# Mixed methods for complex adaptive systems: Reconceiving communication in healthcare delivery research

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Implementing Interventions along Translational Continuum
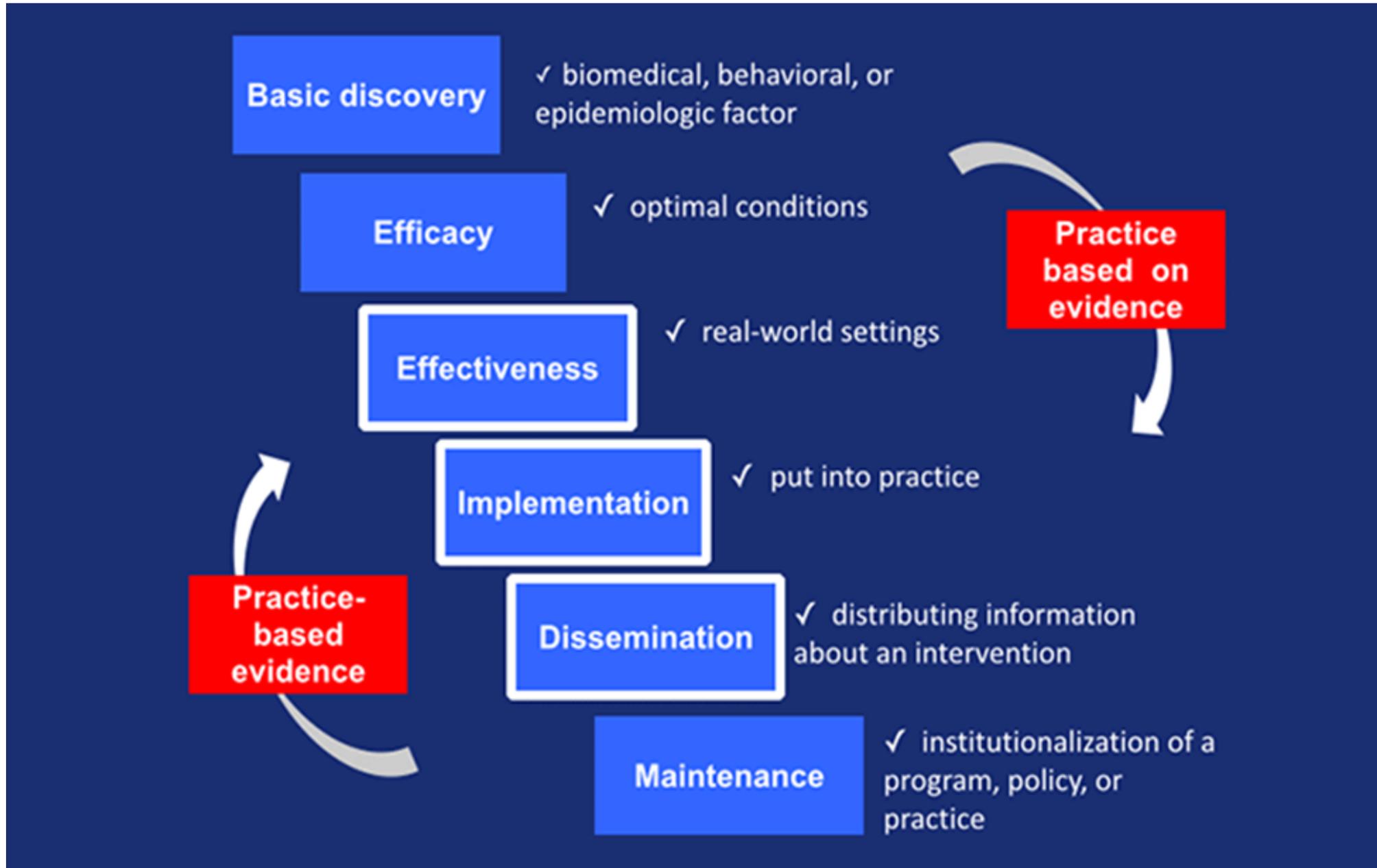
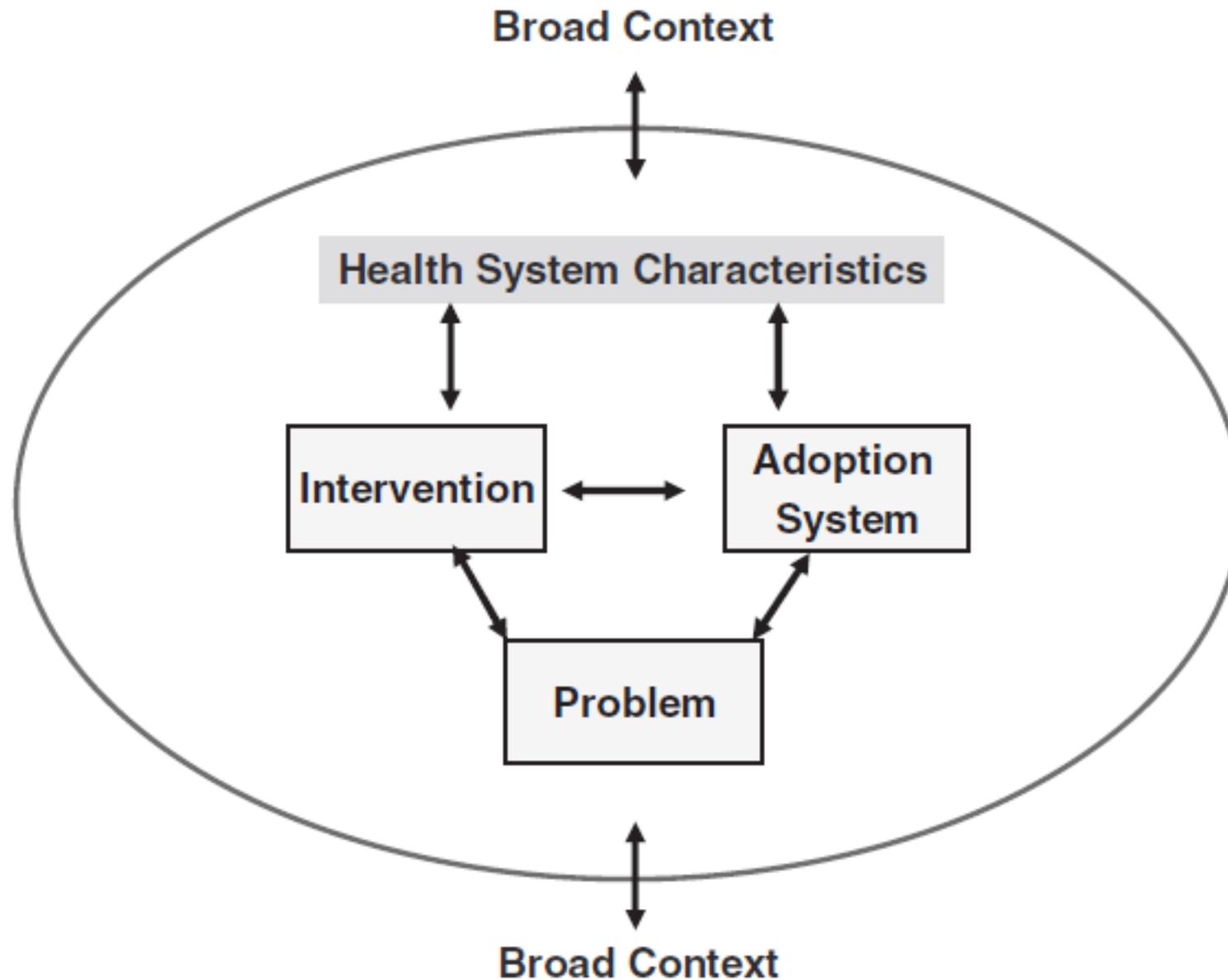# *Context matters*: before, during, after Implementation

