Bridging Health and Health Care
Wednesday, August 5, 2015   *12-1pm ET*

Applying Failure Modes and Effects Analysis to Public Health:

The Breathe Easy at Home Program

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Agenda

Welcome: **Angie Carman, DrPH,** National Coordinating Center for PHSSR, and Assistant Professor, U. of Kentucky College of Public Health

"*Applying Failure Modes and Effects Analysis to Public Health: Breathe Easy at Home Program*"

Presenters: **Megan Sandel, MD, MPH, FAAP**, Associate Professor of Pediatrics, Boston U. Schools of Medicine and Pediatrics *megan.sandel@bmc.org*
Margaret Reid, RN, MPA, Director, Healthy Homes and Community Supports, Boston Public Health Commission *MReid@bphc.org*

Commentary: **Jonathan I. Levy, ScD,** Professor and Associate Chair, Environmental Health, Boston University School of Public Health *jonlevy@bu.edu*
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Questions and Discussion

Presenters

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Boston University Schools of Medicine
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Medical Director, National Center for
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Margaret Reid, RN, MPA
Director, Healthy Homes and
  Community Supports
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Applying Failure Modes and Effects Analysis to Public Health:
## The Breathe Easy at Home Program

Margaret Reid, RN, MPA
Boston Public Health Commission
Megan Sandel, MD, MPH, FAAP
Boston Medical Center

Breathe easy
at home program

- Breathe Easy at Home (BEAH) is a free, web based program allowing clinicians to refer their asthmatic Boston patients for a home inspection.

  ➢ Designed to improve the health and housing of Boston residents with asthma

  ➢ Inspectors search for asthma triggers that are covered by the Massachusetts state sanitary code for housing

  ➢ Clinicians receive an email notifying them of an update

  ➢ Encourages clinicians to ask questions regarding environmental triggers patients may be exposed to within the home
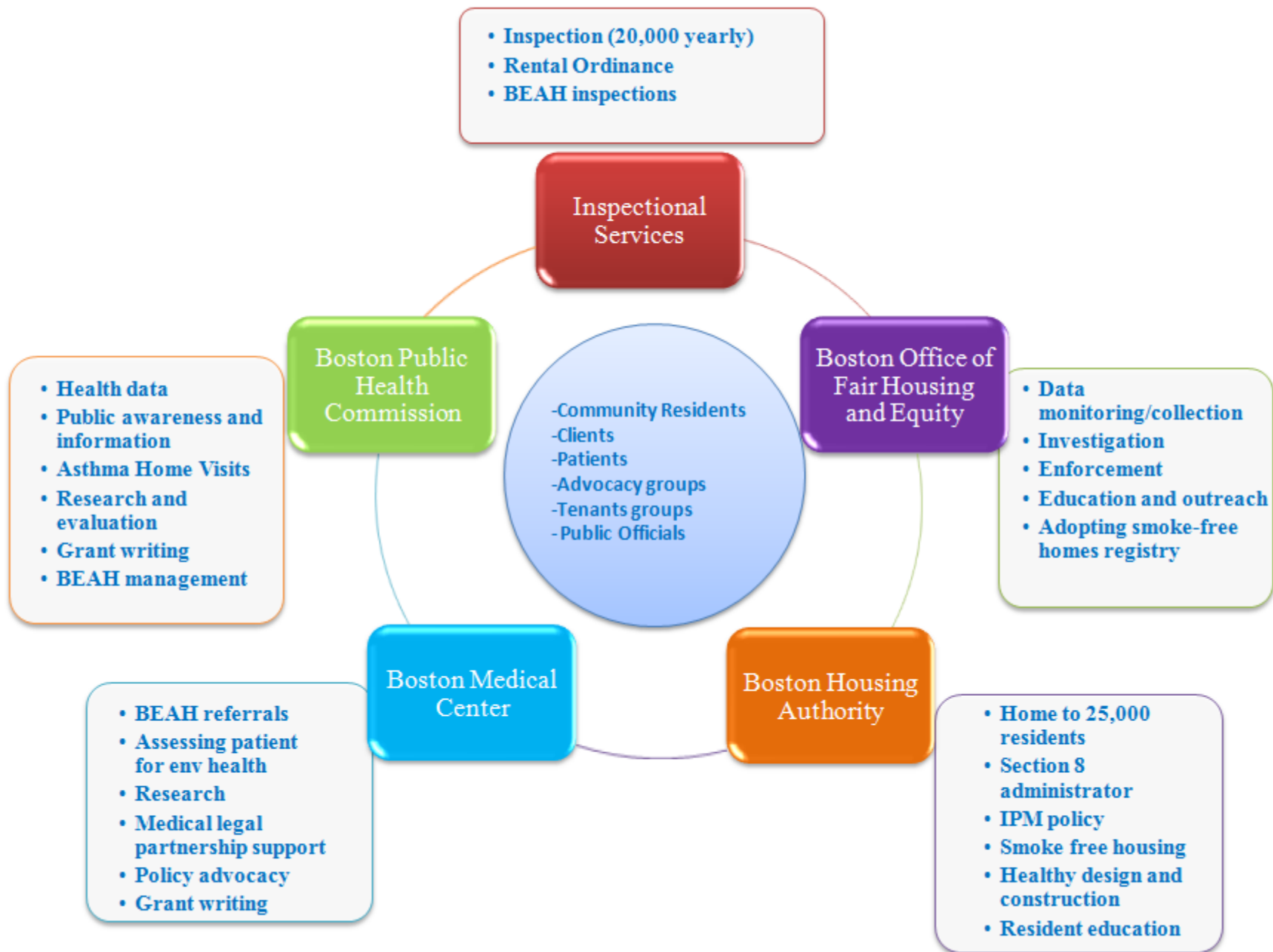
Timeline of Boston Healthy Homes Collaborations

