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Modeling Healthcare Information Technology (HIT) Adoption using Systems Dynamics

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Agenda

Introduction

- Definition of Healthcare Information Technology (HIT)
- Example of a typical user (Patient with multiple chronic Diseases)
- A solution: Care Management Plus Program (CMP)
- CMP Research Team

Background

- Significance of the National Healthcare crisis
- History of Care Management
- ROI of CMP (HIT) for healthcare

Forecasting HIT Adoption & Diffusion

- Business Driver: Gap in Primary Care
- Model 1 – Productivity
- Model 2- Dissemination Rates

Conclusion

- Lessons Learned
- Future Work

Introduction

What is Health Information Technology?

Health information technology (Health IT) allows comprehensive management of medical information and its secure exchange between health care consumers and providers.

Broad use of health IT will:

- Improve health care quality
- Prevent medical errors
- Reduce health care costs
- Increase administrative efficiencies
- Decrease paperwork
- Expand access to affordable care

Interoperable health IT will **improve individual patient care**, but it will also bring many **public health benefits** including:

- Early detection of infectious disease outbreaks around the country
- Improved tracking of chronic disease management
- Evaluation of health care based on value enabled by the collection of de-identified price and quality information that can be compared.

An Example that can benefit from HIT

Case Study:

Ms. Viera a 75-year-old woman with diabetes, systolic hypertension, mild congestive heart failure, arthritis and recently diagnosed dementia.



Ms. Viera and her caregiver come to clinic with several problems, including:

- 1) Hip and knee pain
- 2) Trouble taking all of her current 12 medicines,
- 3) Dizziness when she gets up at night,
- 4) Low blood sugars in the morning, and
- 5) A recent fall.

And Out in the hall:

- 6) The caregiver confidentially notes she is exhausted
- 7) Money is running low for additional medications.

An Example that can benefit from HIT

Case Study:

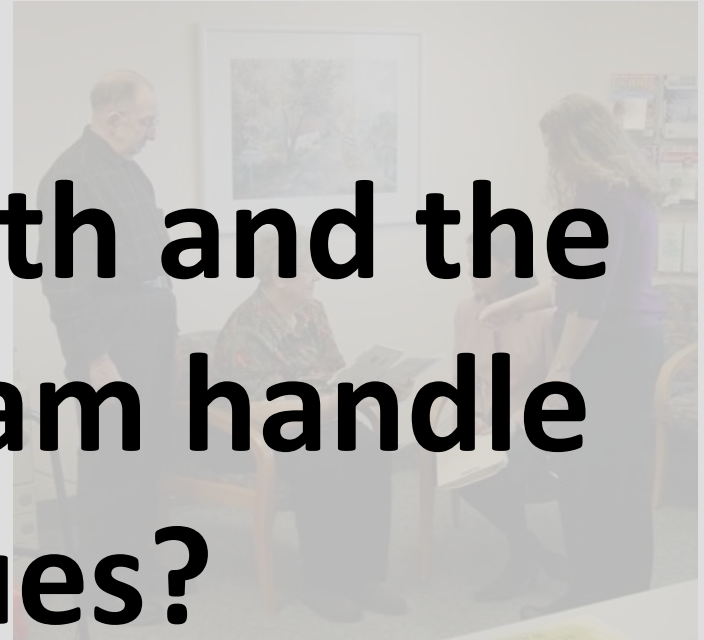
Ms. Viera a 75-year-old woman with diabetes, systemic hypertension, mild congestive heart failure, arthritis, and dementia. She has a history of osteoarthritis.

Ms. Viera's primary care physician consults with several providers, including:

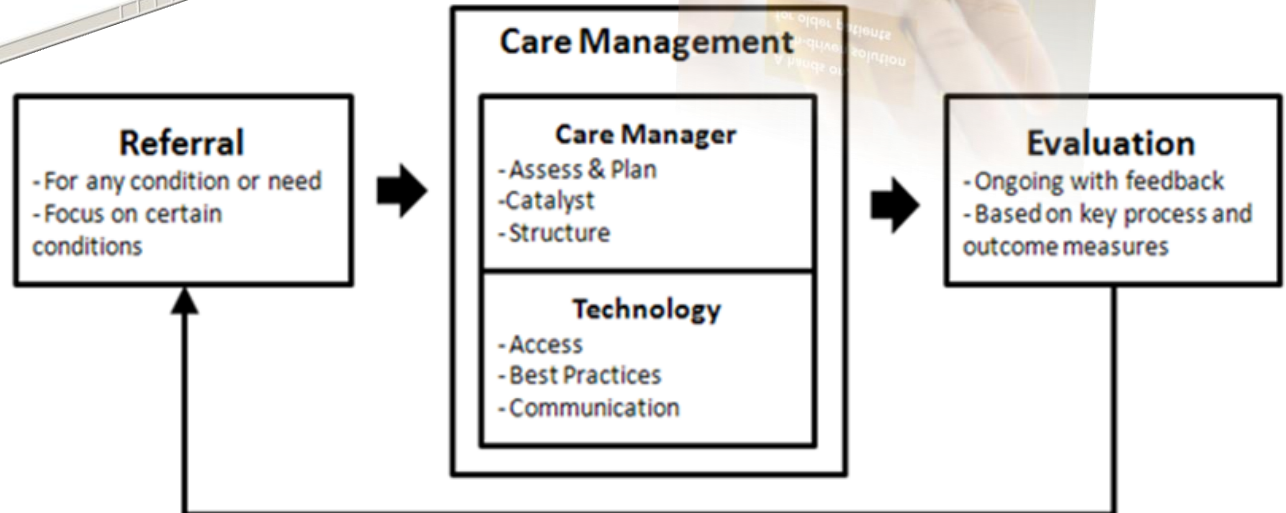
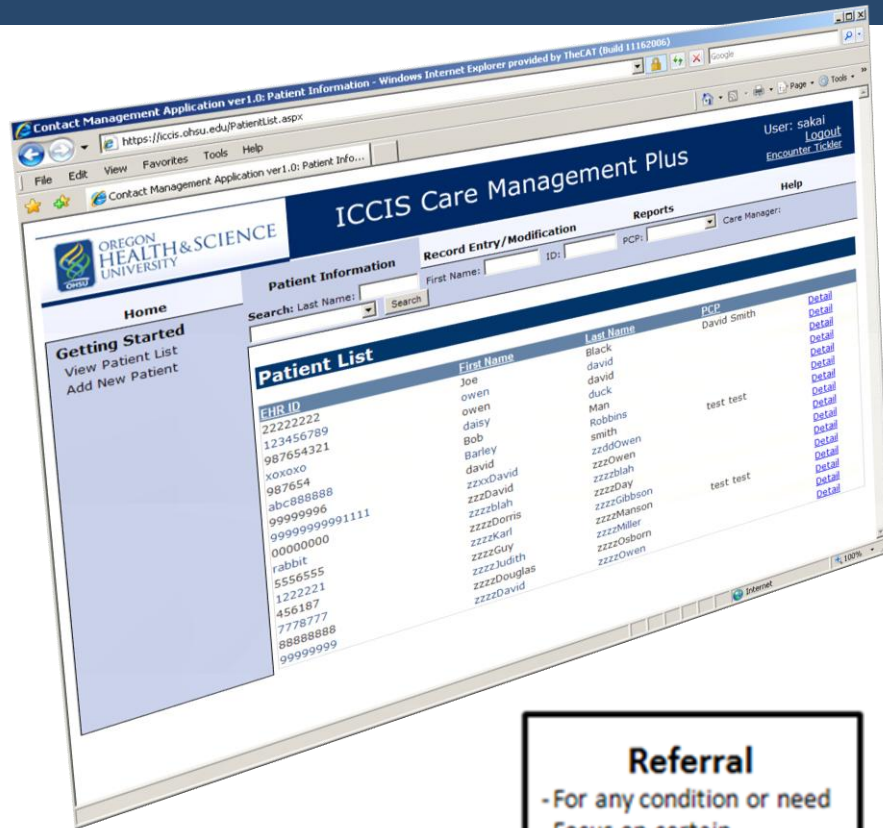
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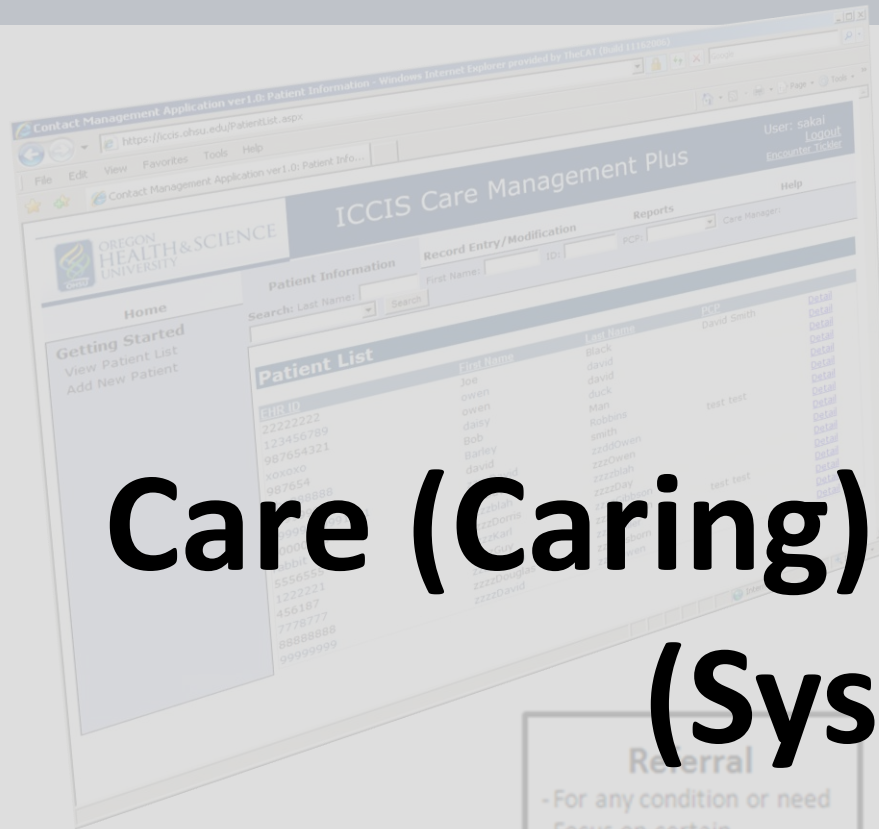
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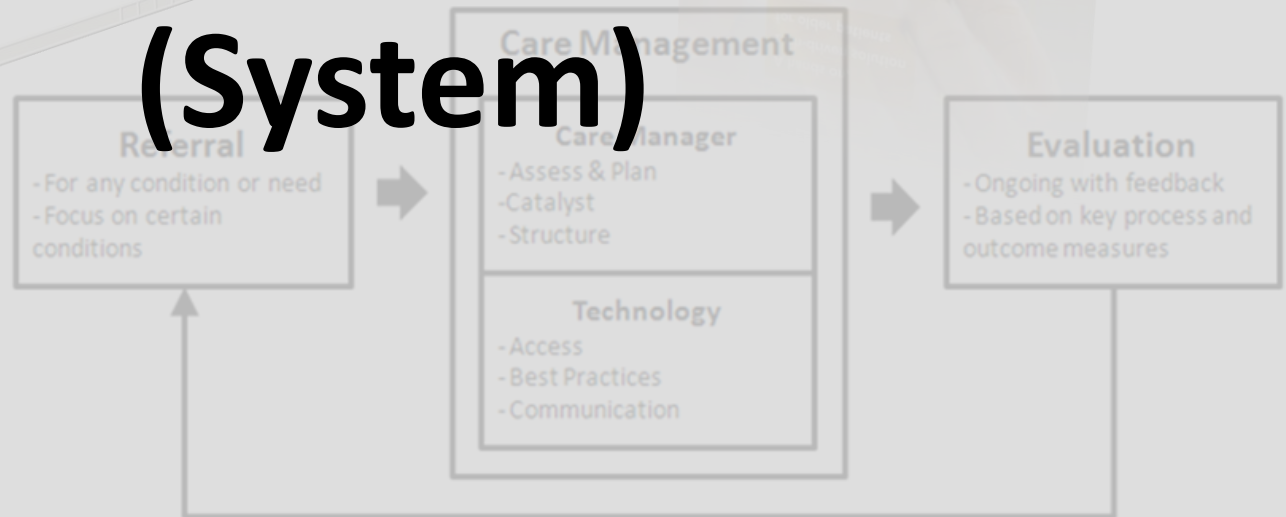
Care Management Plus Program