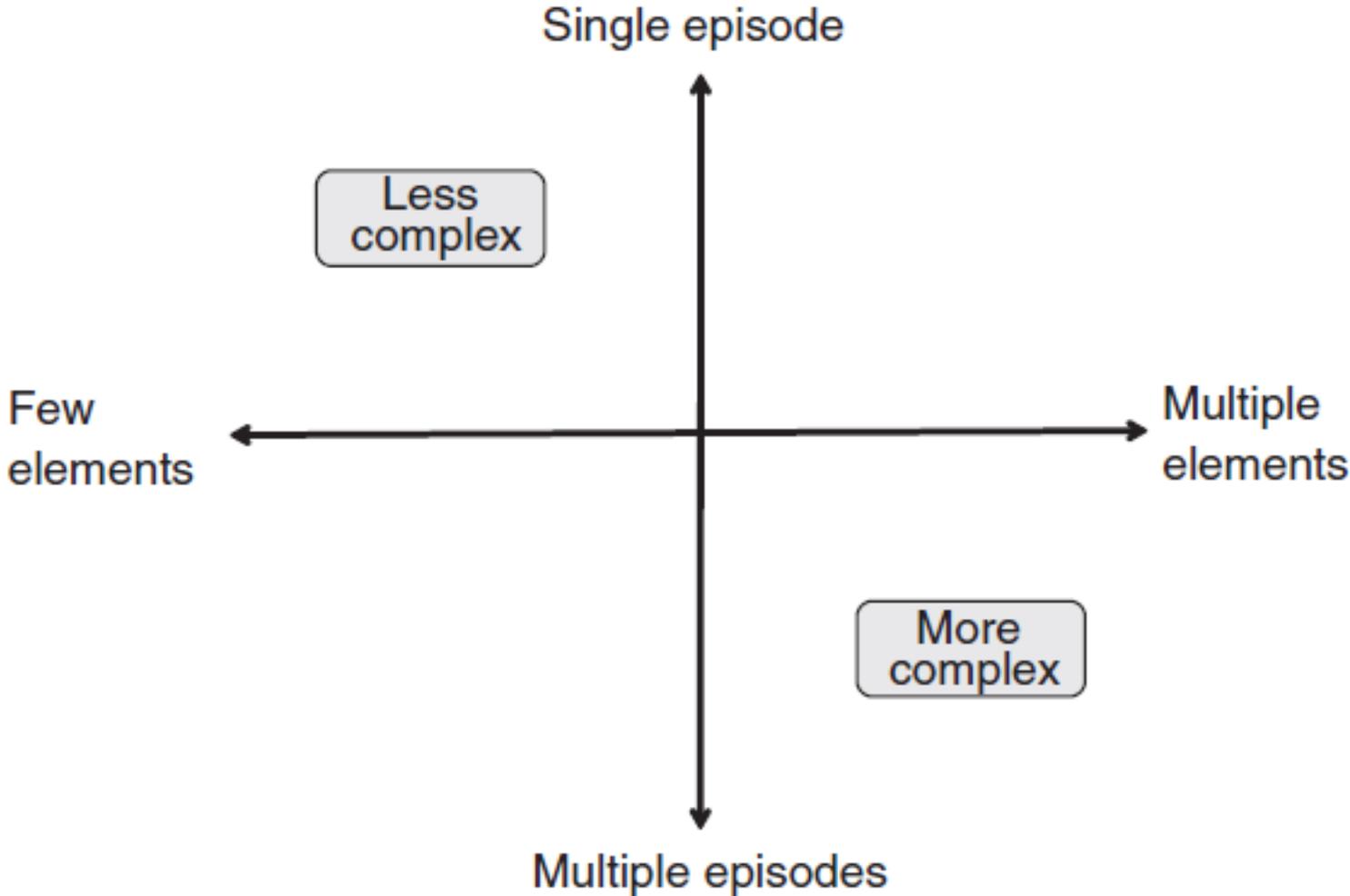Pre-implementation

Baseline

Post-Implementation

During Implementation
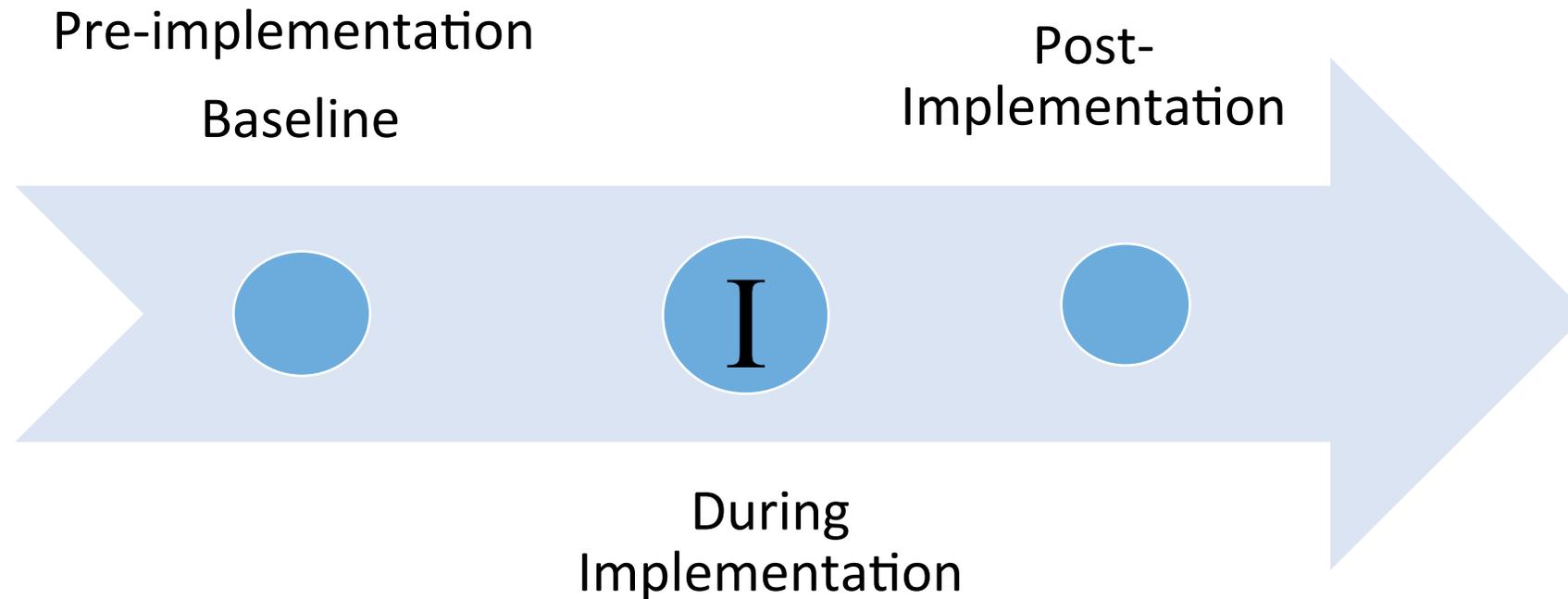
Mixed methods to assess effects- intended and unintended – and at multiple levels

