An introduction to Business Process Modelling (BPM) in healthcare

British Computer Society

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1. Process Mapping in healthcare: WHY?

2. What is Process Mapping and its origins?

3. Process Mapping in healthcare

4. How to conduct a Process Mapping exercise

5. Benefits, Success factors and Challenges

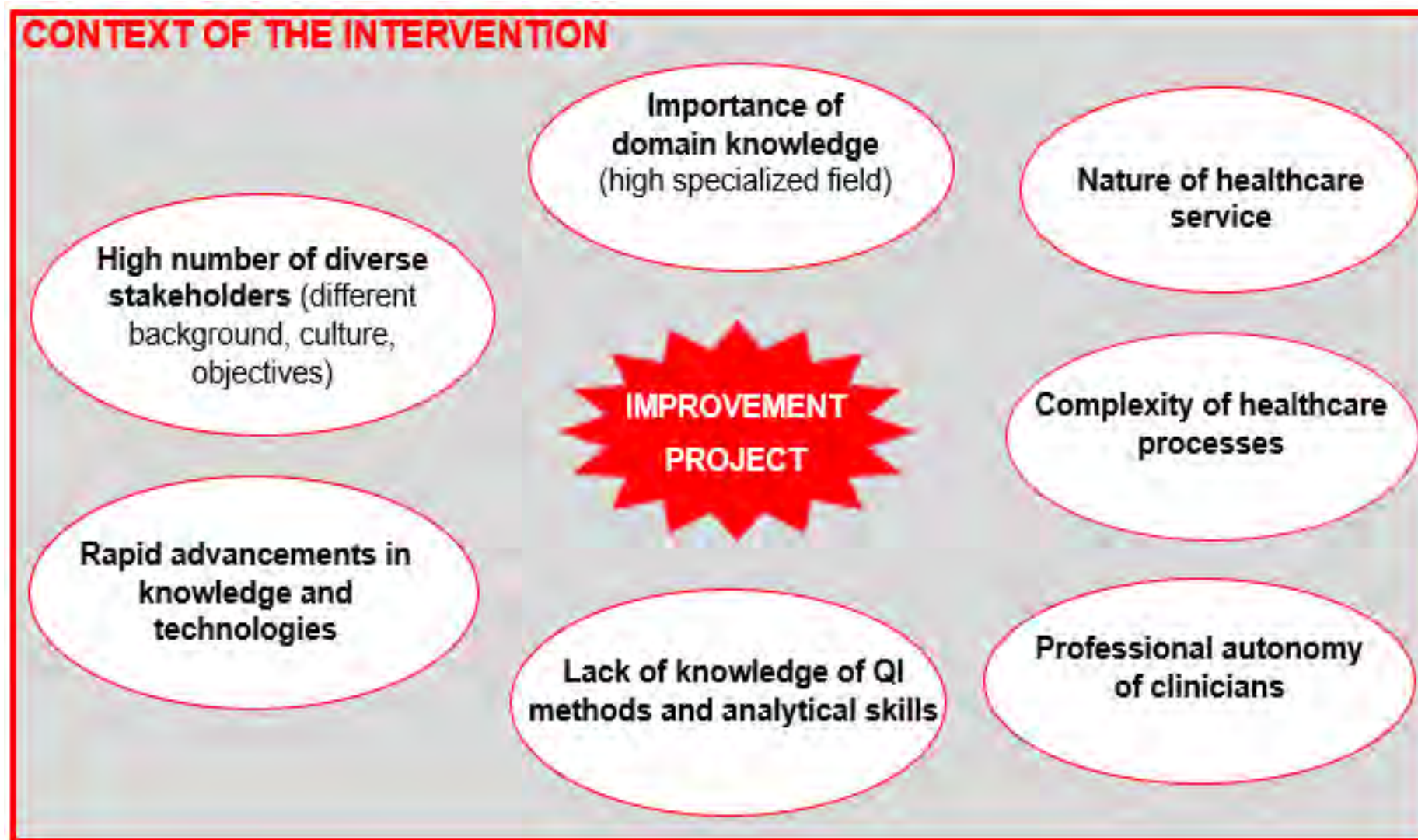# 1. Process Mapping in healthcare: WHY?