Care Management Plus Program



Care (Caring) management (System)



CMP Research Team



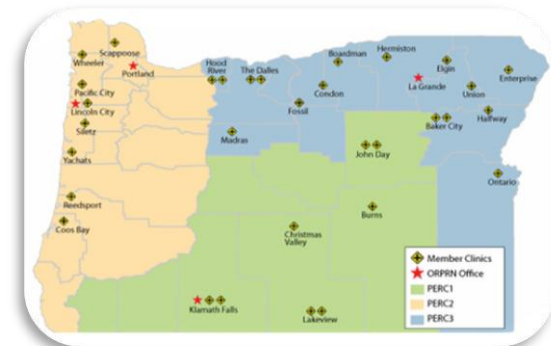
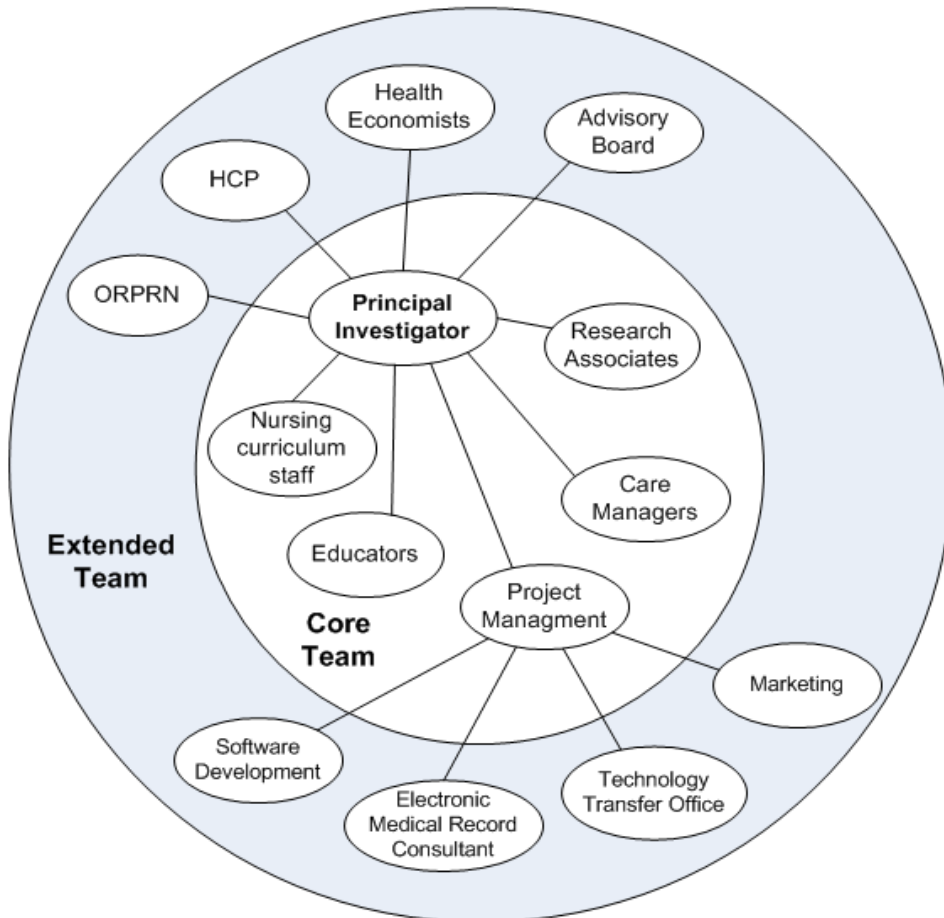
DEDICATED TO IMPROVING HEALTH CARE FOR OLDER AMERICANS

The John A. Hartford Foundation



Agency for Healthcare Research and Quality

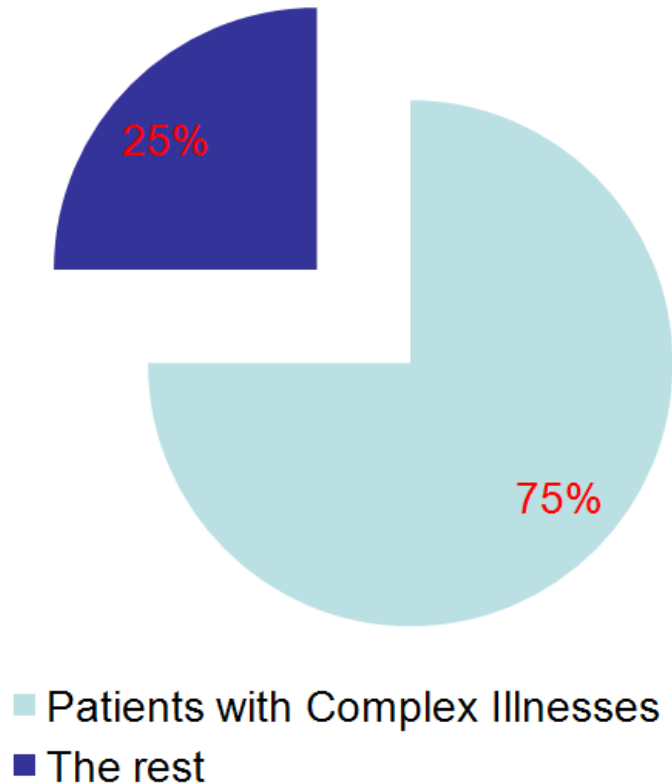
Advancing Excellence in Health Care www.ahrq.gov