1999
BPHC establishes Healthy Housing Office

2005
Breathe Easy at Home is piloted

2006
Healthy Pest Free Housing Initiative

2010
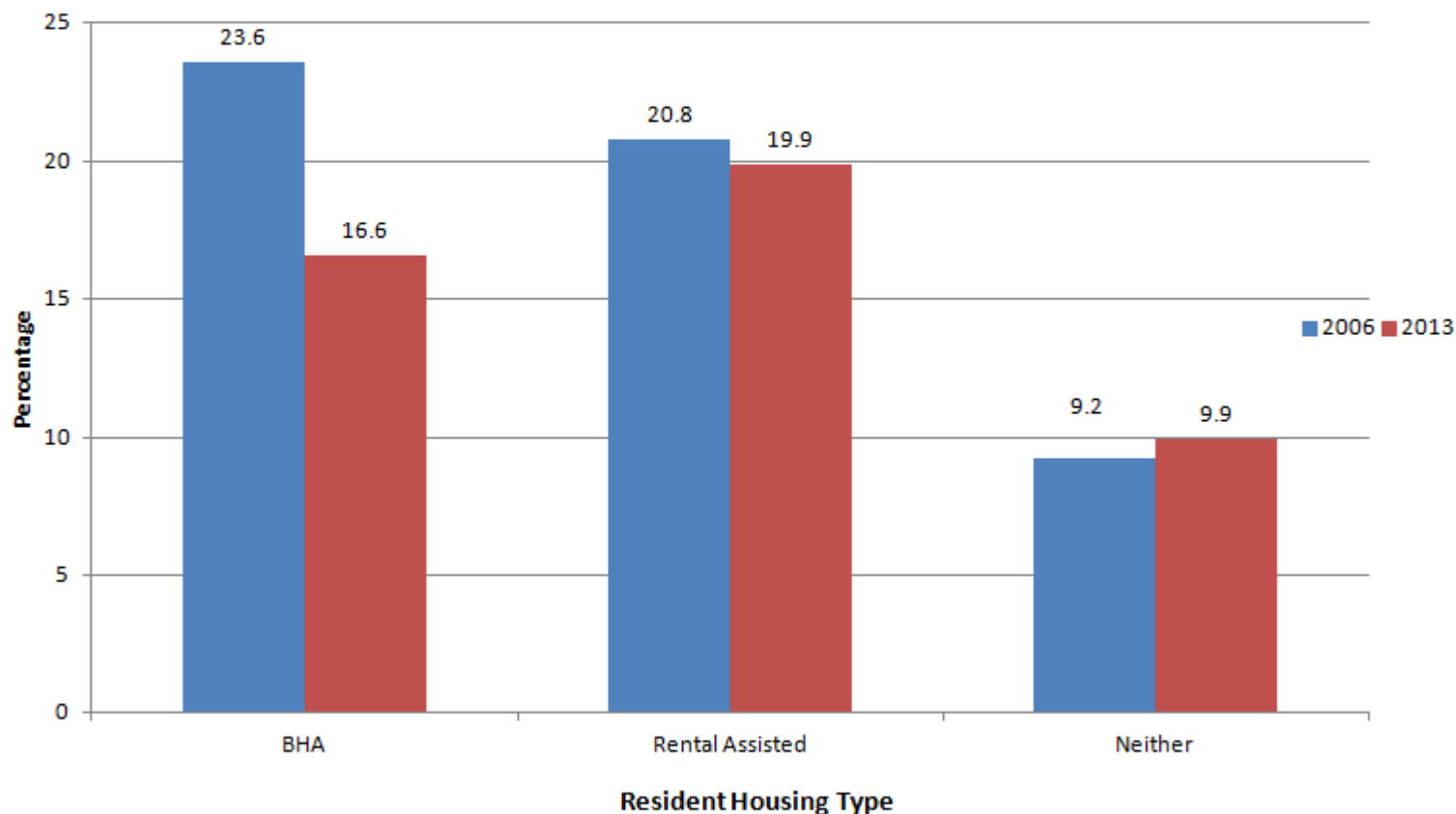BHA announces smoke free housing

2012
Rental Registration and Inspection Ordinance

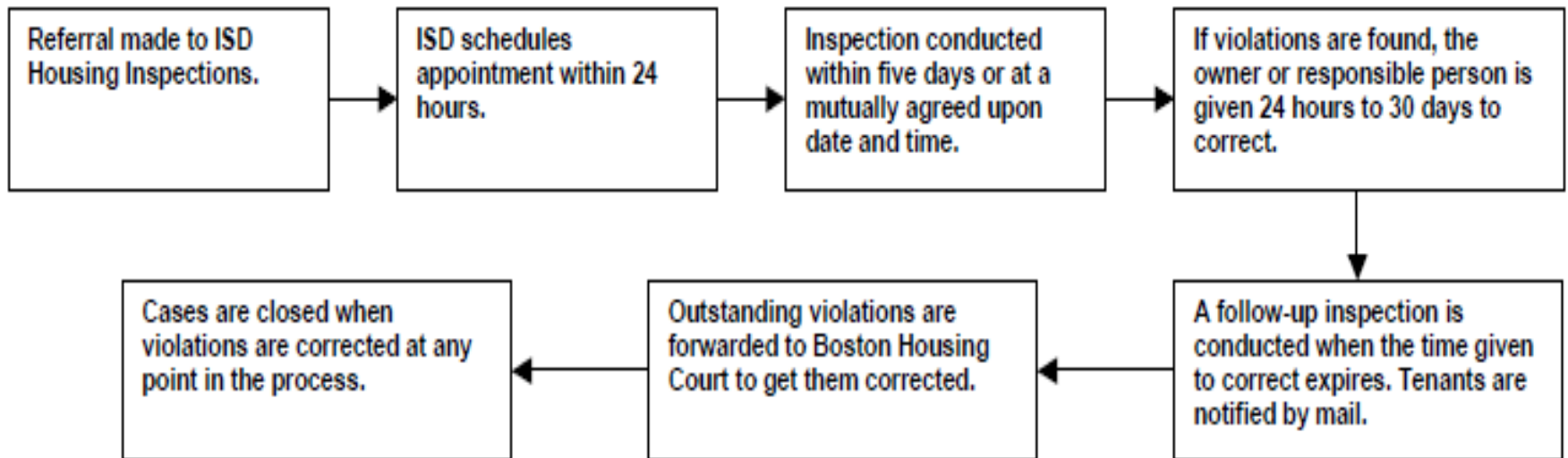**2014**
Office of Fair Housing and Equity

Self Reported Asthma Rates

Source: Boston Behavioral Risk Factor Surveillance System (BBRFSS), Boston Public Health Commission Research Office

Breathe Easy at Home Process:
The Ideal System

Referral made to ISD Housing Inspections.	ISD schedules appointment within 24 hours.	Inspection conducted within five days or at a mutually agreed upon date and time.	If violations are found, the owner or responsible person is given 24 hours to 30 days to correct.

Cases are closed when violations are corrected at any point in the process.	Outstanding violations are forwarded to Boston Housing Court to get them corrected.	A follow-up inspection is conducted when the time given to correct expires. Tenants are notified by mail.	