If we want to change the outcomes of a system,
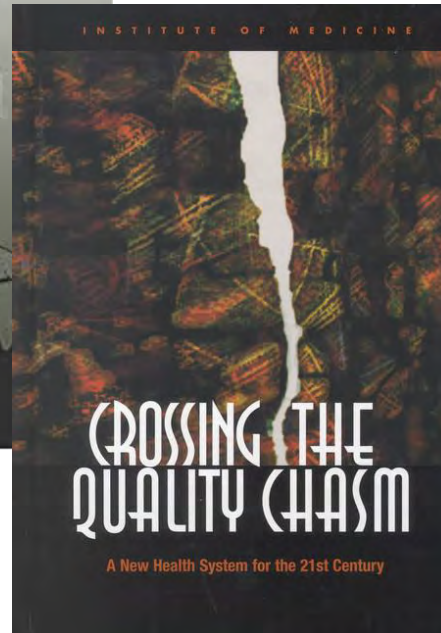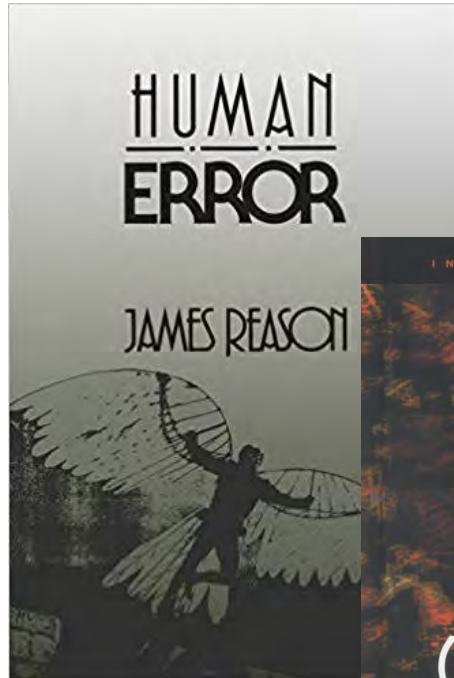
we need to change something in the system.

1. Process Mapping in healthcare: WHY?

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Most observed healthcare failures can be ascribed to **system and process criticalities** rather than to human error.

HUMAN ERROR

JAMES REASON

INSTITUTE OF MEDICINE

CROSSING THE QUALITY CHASM

A New Health System for the 21st Century

QUALITY GRAND ROUNDS
Series Editors: Robert M. Wachter, MD; Kaveh G. Shojania, MD;
Sanjay Saint, MD, MPH; Amy J. Markowitz, JD; and Mark Smith, MD, MBA

ACADEMIA AND CLINIC

The Wrong Patient

Mark R. Chassin, MD, MPP, MPH, and Elise C. Becher, MD, MA*

Among all types of medical errors, cases in which the wrong patient undergoes an invasive procedure are sufficiently distressing to warrant special attention. Nevertheless, institutions underreport such procedures, and the medical literature contains no discussions about them. This article examines the case of a patient who was mistakenly taken for another patient's invasive electrophysiology procedure. After reviewing the case and the results of the institution's "root-cause analysis," the discussants discovered at least 17 distinct errors, no single one of which could have caused this adverse event by itself. The discussants illustrate how these specific "active" errors interacted with a few underlying "latent conditions" (system weaknesses) to cause harm. The most remediable of these were absent or misused protocols for patient identification and informed consent, systematically faulty exchange of information among caregivers, and poorly functioning teams.

Ann Intern Med. 2002;136:826-833.
For author affiliations, see end of text.
See editorial comment on pp 850-852.
An expanded version of the text is available at www.annals.org.

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1. Process Mapping in healthcare: WHY?

Since 1980, governments and healthcare organizations have shown an **increased interest in the adoption of management practices** and technologies successfully adopted by other industries to improve quality of care (Business Process Management practices, Lean manufacturing and Six Sigma, the use of modelling and simulation approaches, etc.).