Conceptual model for intervention adoption

Atun et al. Health Policy &
Planning 2010; 25:104-11
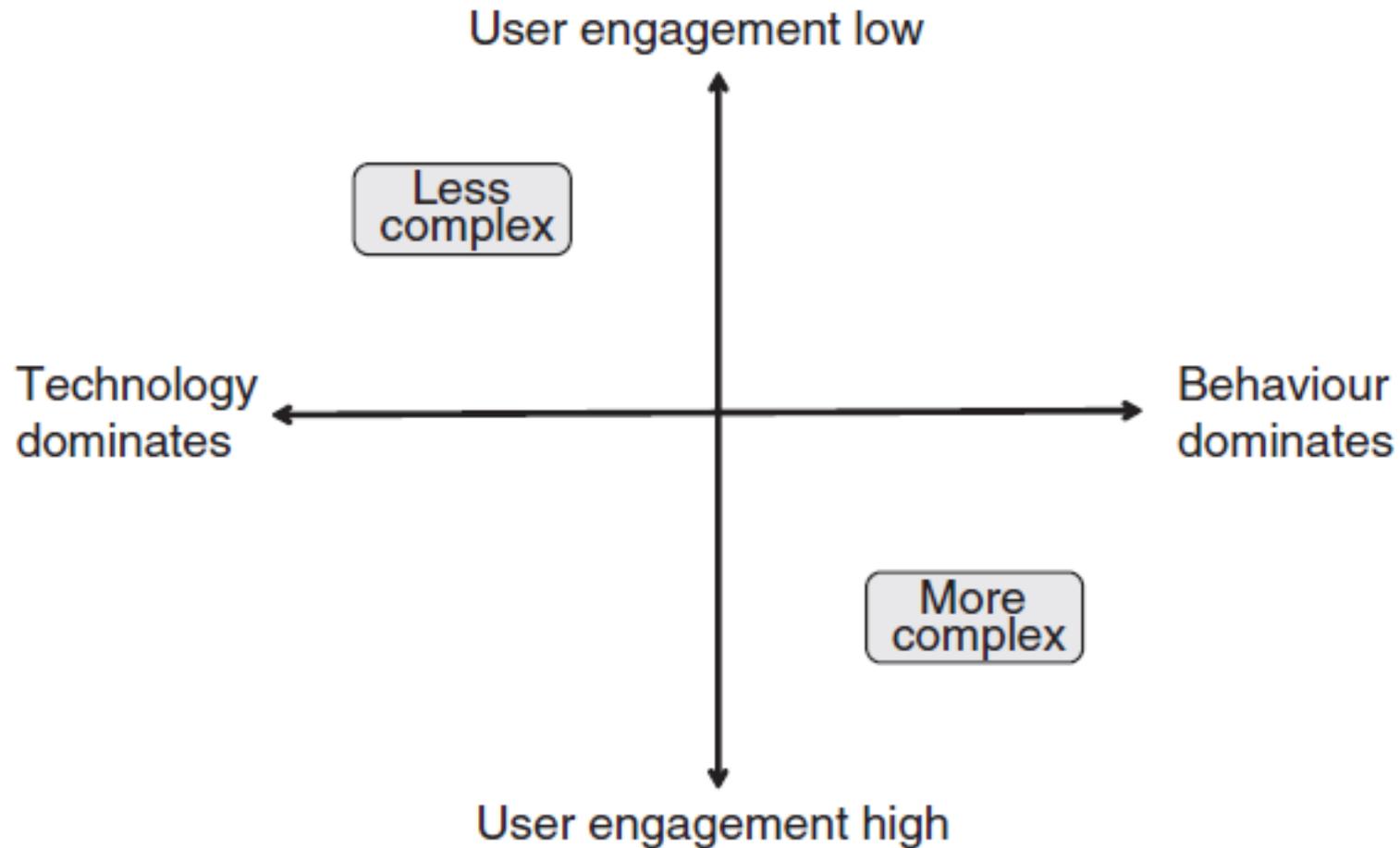
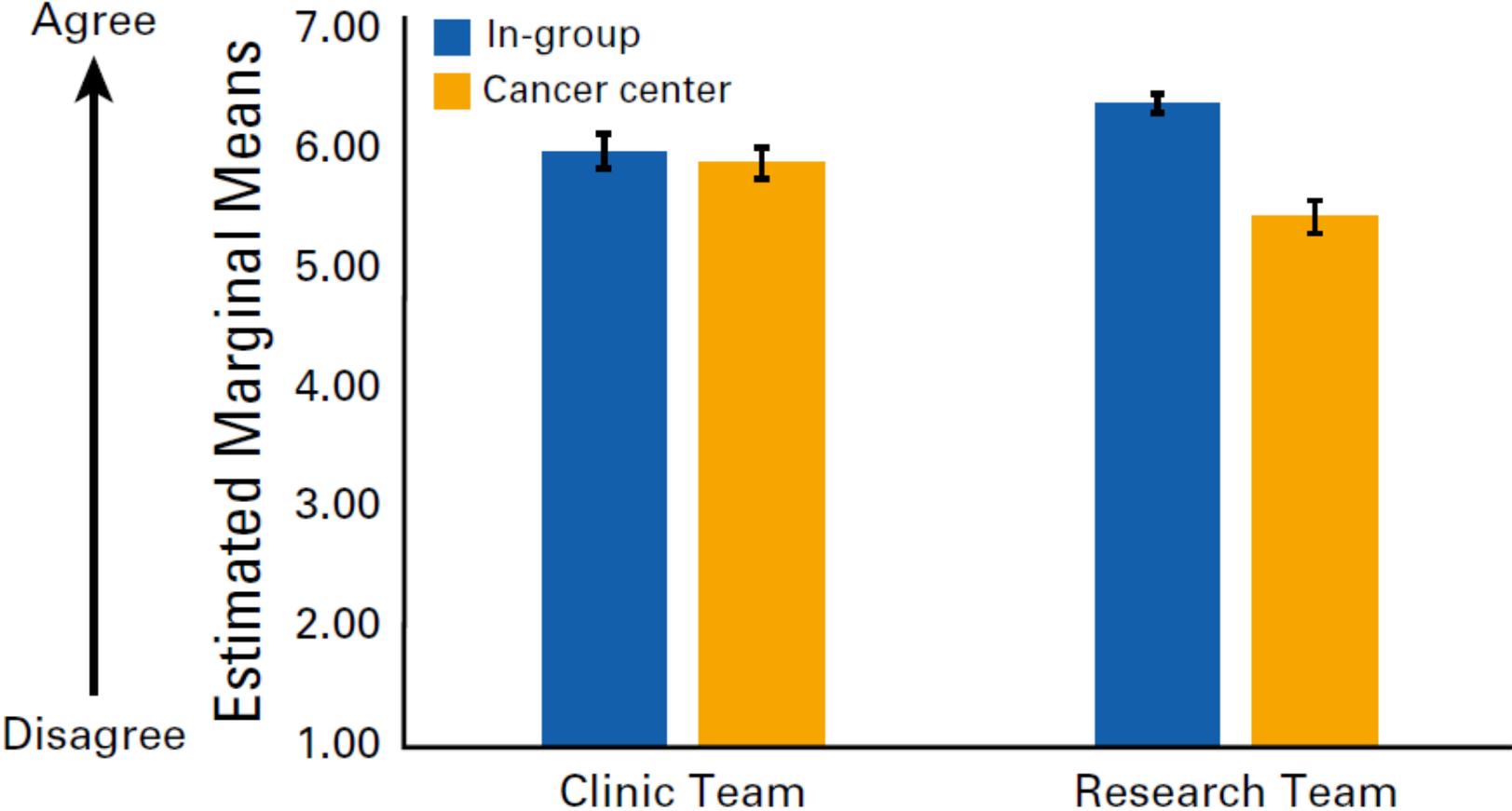# Intervention complexity: episode vs element