Background

Significance of our National Health Crisis

US Healthcare Expenditure

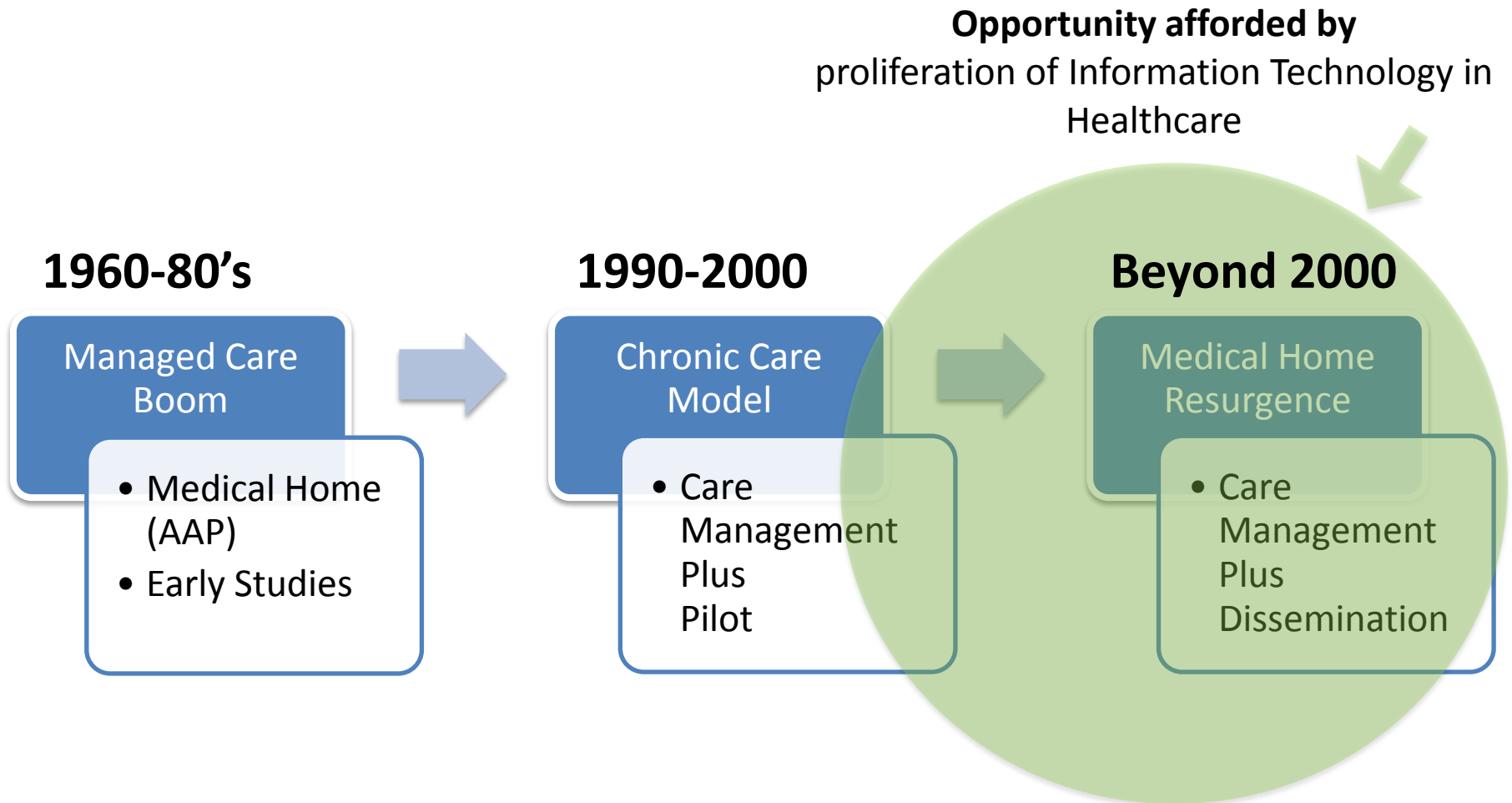


A person with complex illnesses on average:

- Can have 5 different diseases
- See a physician 14 times a year
- Be on up to 50 different medications

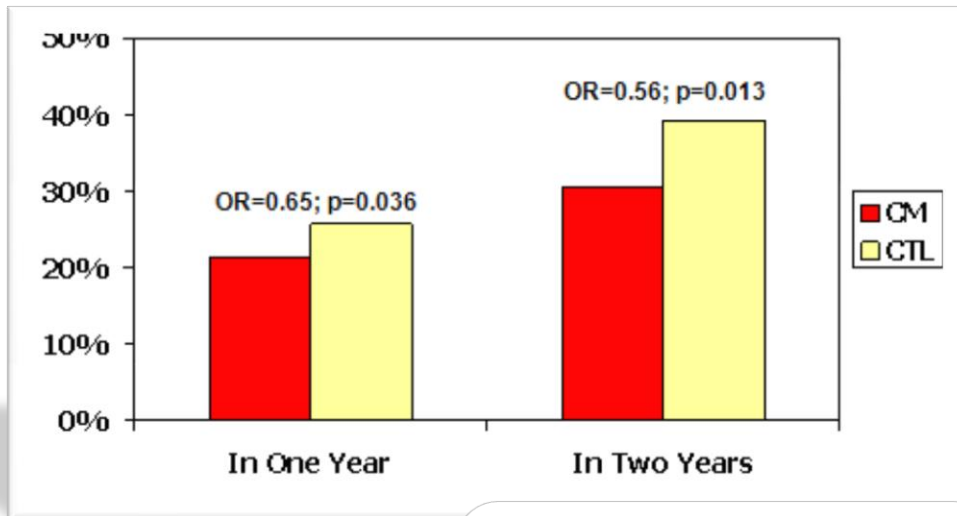


History of Care Management



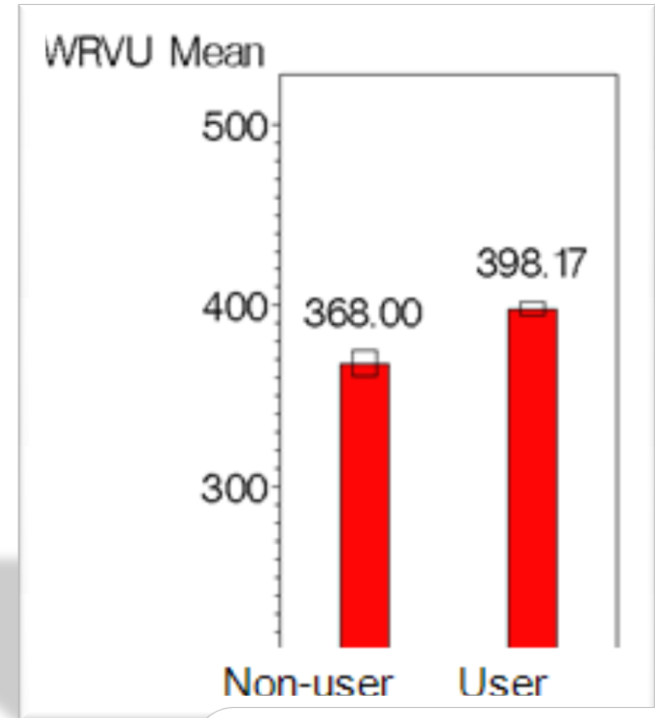
Return on Investment

* Dorr, AJMC, 2007



* Dorr, JAGS, Dec 2008

Reduction in
Hospitalization



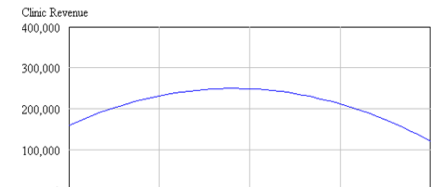
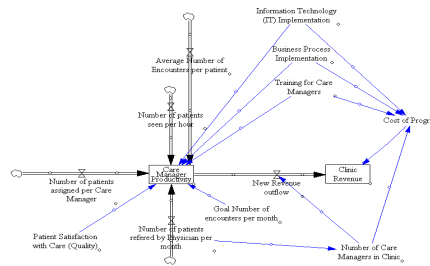
Increased
Productivity

