Between 1 - 3 months	4	0	2	4	0	10
Between 3 - 6 months	6	4	8	14	1	33
More than 6 months	6	7	10	26	2	51
Total	20	12	25	46	4	107

- SS usually takes three months or more
- Information from U.S. hospital

- 56.5% of QIPs took more than six months
- 30.4% of QIPs took between 3 – 6 months

Phase II: Model Development and Testing

Empirical Field Study



Demographic Results - Hospital with multiple CIPs

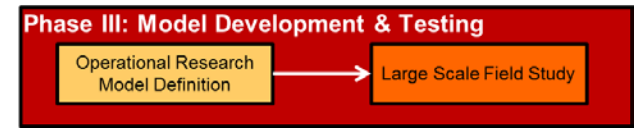
- 15 hospitals participated with two or more CIPs

- Is this evidence of lack of institutionalization of CI efforts in hospitals or evidence of a more mature approach with multiple improvement approaches?

Hospital with multiple CIPs	Type of CIP
Single type of CIP	LM (2)
	QIP (2)
Two types of CIP	LSS – QIP (1)
	LSS - Other (1)
	LM – LSS (2)
	LM – Other (1),
	LSS – SS (1)
	SS – QIP (1)
	LM – SS (1)
Three types of CIP	LM – SS – LSS (1)
	LM – QIP – Other (1)
	LM – LSS – QIP (1)

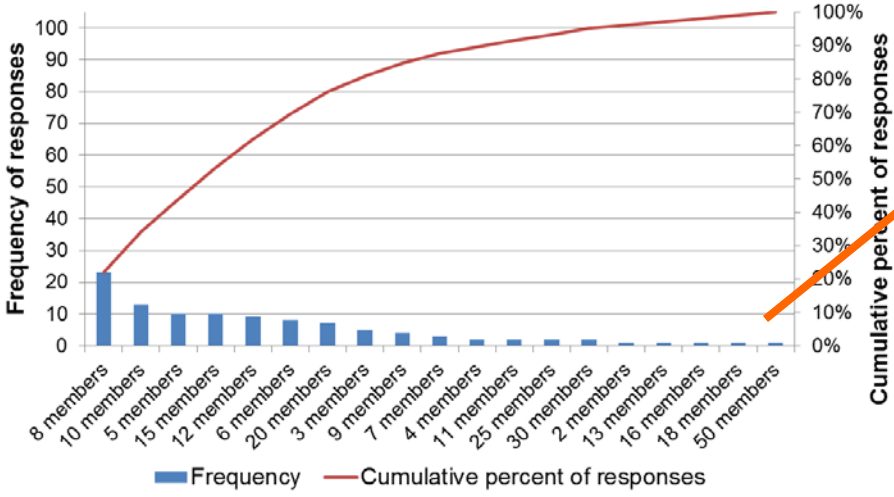
Phase II: Model Development and Testing

Empirical Field Study



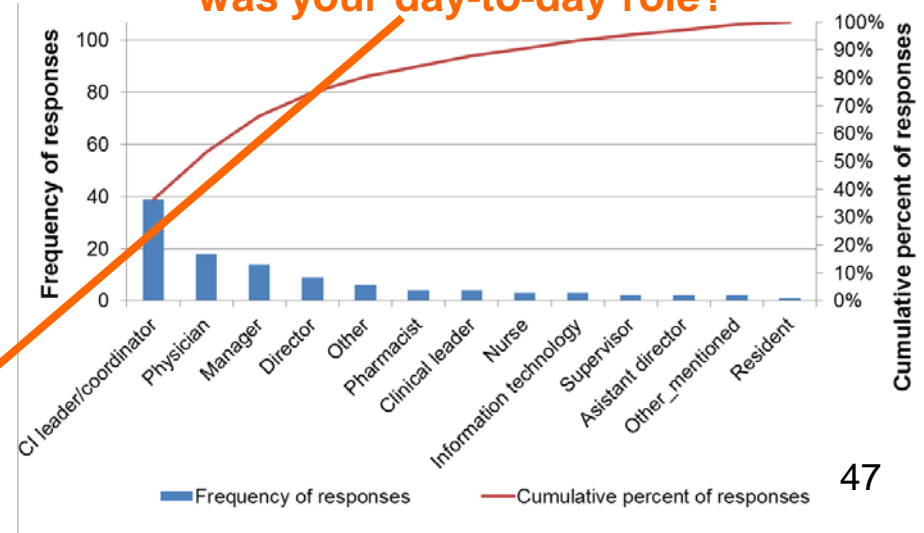
Demographic results – Team size and day-to-day roles

How many people directly participated in this CIP as team members?