All these techniques require a **deep understanding of the system** and processes under analysis, which is usually provided by **Process Mapping**.
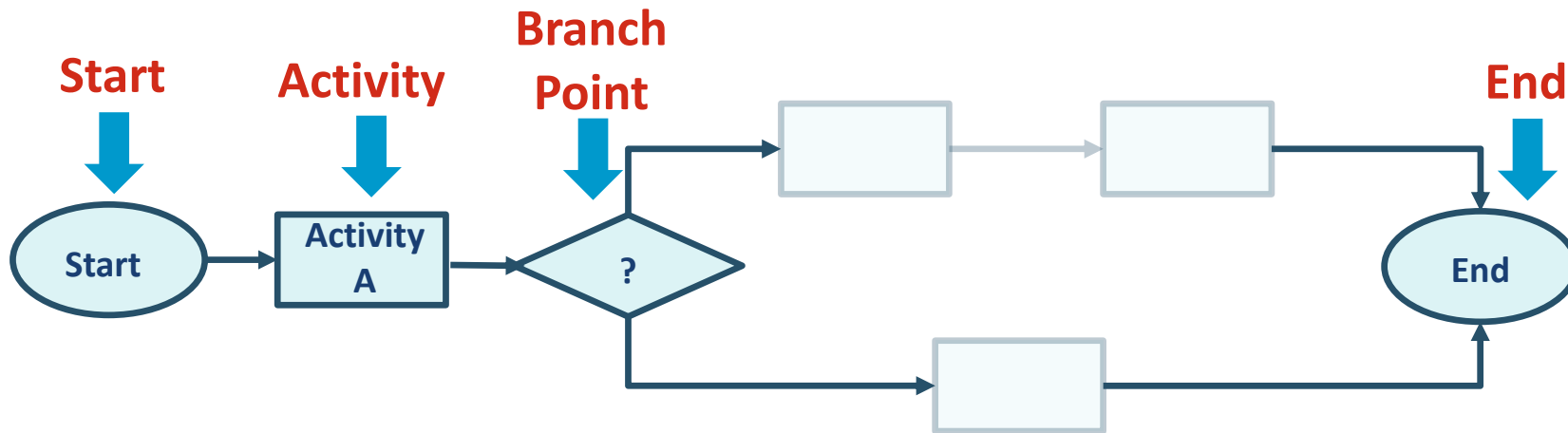
2. What is Process Mapping?
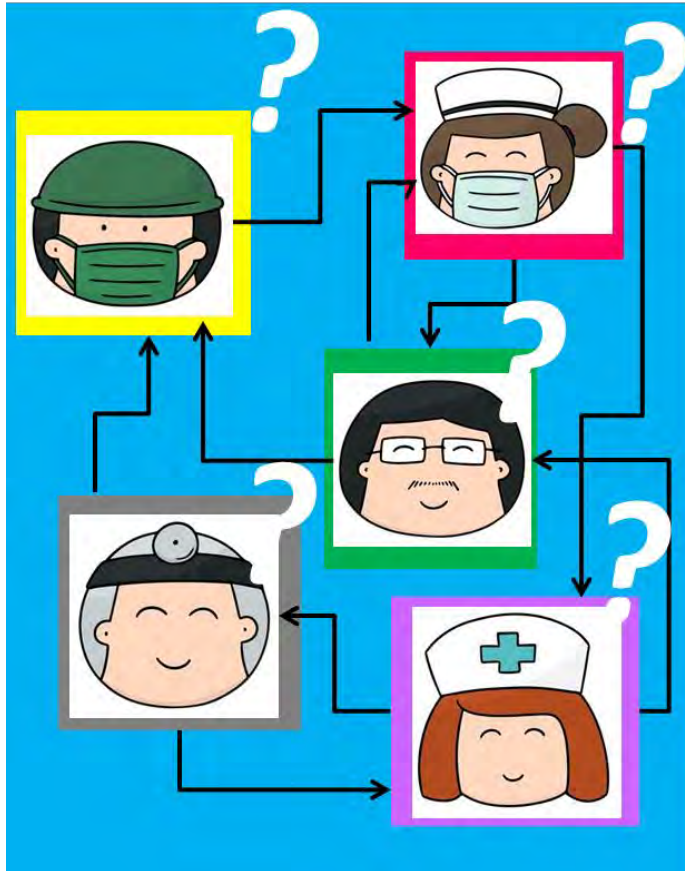
PM is a **Method** which allows:

- to identify and expose key elements of a process and to **gain insight into actual practice** as well as to **design** new or enhanced processes.

- to **analyse and better understand** the **systems** and processes in which **improvement interventions** may be introduced.