Intervention complexity: level of care vs stakeholders
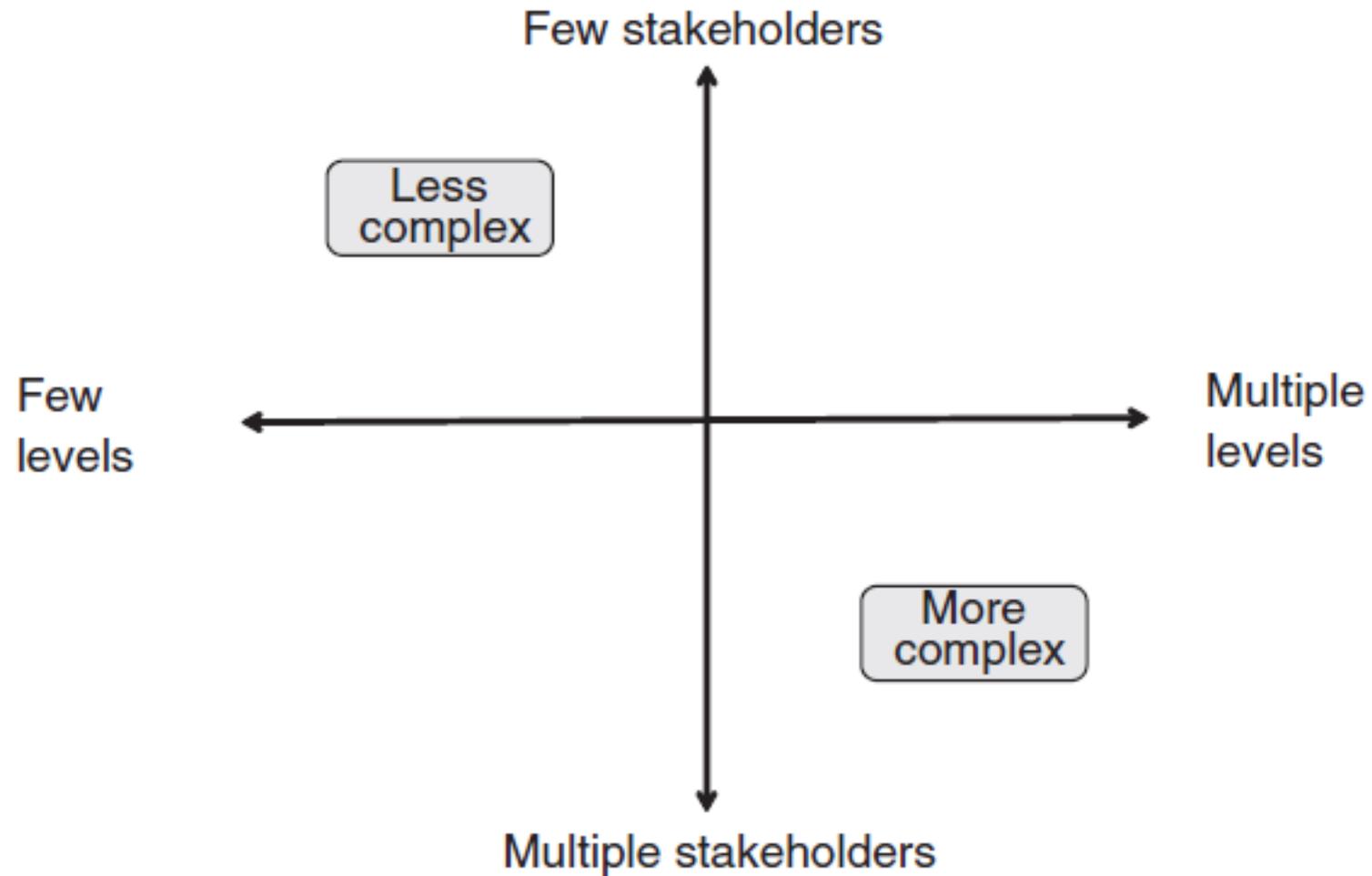
Intervention complexity: user engagement vs degree of tech

Perceptions of identity and interactions

Reimer et al. (2017) *J Oncology Practice*

Processes of Care across the Cancer Care Continuum → **Process of care Impacts** → **Patient and population outcomes**

Types of Care

Risk assessment	Primary prevention	Detection	Diagnosis	Cancer or precursor treatment	Post-treatment survivorship	End-of-life care
Age	Lifestyle counseling	Screening (Asymptomatic)	Imaging	Excision	Testing	Palliative Care
Family Hx	Chemo prevention	Appropriate Testing (Symptomatic)	Biopsy	Surgery	Follow-Up Care	
Exposure Hx			Repeat Exams	Radiation	Palliation	
Genetics		Follow-up of abnormals	Laboratory Tests	Adjuvant	Recurrence	Advanced Care Planning
Lifestyle			Other Appropriate Procedures	Chemo	Surveillance	
Screening Hx				Palliation		

Efficiency
Equity
Safety
Timeliness
Patient-centeredness
Subprocess effectiveness

Patient

Risk status
Biologic outcomes
Health-related quality of life & well-being
Quality of death
Financial burden
Patient experience

Population

Mortality
Morbidity
Cost-effectiveness

Transitions in Care

Each type and transition in care offers opportunities for improvement. Some have been identified in the figure, but within and between types of care, there are interfaces and steps that may be articulated to identify more opportunities. Effectiveness of the process is measured at the patient and population levels based on the outcomes shown. Differences in service delivery and effectiveness across populations are the metrics of disparities (equity).

Taplin et al. Understanding and Influencing Multilevel Factors Across the Cancer Care Continuum J Natl Cancer Inst Monogr. 2012;2012(44):2-10.