- Respondent reported 50 members used; “Mainly action research” was response to improvement approach question

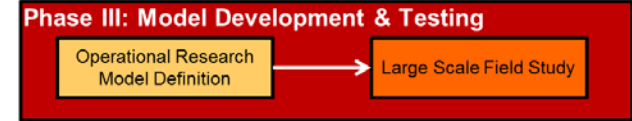
At the time you led/facilitated this CIP, what was your day-to-day role?



- Hospitals had full-time positions focused on CI
- Involvement of different levels in the organization on CI

Manuscript 5

Data reduction – Factors related to CIP success

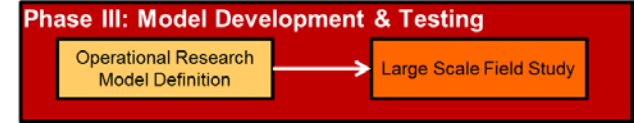


Task design	Items	Factor loadings	Communality	Cronbach's alpha
Goal Characteristics	Goal clarity	0.817	0.657	0.736
	Goal alignment	0.802	0.585	
	Goal development process	0.622	0.625	
	<i>Target area understanding of CI</i>	0.603	0.302	
Project Scope	Problem scope	0.828	0.647	0.720
	Project duration	0.817	0.591	
	Target area routineness	0.810	0.600	
	<i>Target area commitment to change</i>	0.430	0.357	
	<i>Goal difficulty</i>	0.353	0.335	

Team design	Items	Factor loadings	Communality	Cronbach's alpha
Stakeholder Involvement	Target area representation	0.764	0.549	0.655
	Stakeholder representation	0.739	0.554	
	Cross-functionality	0.700	0.474	
	Expert champion/sponsor	0.632	0.444	
Team Structure	Team improvement skills	0.807	0.631	0.724
	Team size	0.687	0.499	
	Internal team roles	0.665	0.581	
	<i>Team member experience</i>	0.642	0.386	
	<i>Team autonomy</i>	0.596	0.337	

Manuscript 5

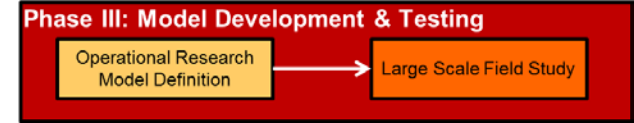
Data reduction - Organization



Construct variables	Items	Factor loadings	Communality	Cronbach's alpha
<i>Intangible Resources</i>	<i>Team member time</i>	0.769	0.706	0.672
	<i>General management support</i>	0.624	0.604	
<i>CIP Infrastructure</i>	<i>CIP planning</i>	0.837	0.612	0.862 (0.867*)
	<i>Facilitation</i>	0.784	0.628	
	<i>Data availability</i>	0.695	0.609	
	<i>Support from CI program</i>	0.693	0.500	
	<i>Follow-up activities</i>	0.691	0.636	
	<i>Project identification and selection</i>	0.590	0.469	
	<i>Data trustworthiness</i>	0.568	0.563	
	<i>Management involvement</i>	0.551	0.544	
	<i>Training</i>	.443	0.490	

Manuscript 5

Data reduction - Organization

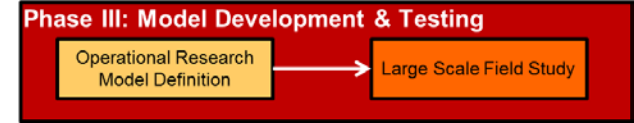


Construct variables	Items	Factor loadings	Communality	Cronbach's alpha
Organizational Process	CIP priority	0.824	0.598	0.753
	Organizational policies and procedures	0.745	0.676	
	Organizational structure	0.644	0.655	
	Organizational culture	0.656	0.571	
	Management understanding of CI	0.465	0.643	
Tangible Resources	Financial resources	0.839	0.692	0.757
	Materials and equipment	0.823	0.703	
	Software	0.704	0.632	
	General resource support	0.537	0.672	
Performance Review Process	Recognition and rewards	0.959	0.755	0.753
	Performance evaluation/review	0.808	0.726	
	Lessons learned	0.707	0.556	
	Information from previous CIP	0.486	0.542	
	Deployment of changes	0.367	0.492	