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2. What is Process Mapping?

Process : *Process (noun): a series of actions or steps towards achieving a particular end [*].*
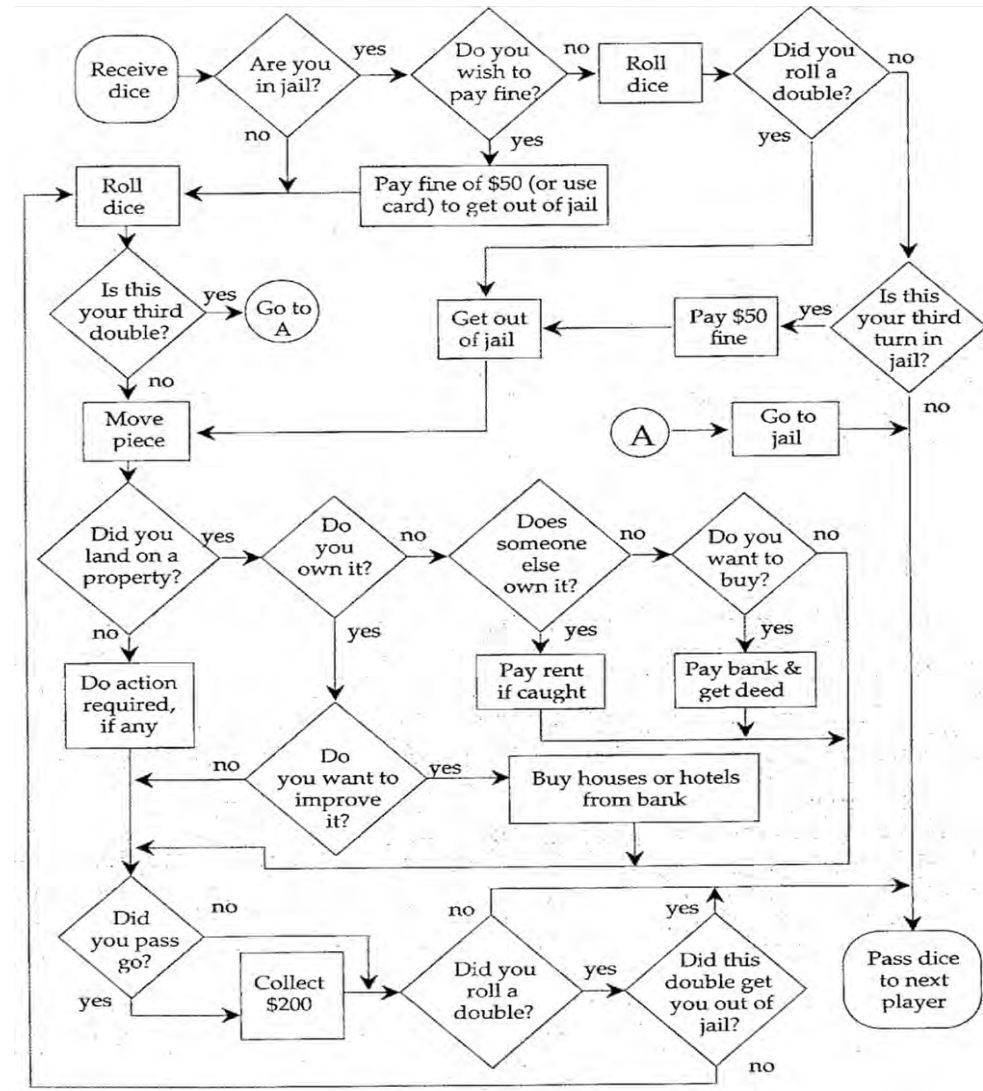
Process Map:

[Compact Oxford English Dictionary]*

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2. What is Process Mapping?
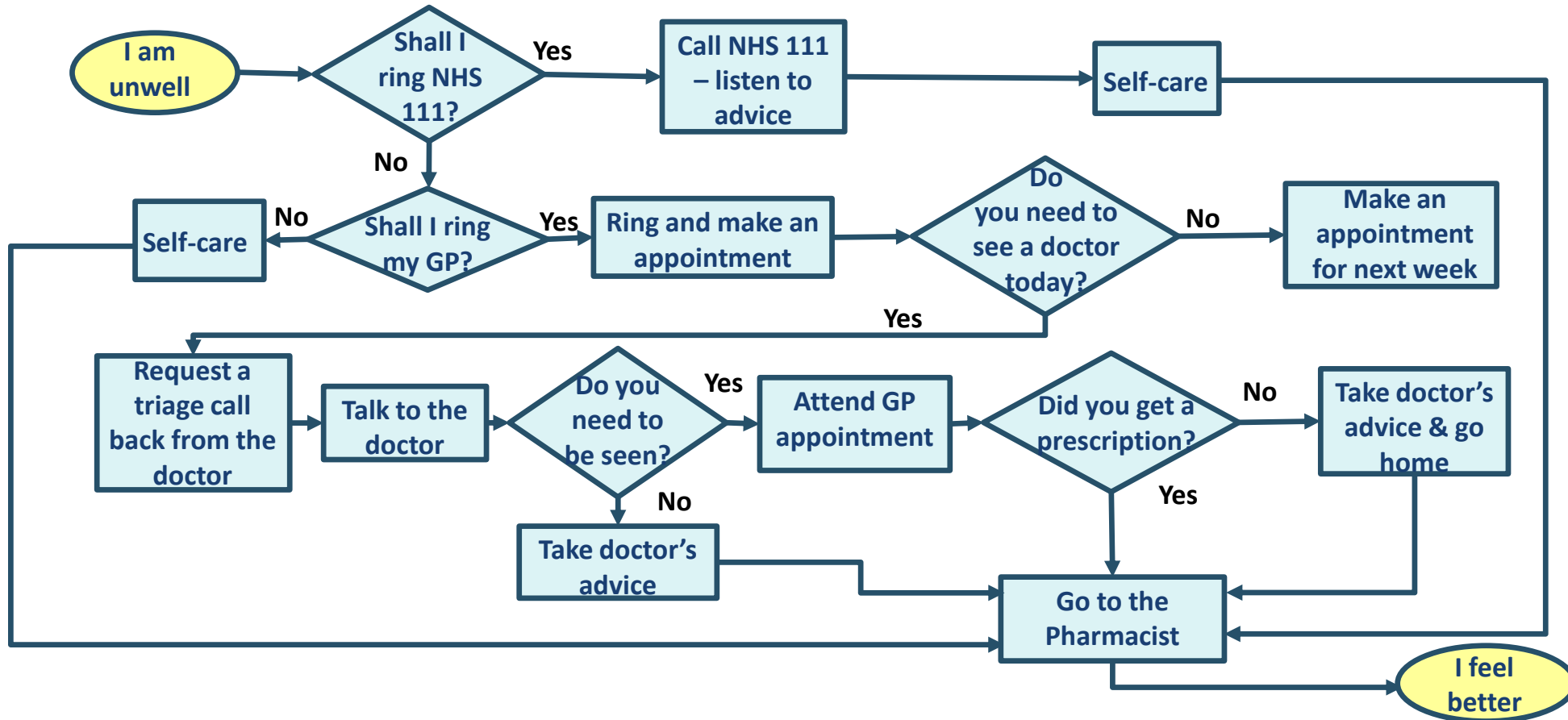
Example of a Process Map

Process mapping for a turn in the game of monopoly

Making Sense of Data,

Donald J Wheeler

2. What is Process Mapping?

Example of a Process Map - Seeking health advice in primary care

2. What is Process Mapping? – Origins

- Frank Gilbreth in 1921 at the *American Society of Mechanical Engineers* (ASME) annual meeting introduced "**Process Chart**", defined as a "device for visualizing a process as a means of improving it" (Gilbreth, & Gilbreth, 1921).

- In 1947 ASME established a set of symbols derived from Gilbreth's original work as the **ASME Standard for Operation and Flow Process Charts**.

- Allan Mogensen described process charts as an "irreplaceable tool" and the "lifeblood of work simplification" (Mogensen & Rausa, 1989) and used them **to organize and analyse work** (Mogensen, 1932).

- Ben S. Graham adapted the process charts from the factory **to office information flows** (Graham, 2004).