Embedded intervention study within larger observational design:

A comparative effectiveness trial of benefits, harms, and costs of mailed invitations to:

- Complete and return an enclosed FIT card, or
- Schedule and complete a colonoscopy

CRC Screening is a Process

Tiro et al. CEBP 2014; 23(7):1147-58
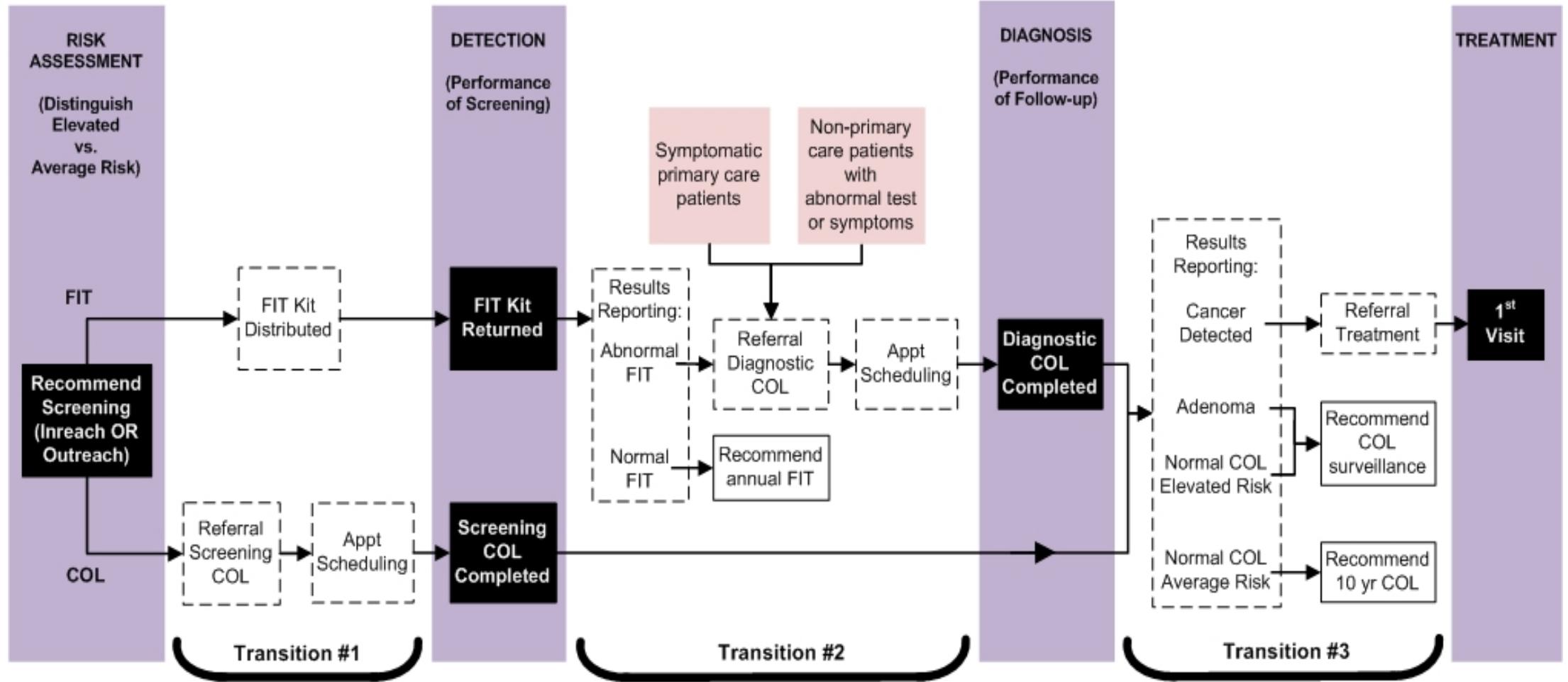
|	
Type of care	The care delivered to accomplish a specific goal of care across the cancer continuum, such as detection, diagnosis, or treatment.
Steps of care	Each type of care involves multiple specific activities such as performing the screening test or delivering a dose of chemotherapy
Transition	The set of interactions necessary to go from one type of care to another, such as the transition from detection to diagnosis.
Interface of care	A finer grade of transition where information and responsibility are transferred, such as communicating test results, calling to schedule an appointment, or contact between physicians to communicate details of a referral

Where are failures in process occurring?
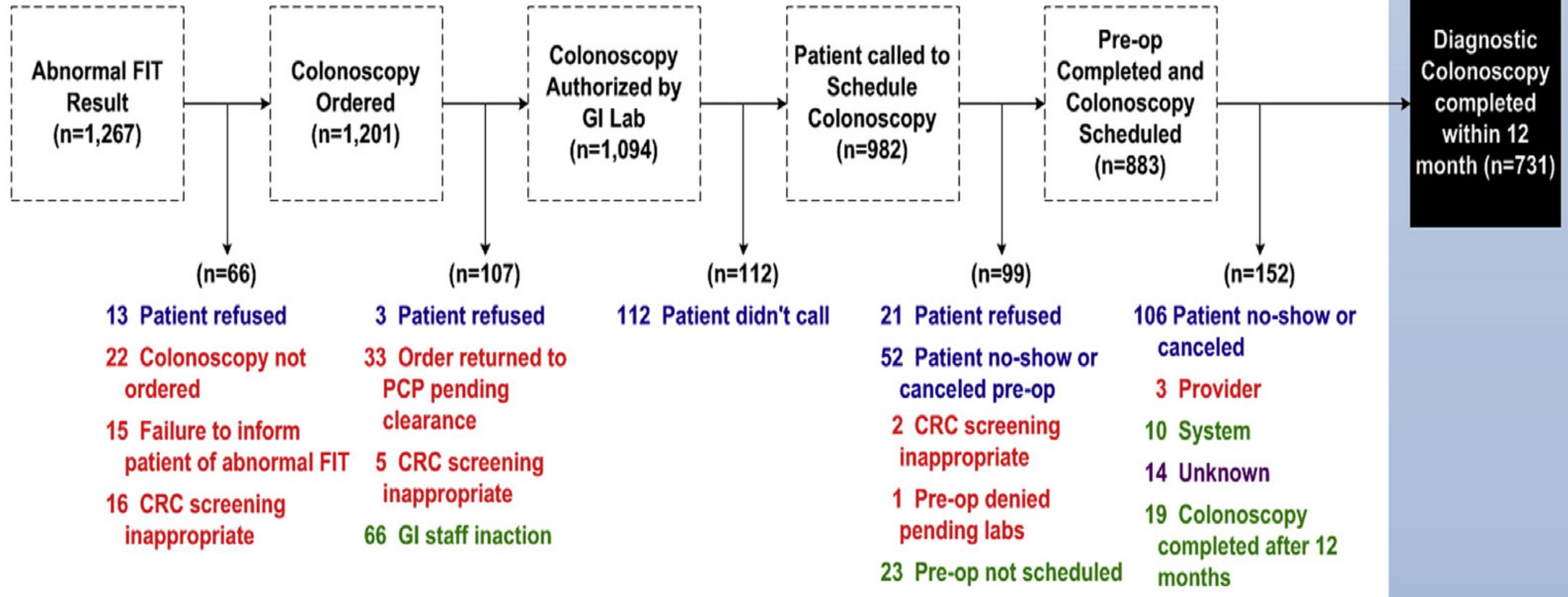
Martin *et al* *Am J Medicine*, 2016