Forecasting HIT (Care Management Plus) Diffusion & Dissemination

System Dynamics

System dynamics is a powerful methodology and computer simulation modeling technique for framing, understanding, and discussing complex issues and problems. Originally developed in the 1950s to help corporate managers improve their understanding of industrial processes, system dynamics is currently being used throughout the public and private sector for policy analysis and design.[2]

| | level0 | level1 (Training) | level2(BP) | level3(IT) |
|--|--------|-------------------|------------|------------------|
| Number of patients assigned per Care Manager | 12 | 12 | 12 | 12 |
| Number of patients referred by Physician per month | 30 | 30 | 33 | 37.5 |
| Number of patients seen per hour (encounter) | 2 | 2 | 2 | 1.2 |
| Average number of Encounter per patient | 15 | 13.5 | 12 | 7.5 |
| Goal (20 workdays*8hour/day) | 160 | 225 | 2 | |
| hour | hour | headcount | | |
| Total Care Manager Hours | 225 | 2 | \$100k | 1.41 |
| level0 | 225 | 2 | \$100k | 1.41 |
| level1 | 203 | 2 | \$100k | 1.27 |
| level2 | 198 | 2 | \$100k | 1.34 |
| level3 | 141 | 1 | \$0k | 0.88 |
| | | | | Underutilization |

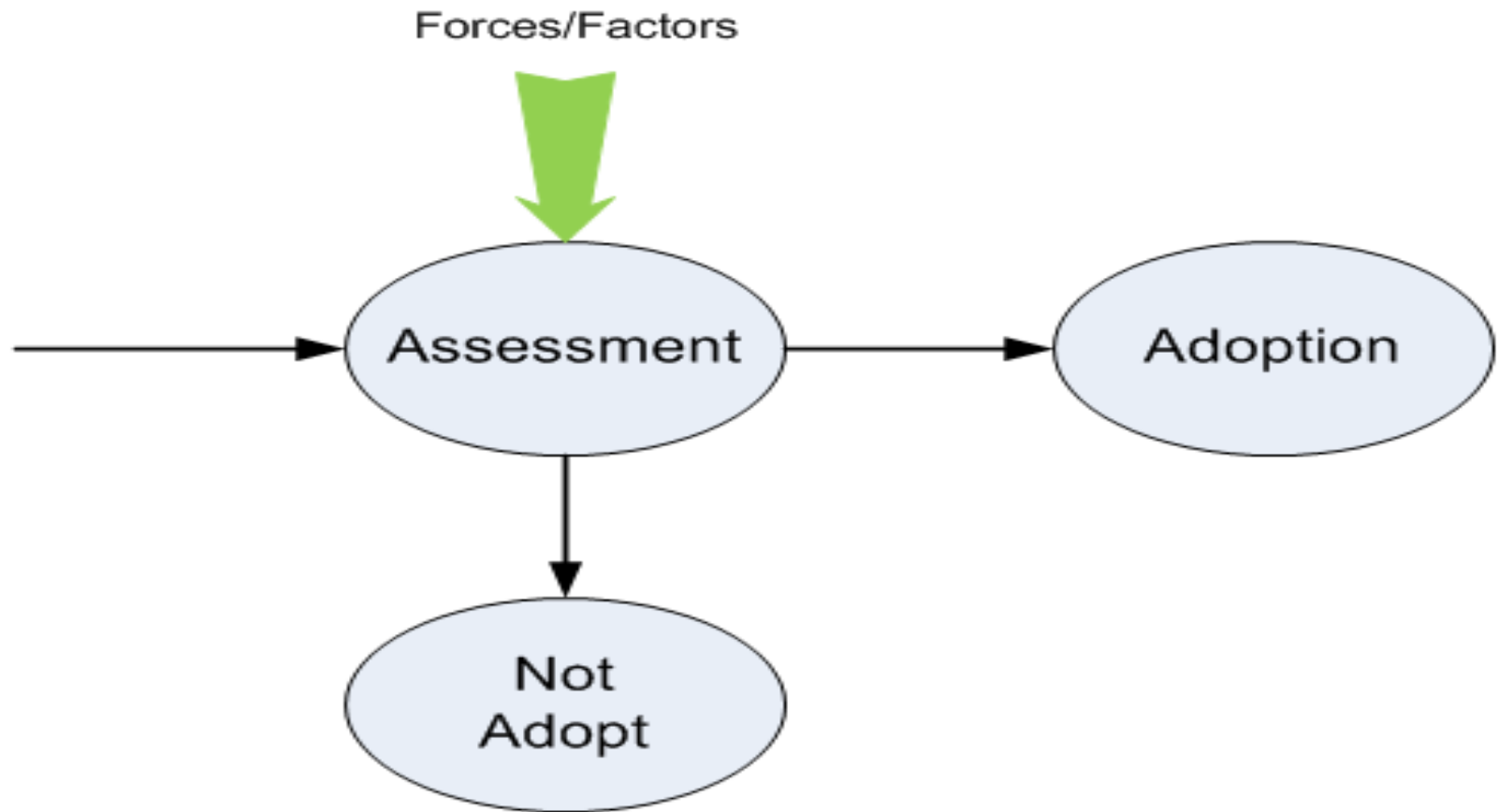


[1] Robert A. Taylor (2008). "Origin of System Dynamics: Jay W. Forrester and the History of System Dynamics". In: U.S. Department of Energy's Introduction to System Dynamics. Retrieved 23 Oktober 2008.

CMP Learning Goals

- Applied to predict Nurse care manager productivity gains over time based on Health IT adoption.
- Forecast dissemination and adoption of care management HIT for older adults in the United States.
- Develop scenarios for diffusion of HIT in the care management domain.

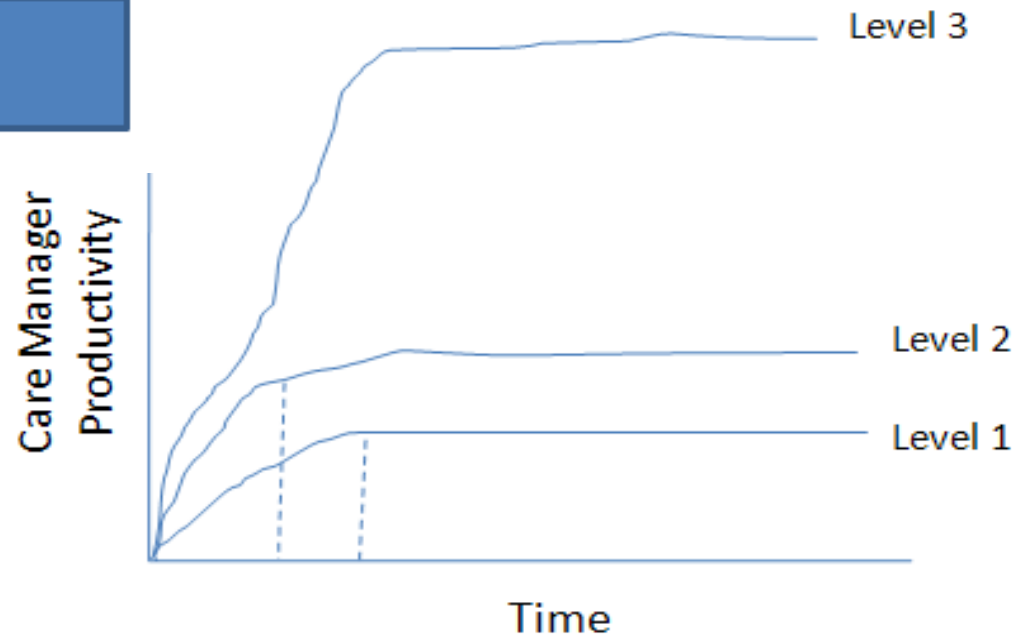
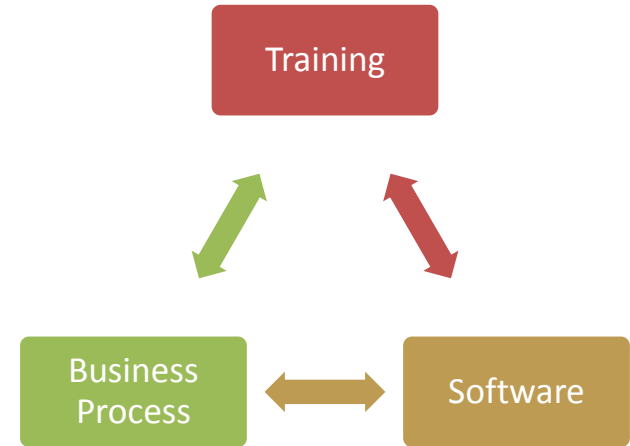
A Simple Adoption Decision