FIG. 5 PROCESS CHART FOR LOADING RIFLE GRENADES
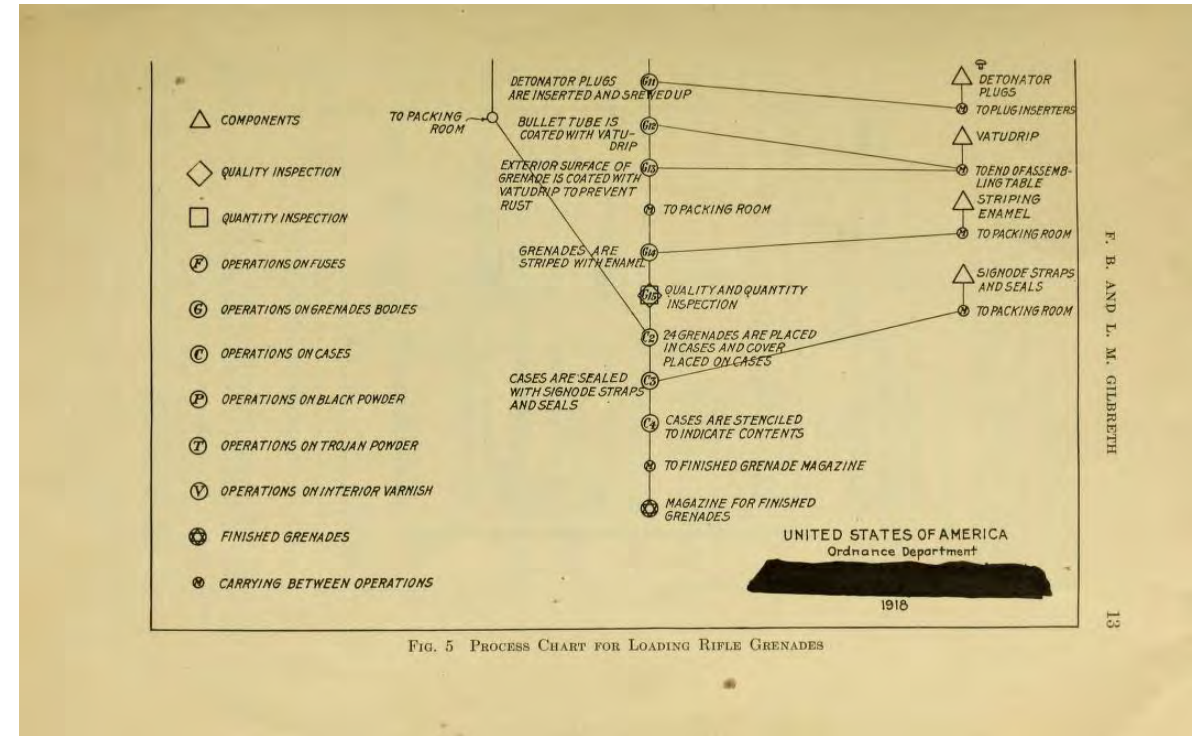
The **popularity of PM techniques is rapidly increased** in the **manufacturing** field as well as in some **service industries** and involves many application domains.

3. Process Mapping in healthcare – Evidence from literature

3. Process Mapping in healthcare – Evidence from literature

Objective

1. Identify the **context of use** of PM in healthcare QI projects.

2. Develop a conceptual framework identifying different phases in PM, with **quality criteria** for each, to guide the implementation, assessment and reporting of this method.