Data Collection Phases
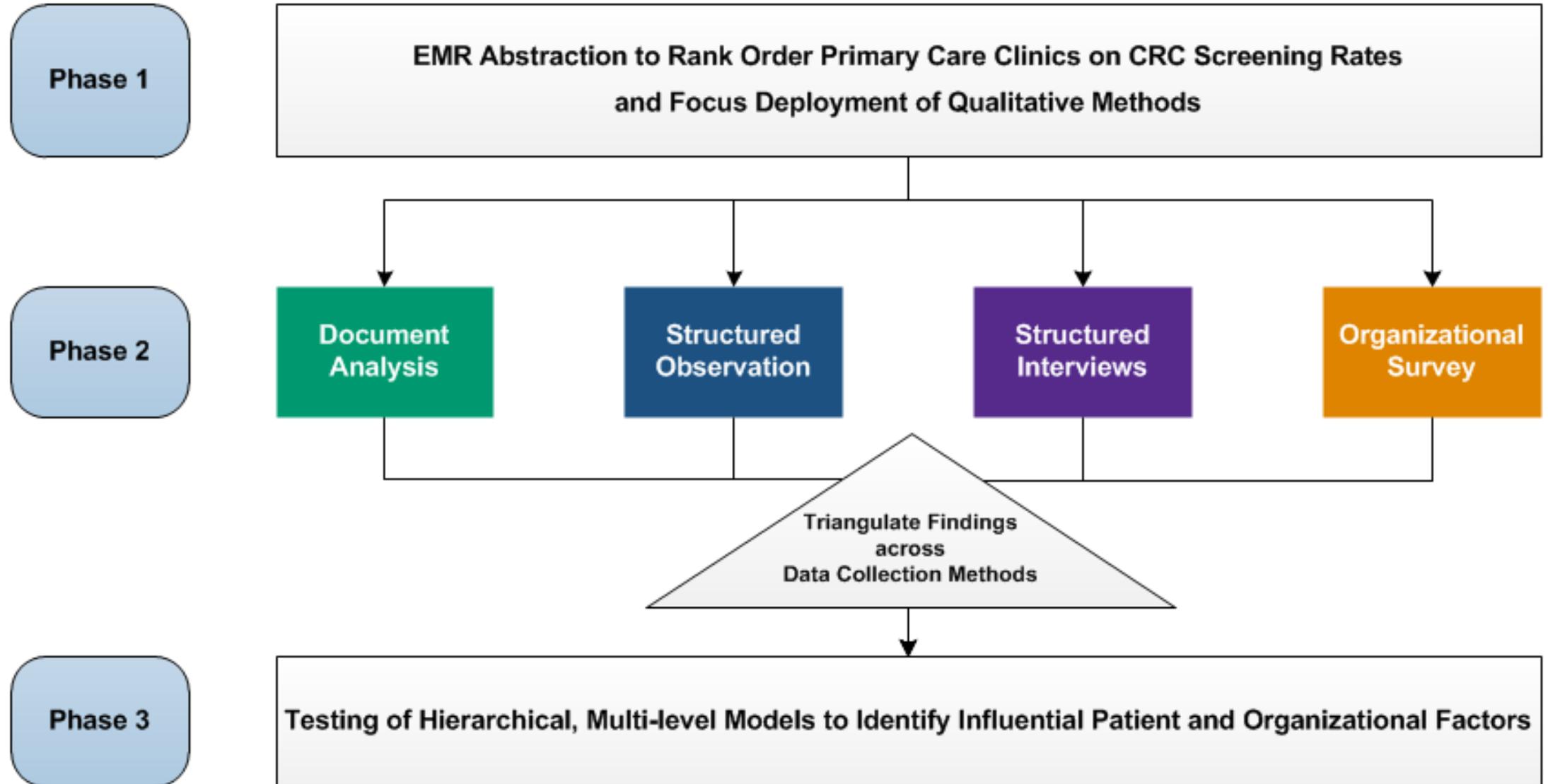
CRC Screening Rate at Cohort Entry by clinic, 2010-2011 cohort, N=41,127

Clinics[1]	% Total Screened	% FIT Screened	% COL/SIG
Community-Based Clinic 1	11.1	5.3	5.8
Clinic 2	13.0	2.8	10.2
Clinic 3	17.9	13.1	4.8
Clinic 4	15.8	11.2	4.6
Clinic 5	13.0	8.5	4.5
Clinic 6	19.2	15.5	3.7
Clinic 7	16.2	11.5	4.7
Clinic 8	10.7	0.4	10.3
Academic Clinic 1	14.4	3.0	11.4
Clinic 2	14.8	1.9	12.9
Total (Range)	**14.6 (10.7-19.2)**	**8.1 (0.4-15.5)**	**6.6 (3.7-12.9)**

1 Community-Based Clinic 9 not included in cohort until 2012

Tiro et al (In Press) Pop Health Mgmt

Triangulation of Qualitative Methods

Structured Observation
- Observation of physicians, nurses, lab staff, administrators during usual working activities, including communications with patients and co-workers, EMR data entry.
- 90+ hours at 10 sites

Structured Interviews
- Lead Physicians, Clinical and Administrative Staff at primary care and gastroenterology clinics
- N=32; transcribed and analyzed

Document Analysis
- Analysis of policies, procedures, training manuals, quality reports, lab worksheets, notes from observation, transcripts
- Over 1,000 pages, using Nvivo

*Sobo, EJ (2009) *Culture and Meaning in Health Services Research*. Walnut Creek, CA: Left Coast Press.