BEAH Incoming Referrals

Referrals

- 2006 (Launch): 60
- 2008: 176
- 2010: 171
- 2012: 233
- 2014: 240
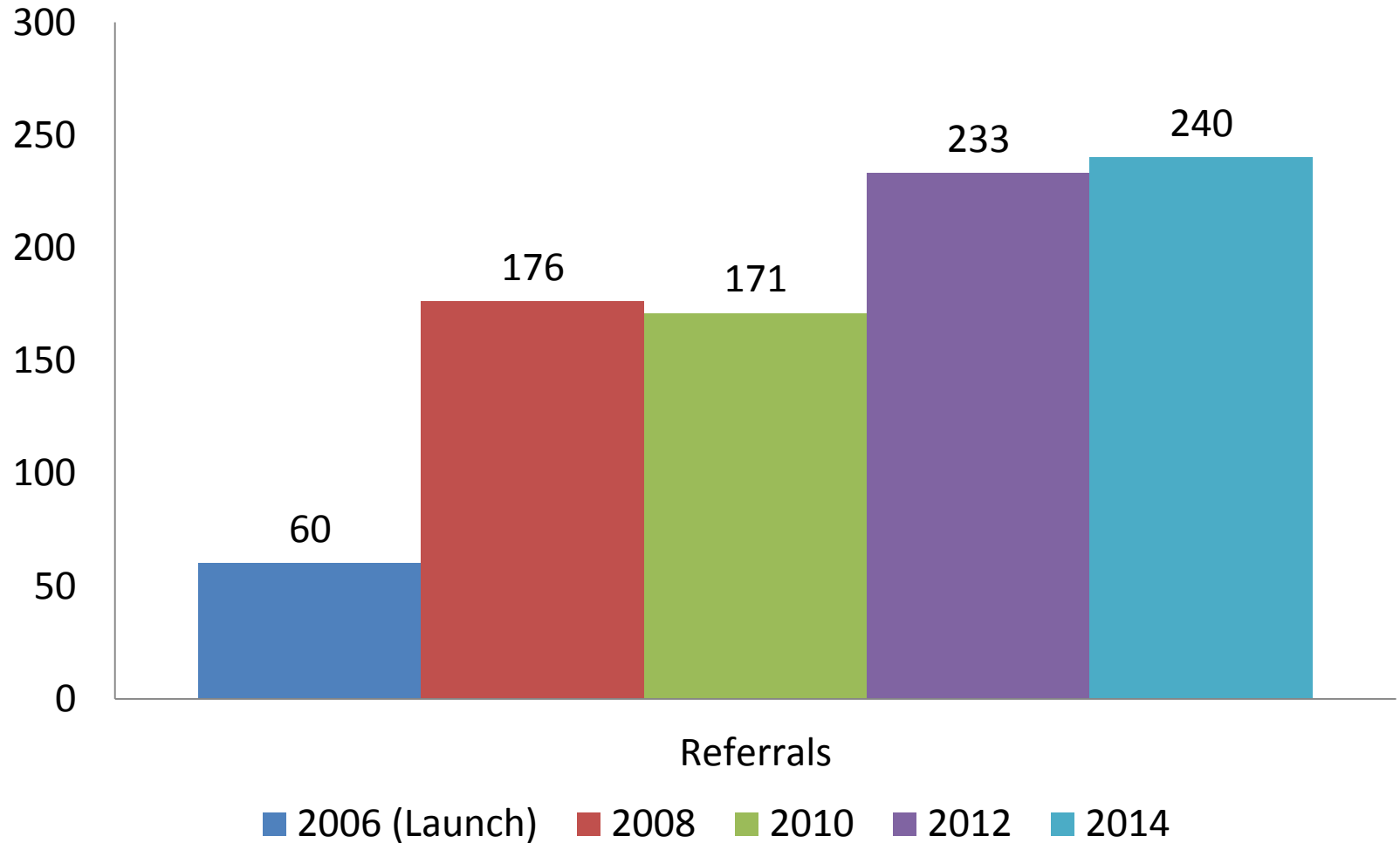
BEAH Study

- Funded through Robert Wood Johnson Foundation funding for Public Health Services and Systems Research
- Two-part <u>hypothesis</u>:
  - That a multi-sector partnership enabling clinical providers to refer pediatric asthma patients for a housing inspection will reduce asthma triggers in the home and improve symptomology and quality of life.
  - That the effectiveness of such a partnership can be improved by better understanding barriers to its operation and establishing metrics for program effectiveness.
- Mixed methods including case review, qualitative interviews and focus groups and Failure Modes and Effects Analysis

Failure Modes and Effects Analysis

- FMEA aids in identifying potential failures and developing preventative action plans reducing risk of damage

- Most useful when used to determine the affect of a modification to a process already in place or a new process

- Method to evaluate the process of identifying potential failure impacts, as well as when and how failures occur and to prioritize failures for change. FMEA reviews failures based on three failure criterion:

1. **Failure Mode:**
   - ➢ What could go wrong?
2. **Failure Causes:**
   - ➢ Why would this failure occur?
3. **Failure Effects:**
   - ➢ What would be the consequences of each failure?

Developing the BEAH FMEA

- Institutes for Healthcare Improvement guidance (copyright 2004).