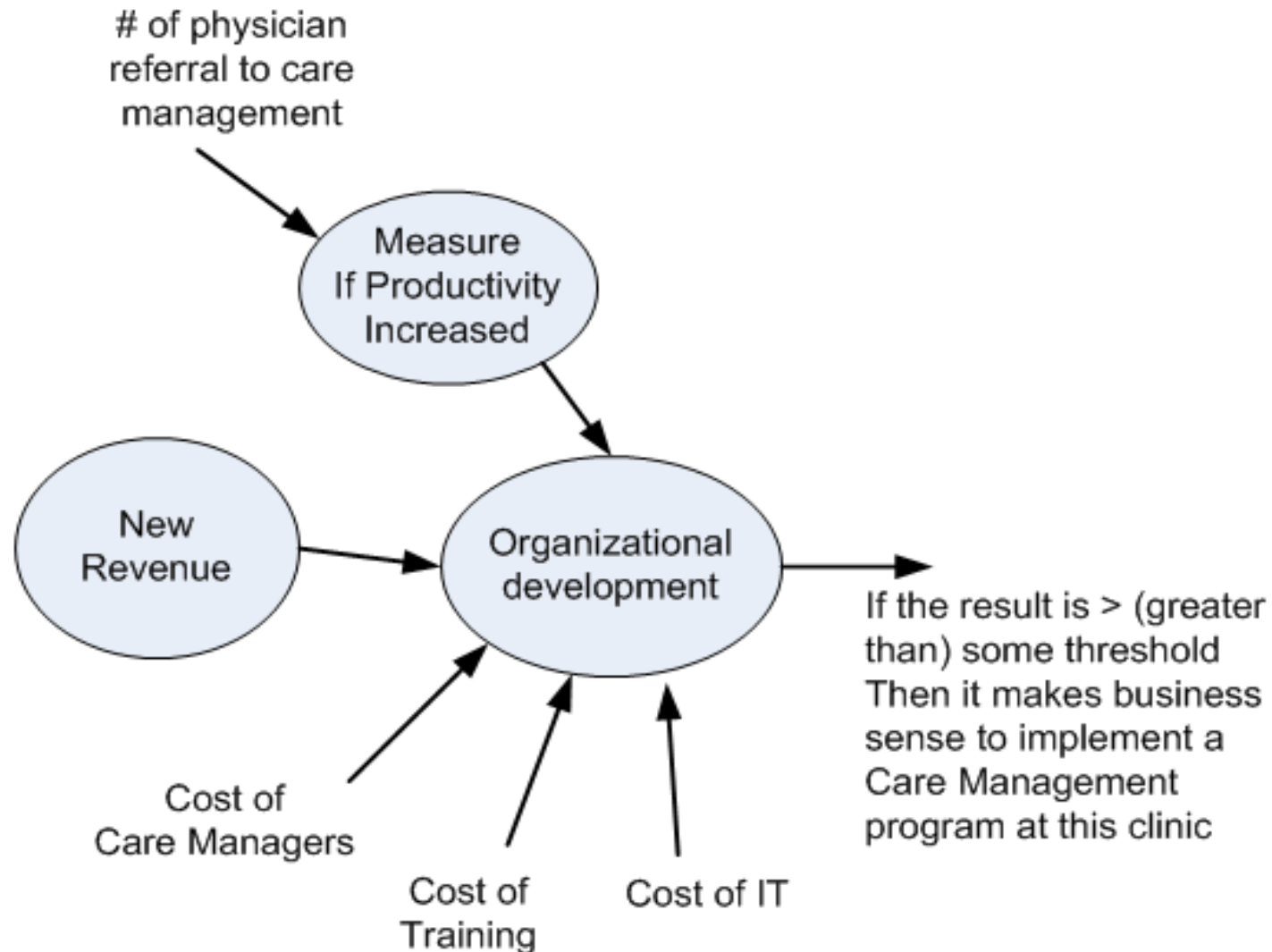
Model1: Nurse Care Manager Productivity

CMP Maturity Model

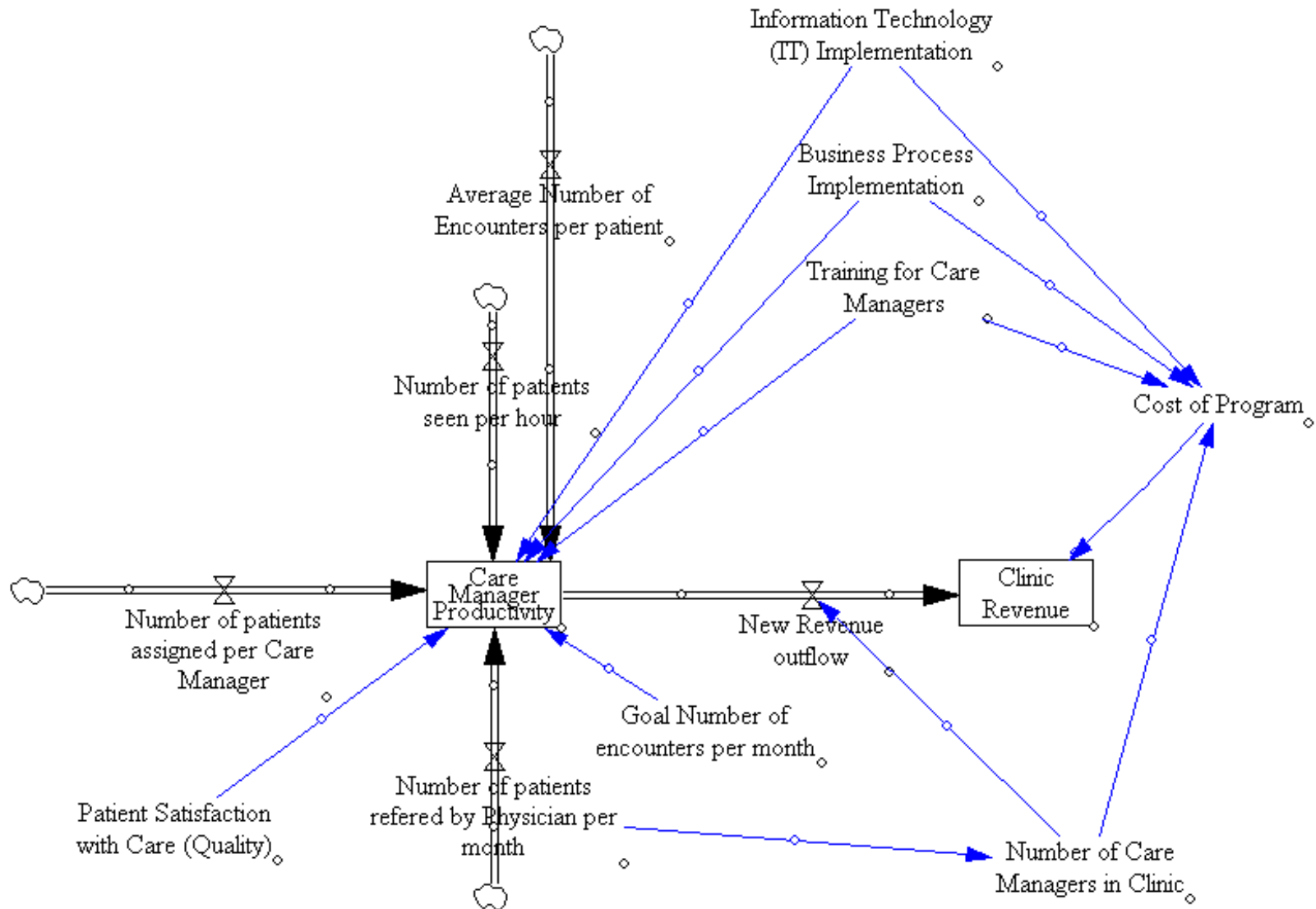
| | |
|---------|--|
| Level 4 | Integration with EHR (Electronic Health Record) |
| Level 3 | Implement CM IT (CMP @OHSU) |
| Level 2 | Implement CM Business Processes |
| Level 1 | Care Management Training Only |
| Level 0 | No Care Management |