Focus: (1) Reporting of FIT Results and (2) Referral for Diagnostic COL
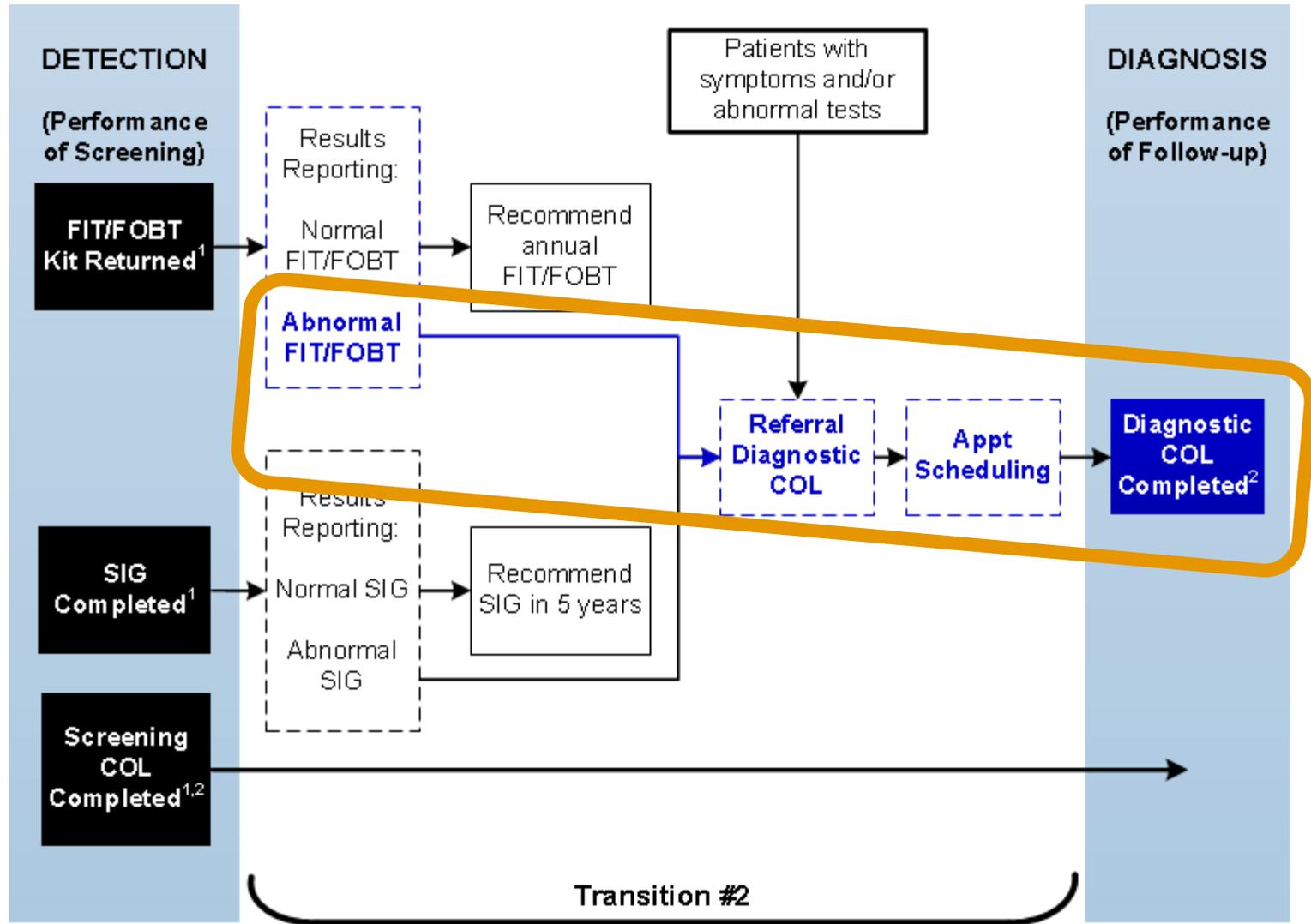
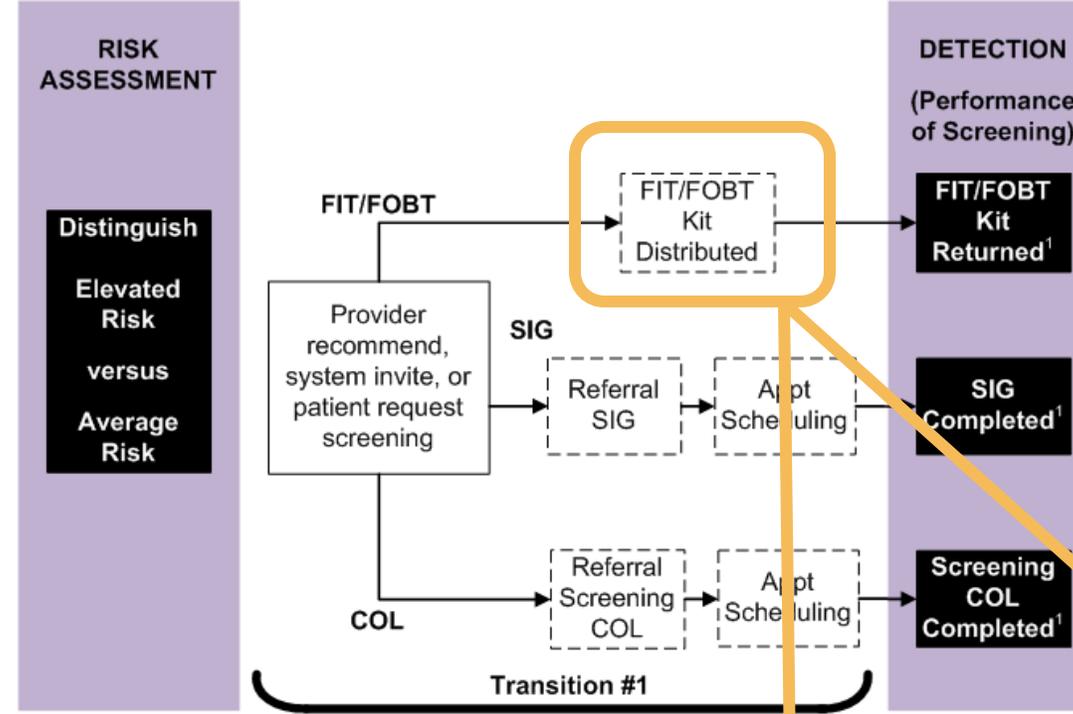| Qualitative Method	Rationale for use	Process	Objectives
Document Analysis	Understand development, implementation, and prioritization of CRC screening	Photocopies of documents scanned into database using Optical Character Recognition (OCR)	Identify information that may not be recorded in or easily retrieved from EMR
			Catalog CRC screening-related policies and protocols
	Characterize organizational culture, structure, and formal protocols of the CRC screening process, including guideline dissemination and training of care teams		Inform chronology of policy implementation
			Identify information disseminated systematically (e.g. via email vs. word of mouth)
Participant Observation	Describe organizational structure, a broad range of clinical and non-clinical care behaviors as they relate to organizational protocols for CRC screening processes	Detailed descriptive field notes transcribed and entered into database	Inform flowcharts of team members' roles, responsibilities, relationships, and behaviors across screening steps and interfaces
	Evaluate functionality of the system for referring patients with abnormal screening tests		Validate extent protocols are understood and adhered to, and observe 'work-arounds' (deviations)
Semi-structured Interviews	Clarify observations; assess organizational culture (e.g. values, beliefs, and norms)	Audio recordings of interviews and post-interview audio notes by interviewers transcribed and entered into database	Solicit feedback about whether protocols are realistic, effective for optimizing outcomes
	Elucidate decision-making pathways for CRC screening processes at the network- and clinic levels		Solicit feedback on EMR as a barrier and/or facilitator per experience in practice
	Assess perceptions of organizational protocols and practices (e.g. are they compatible with serving safety-net patients?)		Demonstrate degree of concordance between observed behaviors and verbalized understanding of roles and responsibilities.
			Clarify processes not easily understood during participant-observation (e.g., values, beliefs)

Case Study #1:
FIT Kit Distribution Process

RISK ASSESSMENT

Distinguish

Elevated Risk

versus

Average Risk

DETECTION
(Performance of Screening)

FIT/FOBT

Provider recommend, system invite, or patient request screening

SIG

Referral SIG

Appt Scheduling

COL

Referral Screening COL

Appt Scheduling

FIT/FOBT Kit Distributed

FIT/FOBT Kit Returned[1]

SIG Completed[1]
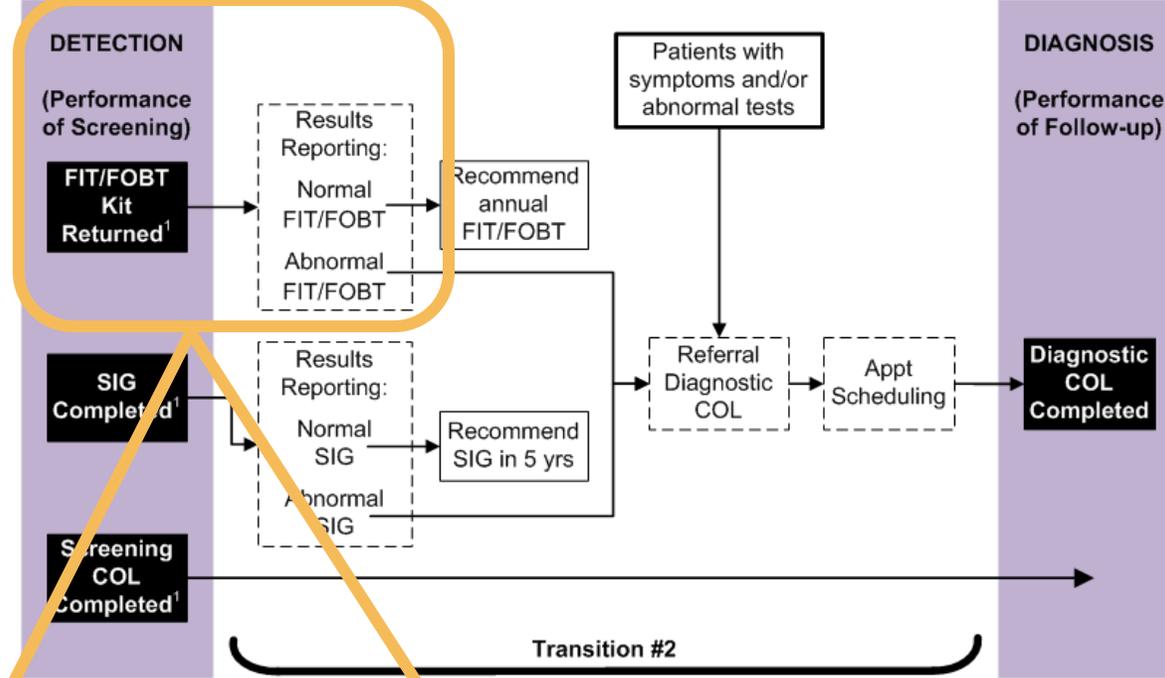
Screening COL Completed[1]