- The Joint Health Commission

- U.S. Veterans Administration

- Guidance from the Executive Director of Quality and Patient Safety and Medical Director of Quality Improvement at Boston Medical Center

Conducting a FMEA

1. **Select an evaluation process**
   - FMEA's work best when the spotlight of evaluation is centralized. Focus on variants and sub-processes.

2. **Recruit a multidisciplinary team**
   - Include everyone who plays a role in the program. Those who are not involved in the entire process may be relieved but should be present for the discussion of their role.

3. **Convene members and list processes**
   - Be as descriptive as possible. Ensure the steps accurately describe the program's processes. Creating a swim lane chart may be beneficial. Several meetings may take place to ensure accuracy.

4. **List failure modes and causes**
   - List all potential failure modes for each step of the process, including rare issues. For each failure mode, identify all potential causes

Conducting a FMEA

5.   Assign an RPN* to each failure mode

➤   Assigning a risk priority number for the likelihood of occurrence, detection and severity for prioritizing focus areas and assesses improvement opportunities.

Steps	Failure Mode	Failure Causes	Failure Effects	Likelihood of Occurrence (1-10)	Likelihood of Detection (1-10)	Severity (1-10)	Risk Profile Number (RPN)	Actions to Reduce Occurrence of Failure
1								
2								
3								

6.   Evaluate the results

➤   RPN calculation for each failure mode is found by multiplying likelihood of occurrence x detection x severity with the lowest possible being 1 and the highest, 1000. Prioritize failure modes with the highest RPN's for improvement.

7.   Plan improvement efforts with the use of RPN's

➤   Use FMEA to plan prevention efforts to reduce failure mode harms; evaluate possible impacts of changes; to monitor and track improvements over time.
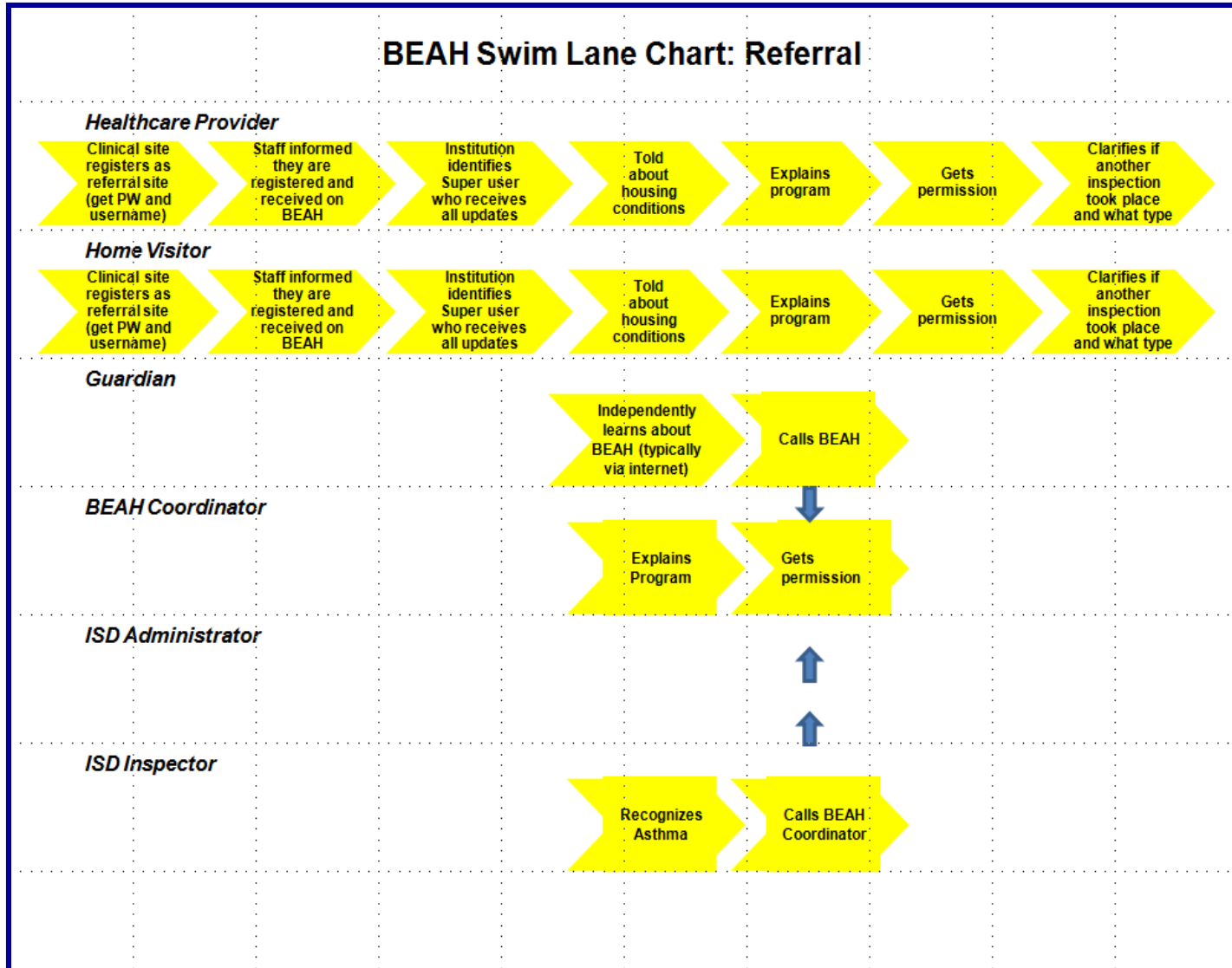
*Numeric assessment of risk assigned to a process as part of (FMEA), in which a team assigns each failure mode numeric values that quantify likelihood of occurrence, likelihood of detection, and severity of impact