3. Assess the **consistency** to the conceptual framework quality criteria with which the method has been applied.

4. Identify the **evidence for the benefits** of using PM in improvement work.

3. Process Mapping in healthcare – Evidence from literature

Healthcare Setting
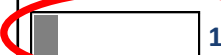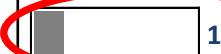
Approaches to improvement
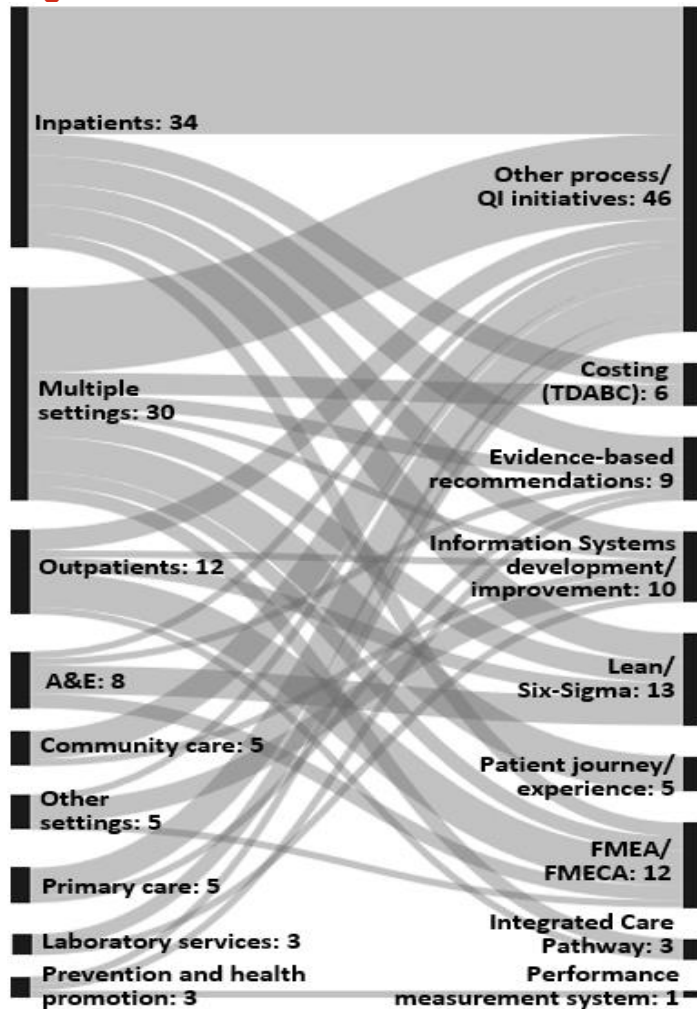
1. Context of use

- In wide **variety settings** (inpatients, public health, etc.).

- As a **standalone methodology** or as **part of other** QI approaches (e.g. Lean, Six Sigma, FMEA, etc.).

- Within **operational research techniques** (e.g. modelling and simulation) or to inform the design, development and evaluation of **health information technologies** (HIT). It can be used for **costing** analysis (e.g. TDABC) or to represent **evidence-based pathways** and **patients' experience**.

3. Process Mapping in healthcare – Evidence from literature

PHASE of PM	CRITERIA	COMPLIANCE (% studies)
Phase 1: Preparation, planning and process identification	A service family and the patient/service user groups is clearly identified	91%
	The team is educated/trained on the use of the process mapping tool.	15%
	A patient representative is involved in the project.	15%
Phase 2: Data and information gathering	Information is gathered to inform the process mapping exercise.	85%
Phase 3: Map generation	Different perspectives from multiple stakeholders groups are gathered	81%
Phase 4: Process analysis	The process map is analysed	100%
	Additional information gathered during the process mapping exercise and analysis is represented on the final map.	78%
	Sticky notes or paper based maps transferred are to charting software as soon as possible	19%
	The final map is validated by key stakeholders/experts.	48%
Phase 5: Take it forward	Further actions based on knowledge gained from PM are undertaken demonstrating the actual implementation or testing of improvement ideas.	42%

2. Conceptual framework

Quality criteria to guide the implementation, evaluation and reporting of Process Mapping in healthcare.

3. Compliance of application of Process Mapping to the conceptual framework criteria

4. How to conduct a Process Mapping exercise

Phase 1. Preparation, planning and process identification

Phase 2. Data and information gathering

Phase 3. Map generation

Phase 4. Process analysis

Phase 5. Take it forward

4. How to conduct a Process Mapping exercise

Phase 1	Phase 2	Phase 3	Phase 4	Phase 5

Preparation, planning and process identification

- Agree **aims of project** and provide a clear and compelling **goal** for creating the map.

- Identify the **team** and define key **roles**.

- Plan the **session**.

- Identify a **service family** and the patient/service **user** group.

- Educate the team on the **process-mapping tool**.

- Involve and **engage "stakeholders"** (including patients).

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4. How to conduct a Process Mapping exercise

| Phase 1 | Phase 2 | Phase 3 | Phase 4 | Phase 5 |

Data and information gathering

- Understand **what information you need** and where you go to learn it.

- Develop data gathering **plans**.