Transition #1

Structured observation at clinics and **structured interviews** with teams revealed modification in how FIT kits are distributed:

- adding colored labels to encourage patient writing collection date
- removing mailing envelopes from the kits to encourage in-person return
- providing verbal and/or written instructions re: 10-day return

Implications: Differences may contribute to clinic variation in patient adherence and % of returned samples that staff label as canceled or invalid

Informed additional analyses: Quantify impact of variation on the rate of canceled and invalid results

Case Study #2:
FIT Kit Return Process

DETECTION

(Performance of Screening)

FIT/FOBT Kit Returned[1]

Results Reporting:

Normal FIT/FOBT

Abnormal FIT/FOBT

Recommend annual FIT/FOBT

Patients with symptoms and/or abnormal tests

SIG Completed[1]

Results Reporting:

Normal SIG

Abnormal SIG

Recommend SIG in 5 yrs

Referral Diagnostic COL

Appt Scheduling

Screening COL Completed[1]

DIAGNOSIS

(Performance of Follow-up)

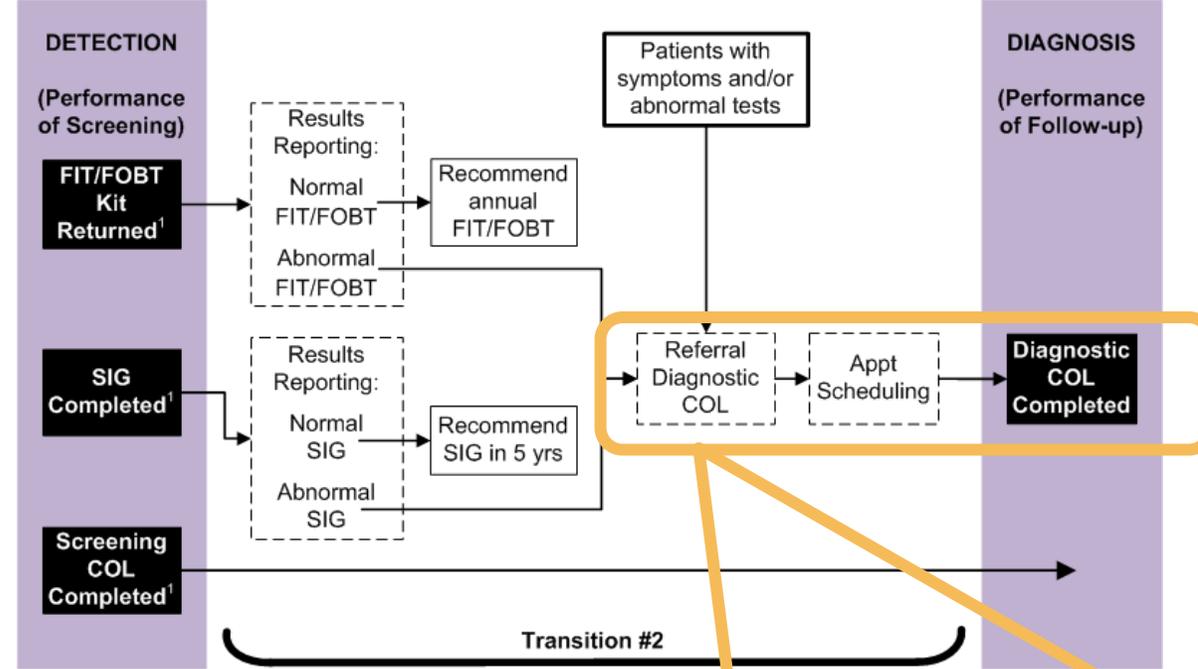**Diagnostic COL Completed**

Transition #2

Structured observation of lab processes, **structured interviews** with lab supervisors and **document analysis** revealed loss of key data from returned FIT kits, specifically:

- Collection date, card result, or reason for invalid card are documented on paper, not in Cerner
- EMR set up to only accept certain data from Cerner; lab processing dates only in Cerner

Implications: A lack of systematic data impairs ability to assess frequency of and communicate reasons for invalid samples. Thus, providers using the HER do not know how best to change patient instructions

Informed additional analyses: Use Cerner to quantify the source of delays in reporting FIT results (attributable to patient, lab, or provider behavior) and average time associated with each delay

Case Study #3:
Abnormal test referral for colonoscopy

DETECTION

(Performance of Screening)

FIT/FOBT Kit Returned[1]

Results Reporting:

Normal FIT/FOBT → Recommend annual FIT/FOBT

Abnormal FIT/FOBT

SIG Completed[1]

Results Reporting:

Normal SIG → Recommend SIG in 5 yrs

Abnormal SIG

Screening COL Completed[1]

Patients with symptoms and/or abnormal tests

Referral Diagnostic COL → Appt Scheduling → Diagnostic COL Completed

DIAGNOSIS

(Performance of Follow-up)

Transition #2

Structured interviews with PCPs revealed frustration with colonoscopy referral process because many were being delayed or denied "pending further action".

Structured observation of GI staff revealed a centralized process for triaging referrals; GI staff may delay or deny a referral pending medical clearance for co-morbidity related safety. GI waits for the ordering PCP to resolve. If no action, GI staff close the referral.

Document analysis of GI clinic procedures detailed triage criteria, but not how GI staff communicate these delays and denials.

Implications: Poor coordination between PCP and GI may create delays & drop-offs at COL referral step.

Planned analyses : Quantify whether delays are longer for high-risk, co-morbid patients.

Our findings illuminate why CRC screening rates are low and why diagnostic colonoscopy referrals are delayed.

Identifying quality improvement targets to facilitate colorectal cancer screening completion

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We pinpointed potential quality improvement intervention targets:

(1) facilitating best-practices implementation across clinics;

(2) improving laboratory communication to providers about FIT testing and results

(3) creating EHR based alerts to resolve pending colonoscopy referrals.

Points to take away

- Settings where health communications occur should be recognized as complex, adaptive systems

- Intervention adoption depends on intervention complexity, including factors highly influenced by context

- Interventions may have impacts on multiple levels, both intended and unintended consequences

- Mixed method designs can enhance assessment of context effects at multiple levels, before, during and after implementation

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Team Science Acknowledgements

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