FMEA and BEAH

- This project explored how the FMEA evaluation template can be adapted to a small public health program.

- BEAH FMEA Team consisted of individuals with extensive understanding of the BEAH process, representing different roles. This team consisted of:
    - An ISD Inspector Who Conducts BEAH Inspections
    - Physician Who Refers to BEAH
    - Parent of Asthmatic Children Who Has Received BEAH Inspections
    - Community Health Worker Who Conducts Asthma Home Visits
    - ISD administrator
    - and Housing Authority Representatives Responsible for Maintenance

Swim lane charts, outlining responsible organization and role, were created for each step of the BEAH process.

BEAH Swim Lane Chart: Referral

Healthcare Provider
Clinical site registers as referral site (get PW and username) → Staff informed they are registered and received on BEAH → Institution identifies Super user who receives all updates → Told about housing conditions → Explains program → Gets permission → Clarifies if another inspection took place and what type

Home Visitor
Clinical site registers as referral site (get PW and username) → Staff informed they are registered and received on BEAH → Institution identifies Super user who receives all updates → Told about housing conditions → Explains program → Gets permission → Clarifies if another inspection took place and what type

Guardian
Independently learns about BEAH (typically via internet) → Calls BEAH

BEAH Coordinator
Explains Program → Gets permission

ISD Administrator

ISD Inspector
Recognizes Asthma → Calls BEAH Coordinator

Severity x Occurrence x Detectability

- **Failure modes were prioritized and ranked based on:**

  - **SEVERITY**
  (U.S. Veteran's Administration)
    - minor event (delay)
    - moderate event (dissatisfaction)
    - serious event (harm)
    - catastrophic (death)

  - **OCCURENCE**
   - remote (once or twice during the program)
    - uncommon (once every 2 to 3 years)
    - occasional (10-20 times a year)
    - Frequent (50+ times a year)

  - **DETECTIBILITY**
  (Joint Health Commission Standards-
  adapted to 4 point scale)
    - Impossible (no ability to detect failure)
    - Slight (after failure, become aware and investigate)
    - Medium (proactively look for failure)
    - High (failure is immediately self revealing)