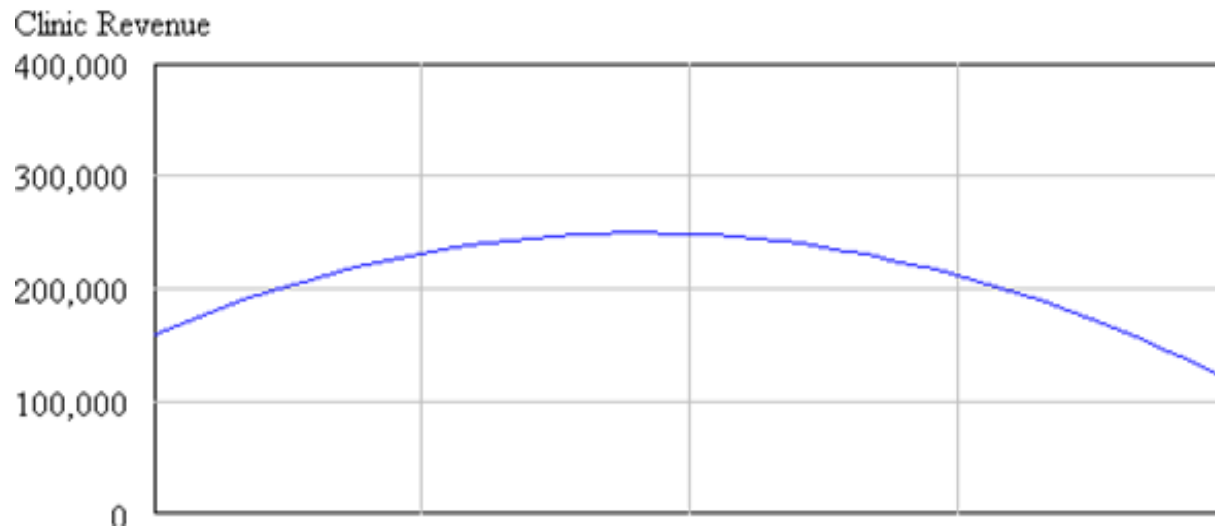
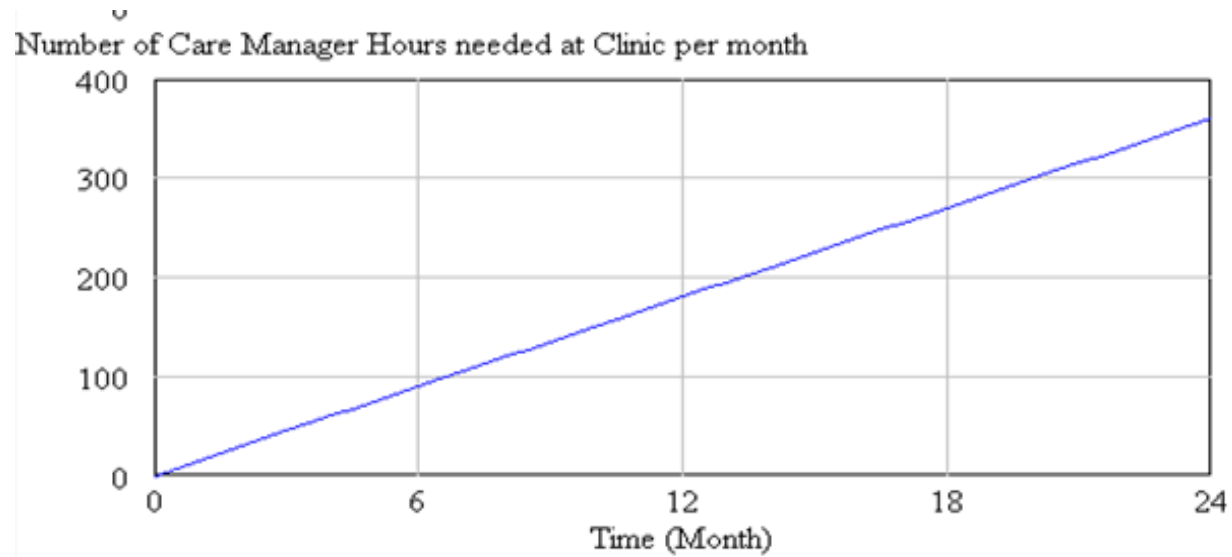
Casual Loop Diagram



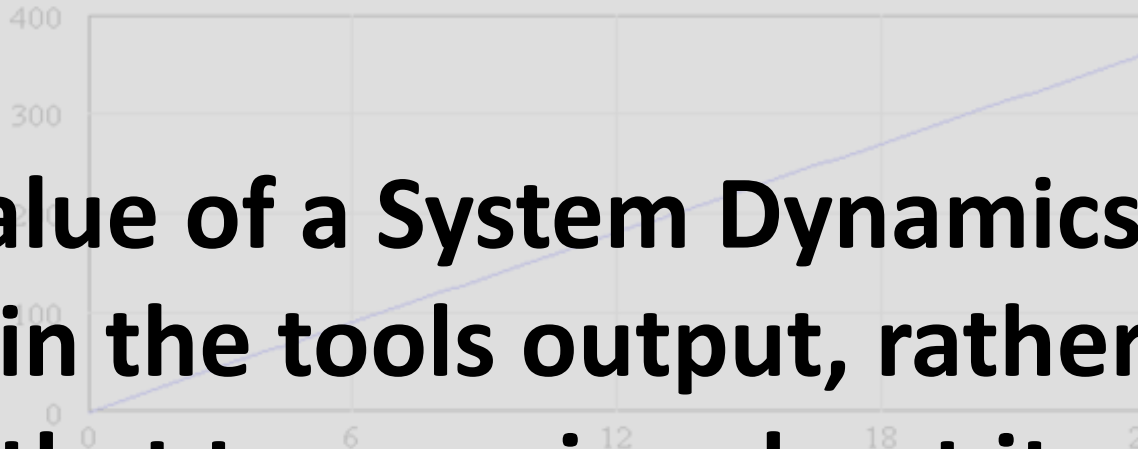
System Dynamics Model



System Dynamics Output

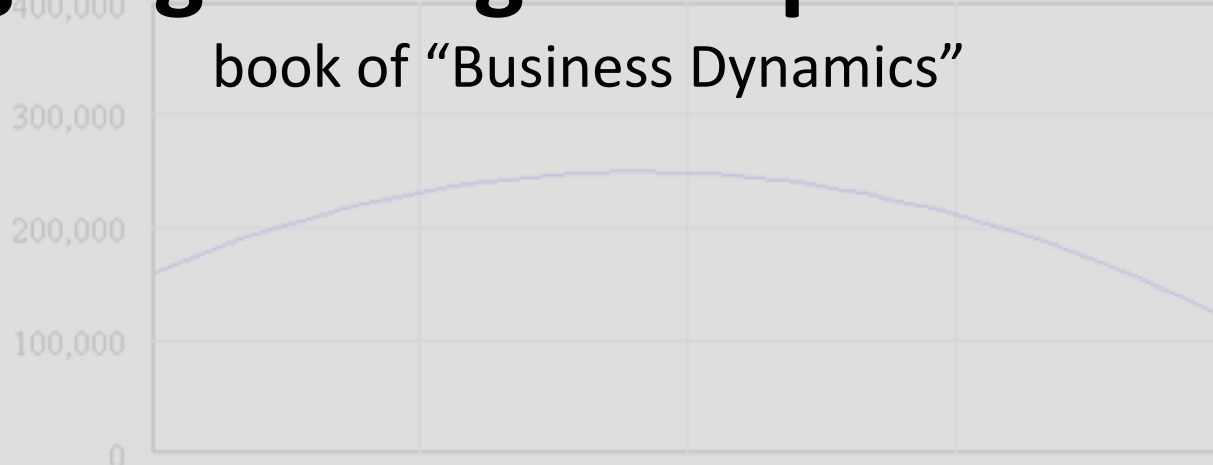


Number of Care Manager Hours needed at Clinic per month



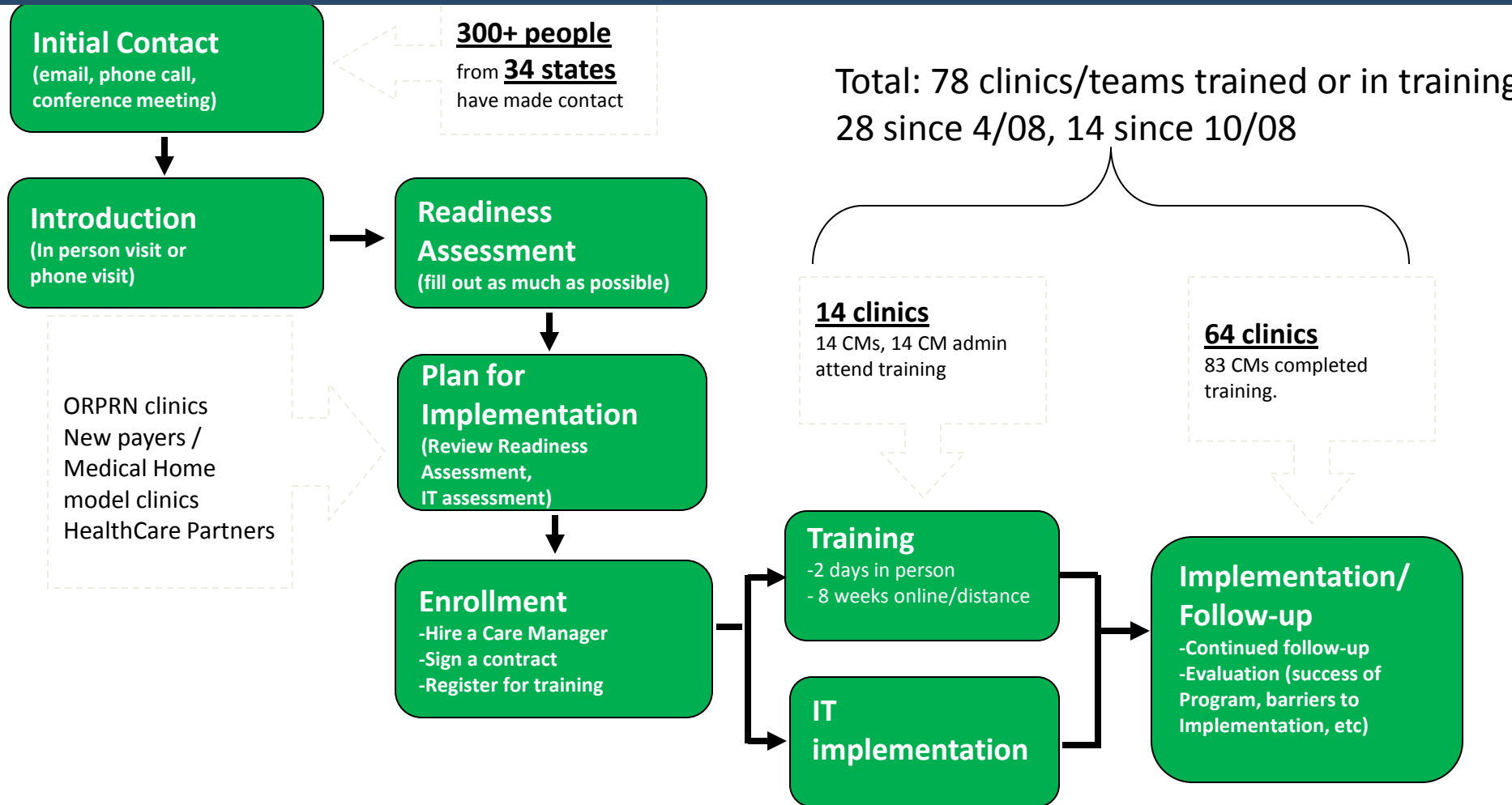
“Often value of a System Dynamics model is not in the tools output, rather the learning that team gains about its market while going through the process.” --Sterman,