** High Cross-loading (0.460) with *Intangible resources*

Manuscript 5

Data reduction – CIP process

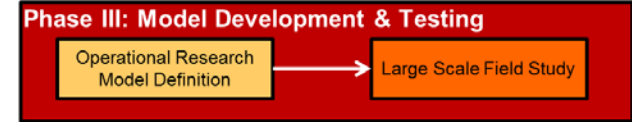


- CIP technical documentation, CIP progress reporting, Solution iterations, and Planning for institutionalization are factors not previously studied in other research

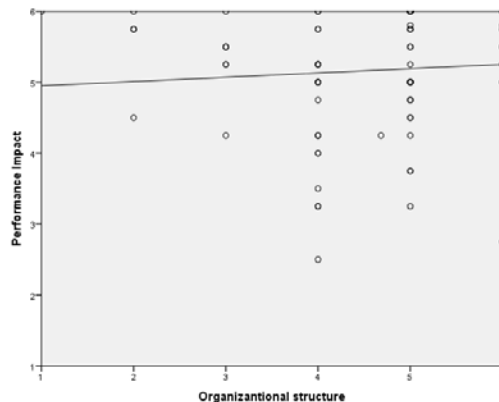
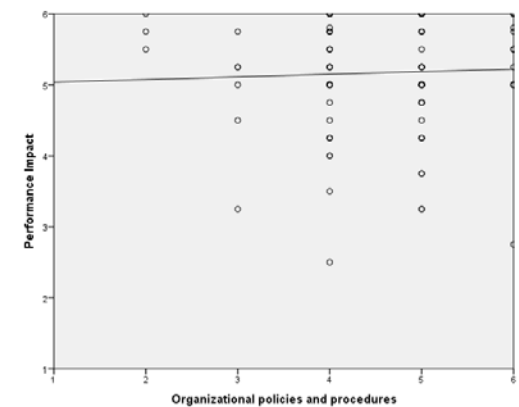
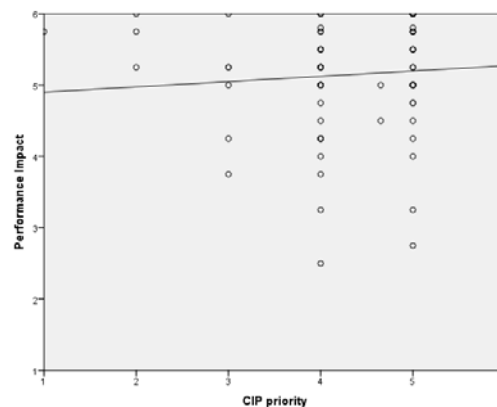
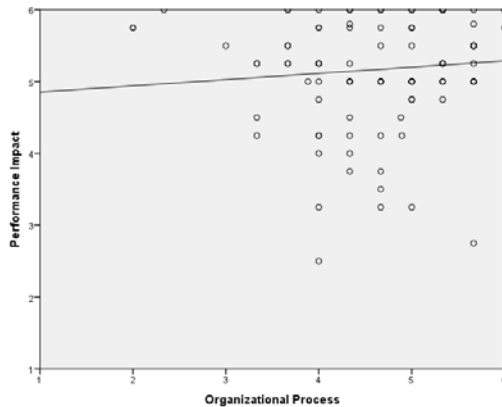
Construct variables	Items	Factor loadings	Communality	Cronbach's alpha
Team Operation	Team commitment to change	0.799	0.505	0.702
	Team communication and coordination	0.793	0.694	
	Team harmony	0.786	0.662	
Improvement Process	Structured methodology	0.880	0.682	0.863 (0.871*)
	Tool appropriateness	0.862	0.556	
	CIP technical documentation	0.840	0.621	
	CIP progress reporting	0.833	0.549	
	Planning for institutionalization	0.611	0.692	
	Solution iterations	0.575	0.702	
	Action orientation	0.517	0.356	

Phase II: Model Development and Testing

Empirical Field Study



Manuscript 5: Research model tested – *Performance Impact*



- There are not a negative relationship between **Performance Impact** vs. each of the factors that integrate **Organizational Process**
- **Does this negative relationship has other explanation?**