Four Major Proposed Actions

Figure 3: Proposed Actions
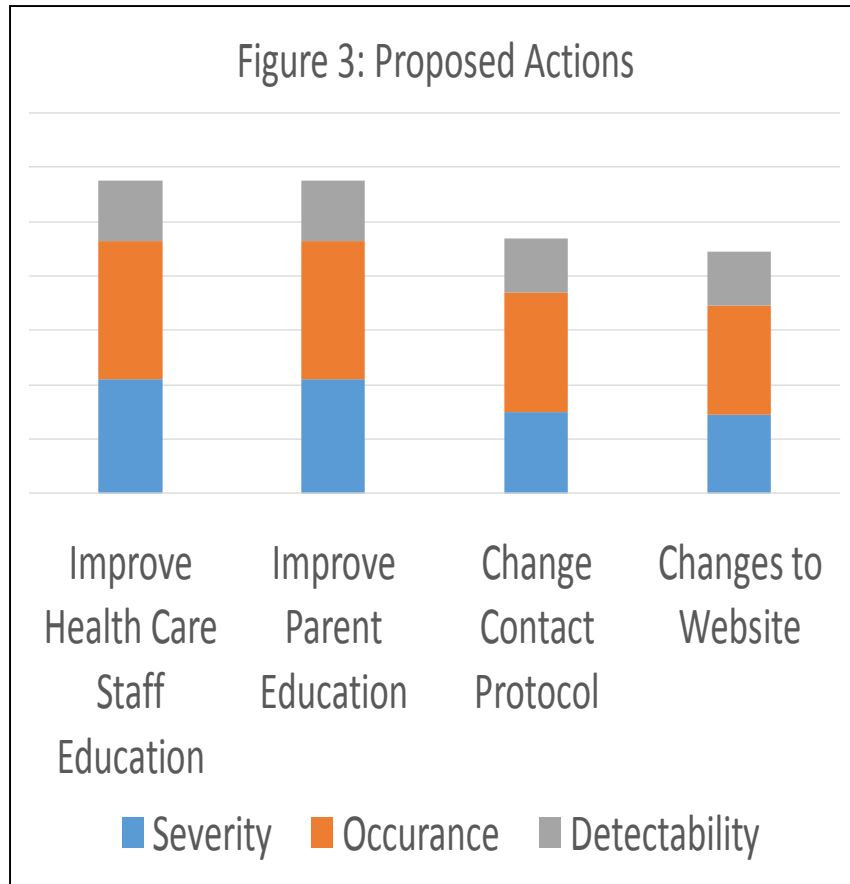
- Four major groupings of actions were determined by the FMEA team

- Each of the four categories were qualitatively determined by grouping individual responses to each failure mode

Risk Priority Number (RPN)

A combined indicator of Risk Priority Number (RPN) was calculated by multiplying

severity x occurrence x detectability.

Some solutions addressed more than one risk. These risks were combined and given a total RPN.

Action Taken	Failures Addressed	Sev	Occ	Det	S*O*D
Improve Staff Education					
	Staff must know about housing conditions	3.5	4	2	42
	Staff must be aware of BEAH	3	3	3	27
	Staff must clearly explain program	2	4	3	24
	Staff must address parent concerns	3	2.5	3	22.5
	Site must be registered	3	2	3	18
Total RPN		14.5	15.5	14	133.5
Improve Parent Education					
	Admin must reach family by phone	2.5	4	1	10
	Adult must be home to let inspector in	2.5	4	1	10
	Parent needs to consent	2.5	3.5	1	8.75
	Client needs to recognize inspection done	2.5	3	1	7.5
	Health Care staff must address parent concerns	3	2.5	3	22.5
	Staff must clearly explain program	2	4	4	24
	Parents must give permission for referral	3	1	1	3
Total RPN		21	25.5	11	121.75
Change Contact Protocol					
	Adult must be available for inspection	2.5	4	1	10
	Adult must be home to let inspector in	2.5	4	1	10
	Staff must have correct information	1.5	4	1	6
	ISD admin must know about referral	3	2	3	18
Total RPN		15	22	10	90
Changes to Website					
	Admin must reach family by letter	3	4	3	36
	Admin must reach family by phone	2.5	4	1	10
	Staff must have correct information	1.5	4	1	6
	Adult must be home to let inspector in	2.5	4	1	10
	ISD admin must know about referral	3	2	3	18
	Staff must log in to working system	2	2	1	4
TOTAL RPN		14.5	20	10	84

Actions Proposed to Address Failure Modes

- **Improve Clinician Education on the Program**
  - ➢ Create new training videos for healthcare professionals
  - ➢ Provide updated, simplified and translated outreach materials to healthcare facilities
  - ➢ Continue regular outreach visits and quarterly newsletter
  - ➢ Encourage universal screening

Actions Proposed to Address Failure Modes

- **Improve guardian/tenant knowledge**
  - ➤ Create videos for parents as well as landlords
  - ➤ Utilize social media to address concerns
  - ➤ Conduct outreach to community organizations

Actions Proposed to Address Failure Modes

- **Adjust scheduling protocol**

  - ➤ Text message, automated voice and email capabilities

  - ➤ Eliminating USPS option

  - ➤ Families asked to confirm scheduled inspections

Actions Proposed to Address Failure Modes

- **Changes to the BEAH website**

  - ➢ Updates to the BEAH website to make it more user friendly

  - ➢ Include mandatory fields and check boxes

FMEA Implications for
Public Health Practice & Policy

- Successfully adapted methodology used in larger scale hospital and industry to a smaller scale public health program.

- Helped to identify potential failures and develop evidence based corrective action plans

- Helped to prioritize risks that have different consequences than those that may occur in a health care setting
  - Ex: risks associated with dissatisfaction as compared to death

Additional BEAH Evaluation

Quantitative and qualitative methods to gain a deeper understanding of BEAH operations, the nature of stakeholder collaboration, and perceptions of program fidelity by BEAH stakeholders and to capture health and environmental outcomes.