book of “Business Dynamics”



Model2:
Dissemination of
Care Management Plus

CMP -- 7 Step Adoption Process



Contact Management Analytics

Total Contacts

444

Total Encounters

138

| Role | 'Count' |
|-------------------|---------|
| | 111 |
| Administrator | 18 |
| Care/Case Manager | 3 |
| Administrator7 | 3 |
| Other | 2 |

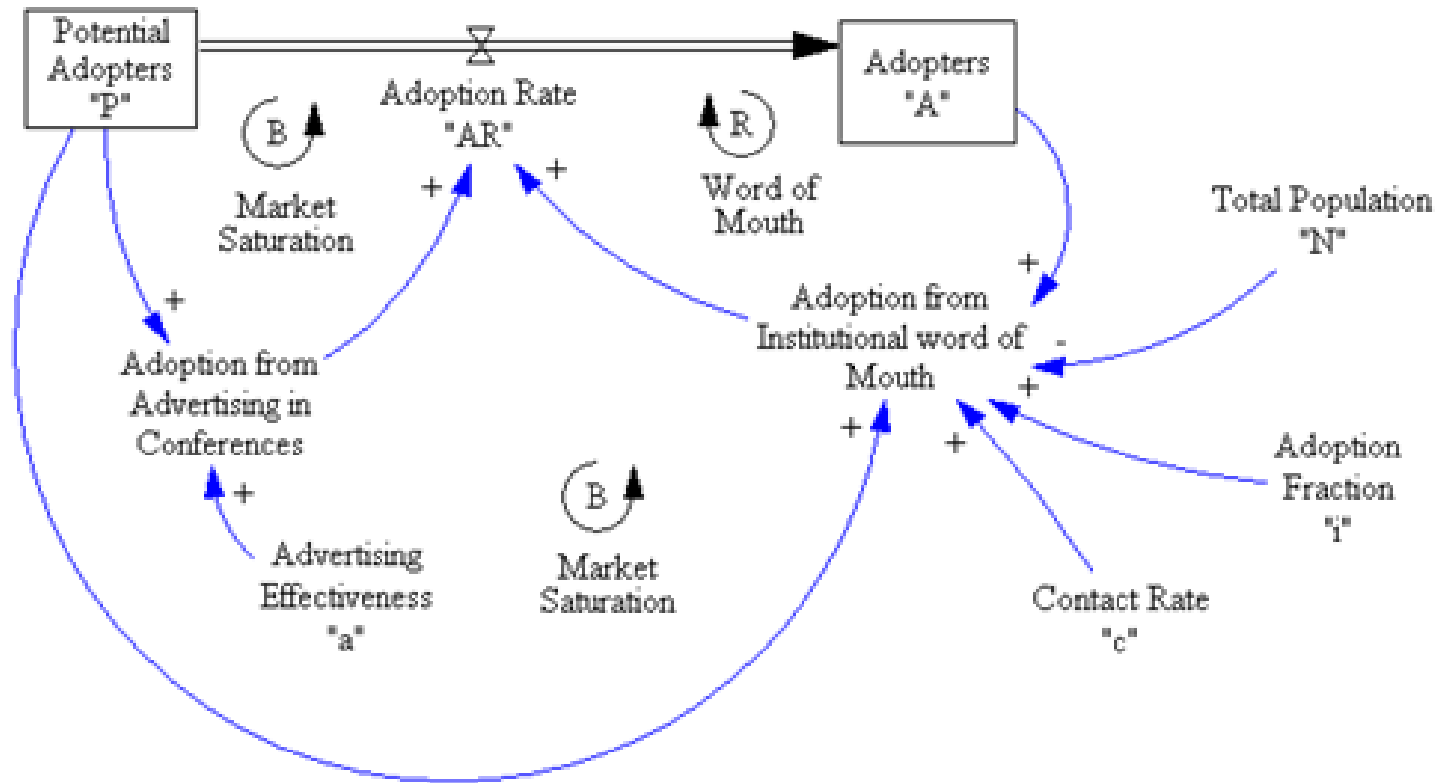
| 'GroupType' | 'Count' |
|---------------------|---------|
| | 120 |
| Other | 6 |
| Mixed | 3 |
| Clinic (Individual) | 3 |
| Medicare HMO | 2 |
| IDN | 2 |
| QIO | 1 |

| Encounter_Reason | Expr1 |
|-----------------------------------|-------|
| In-person Meeting | 33 |
| CMP Materials-Information Request | 27 |
| IT Assistance | 18 |
| Collaboration | 18 |
| Conference Call | 13 |
| Status/Progress | 8 |
| Other | 8 |
| Training | 5 |
| Readiness Assessment | 4 |
| | 4 |

| Referral_Source | Expr1 |
|------------------------------|-------|
| | 182 |
| Website | 139 |
| Other Referral | 57 |
| QIO | 23 |
| Conference/Talk | 23 |
| Conference/Talk/Presentation | 17 |
| Publication | 3 |

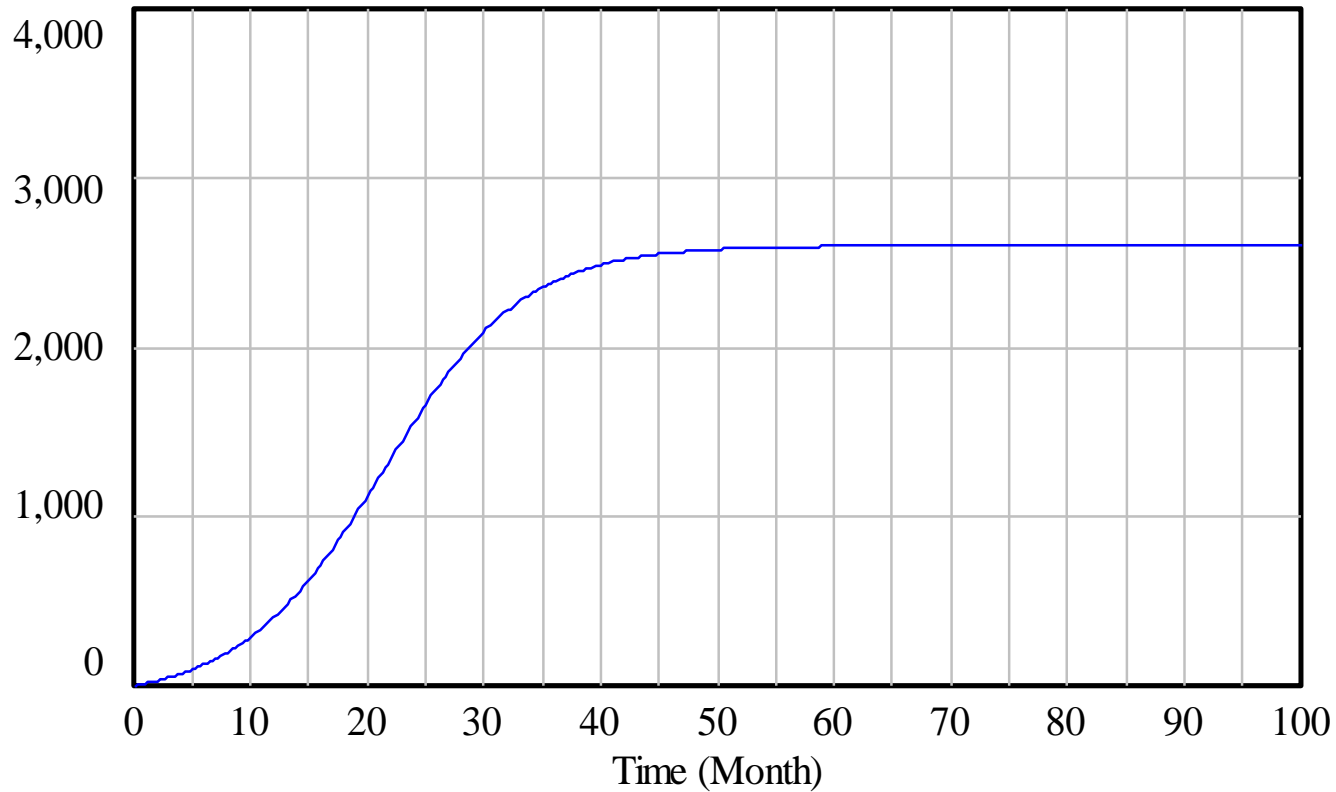
| Status | Expr1 |
|---|-------|
| Ongoing Collaboration | 82 |
| Other | 7 |
| Step 1: Initial Contact (Recruitment/Collaboration) | 116 |
| Step 2: Introduction | 9 |
| Step 3: Readiness Assessment | 14 |
| Step 5: Enrollment | 6 |
| Step 6: Training | 1 |
| Step 7: Implementation and Follow-up | 209 |