Position	n	Data Collection Method	Description
Clinicians	10	One-on-One phone interview	Three medical doctors, three nurse practitioners, two registered nurses and two community health workers from three separate Boston-based health institutions
BEAH Clients	22	One-on-One phone interview	Qualitative interviews with 22 heads of households who have received BEAH inspections.
Inspectors	9	Focus Group	Inspectors who have worked with BEAH cases
Stakeholders	13	Focus Group	People or representatives of organizations directly invested in BEAH. This included pediatric nurse practitioners, community health workers, attorneys, the ISD housing director, health housing advocates, parents of children with asthma, and representatives of the Boston Public Health Commission and the Boston Housing Authority.
BEAH Clients	90	Chart Review	Medical records review of 90 BEAH clients receiving care at Boston Medical Center to monitor changes in health care utilization and environmental improvements.

Focus Group and Interview Findings: Barriers

- Parent Education
  - "A lot of it is just educating families about what their rights are and then helping them to understand what resources are available to them, and then helping them to access those resources."-clinician
  - Inspectors felt need to build trust with tenants to better understand their living situations. Landlords typically reach out to inspectors after initial inspections which is described by inspectors as where "the therapy starts" between landlord and tenant creating "a collaboration where you work together with the landlord and tenant"

- Website
  - Majority of the clinicians found the website time consuming and inefficient
  - You can click on it and usually, there is feedback there, not a lot of feedback, but just updates from ISD, and it pretty much says when the inspection happened or what they found, but nothing in particular as to what the next step would be."-clinician

- Provider Education
  - A challenge identified by inspectors was the inconsistent information provided to the family by the clinician that contributed to, in their opinions, an incomplete or unsuccessful first inspection

- Contact Protocol
  - "…I think it's really between the referral and that first contact is when there is a big problem is the sense that I have"-clinician

Focus Group and Interview Impressions of BEAH

- Clinicians, inspectors and stakeholders all held positive attitudes about the partnership and were generally pleased with the program. There was perceived evidence by inspectors of improved housing conditions and of improved asthma symptoms and severity by both inspectors and clinicians

"I think the program's a great success. I can't tell you how many times I've written up the landlord and I've talked to the tenant, I've written up the tenant. And then I go back or I get a phone call months down the line and say you know 'my child hasn't been in the emergency room since you've been out here, thank you so much.'"-inspector

Additional Analysis

- Mixed Methods
  - Quantitative interviews 3 groups of BEAH referrals
    - Referred but did not participate
    - Referred and received services
    - Referred, received services and asthma home visit service
  - After Quantitative interview, invited to participate in semi structured qualitative interviews
  - Consented for chart review of healthcare utilization by Electronic Health Record data pull

Products

- ## Completed
  - http://www.cityofboston.gov/isd/housing/bmc.asp
  - Reid M, Fiffer M, Gunturi N, Ali A, Irish D, Sandel M. *Breathe Easy at Home: a web-based referral system linking clinical sites with housing code referral for patients with asthma. J Environ Health.* Jan/Feb 2014 76 (6).

- ## In Development
  - Johnna S. Murphy J, Reid M, Ali A, Harrington L, Sandel M. *Applying Failure Mode and Effect Analysis to Public Health: The Boston Breathe Easy at Home Program.* (Revised and resubmitted.)
  - Multi-sector qualitative research manuscript
  - Training and promotional videos for patients, community and referring clinicians

- ## Planned
  - Mixed methods including health outcomes

Acknowledgements

- Robert Wood Johnson Foundation funding for Public Health Services and Systems Research
- University of Kentucky College of Public Health
- Boston Inspectional Services Department
- Boston University School of Public Health
- Boston Housing Authority
- Parent Asthma Leaders at Health Resources in Action

Commentary

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Questions and Discussion

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http://www.publichealthsystems.org/phssr-research-progress-webinars

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Thursday, August 6 (1-2pm ET)

POPULATION HEALTH INVESTMENTS: RELATIONSHIPS BETWEEN LOCAL PUBLIC HEALTH & HOSPITAL COMMUNITY BENEFIT SPENDING

[Simone R. Singh](), PhD, Assistant Professor, School of Public Health, University of Michigan

Wednesday, August 12 (12-1pm ET)

BUILDING ACCESS & UNDERSTANDING OF LAW IN PUBLIC HEALTH PRACTICE IN NEBRASKA

Jennifer K. Ibrahim, PhD, MPH, MA, Associate Dean for Academic Affairs, College of Public Health, Temple University

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