Bass Diffusion Model



CMP Adopters

Adopters "A"

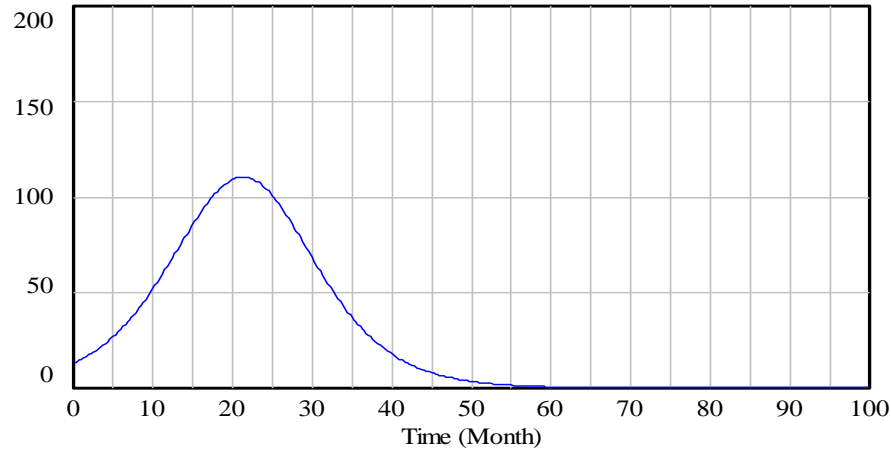


Adopters "A" : Current



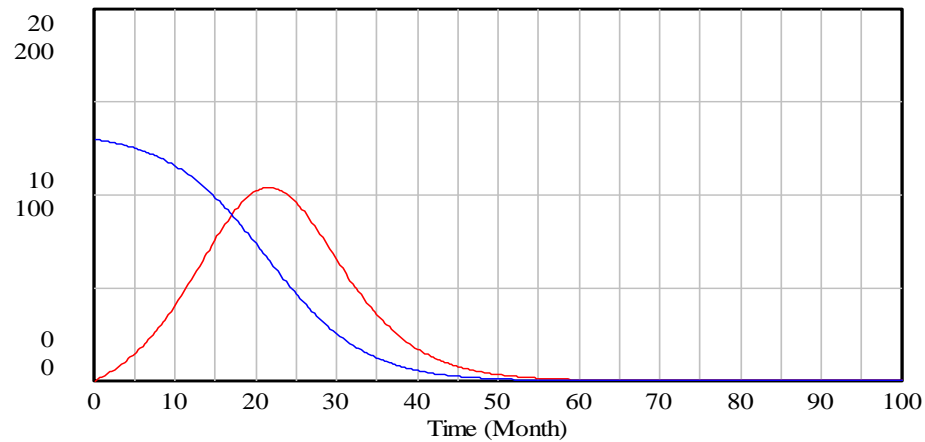
CMP Adoption Rates



Adoption Rate "AR"



Adoption Rate "AR" : Current 

Selected Variables



Adoption from Advertising in Conferences : Current 
Adoption from Institutional word of Moth : Current 

Conclusion:
Lessons Learned & Future Work

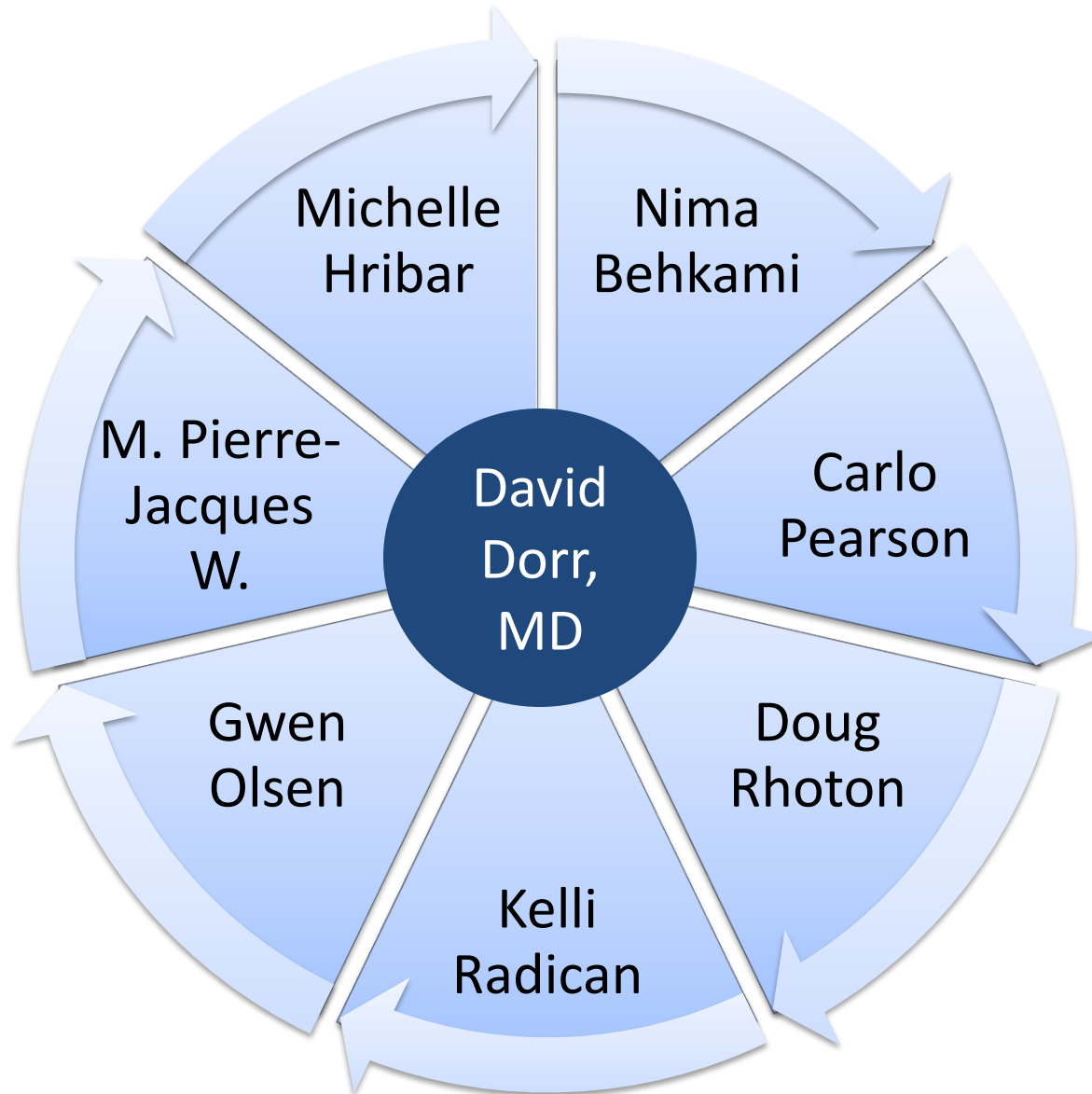
Lessons Learned

- Models can get us closer to correctly predicting future behavior, but many parameters must be considered.
- Demonstrating results through simulation can be an strong factor in Users decision to adopt an innovation.
- The process of building system dynamics model helps the team to truly think about their internal team processes and achievements.

Future Work

- Go back and fix the productivity model
- Add extra qualitative factors to model2
- Segment Adopters in model2
- Add more complicated feedback loops to model2
- Integrate with EHR adoption models
- Verify & validate model
- Much, much, much more

The CMP/ICCIS Team @OHSU



“Thank you”

Care Management Plus

“Information Technology Tools for the Care of Seniors”

www.caremanagementplus.org

Oregon Health & Science University

“Dept of Medical Informatics”

www.ohsu.edu/dmice/

Portland State University

“Dept of Engineering & Technology Management”

www.etm.pdx.edu

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