- Use data gathering **tools**.
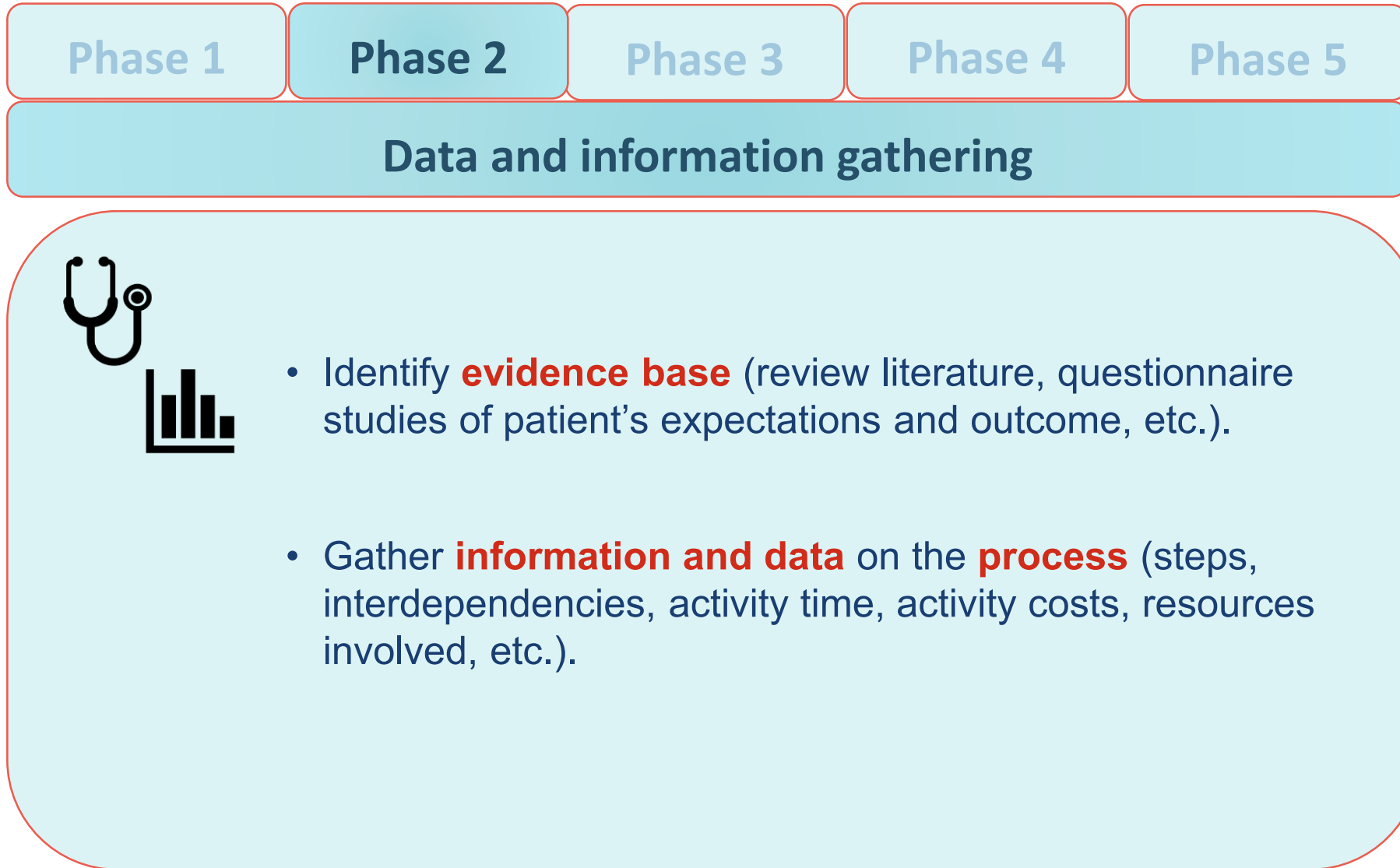
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4. How to conduct a Process Mapping exercise

Phase 1	Phase 2	Phase 3	Phase 4	Phase 5

Data and information gathering

- Identify **evidence base** (review literature, questionnaire studies of patient's expectations and outcome, etc.).

- Gather **information and data** on the **process** (steps, interdependencies, activity time, activity costs, resources involved, etc.).

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4. How to conduct a Process Mapping exercise

| Phase 1 | **Phase 2** | Phase 3 | Phase 4 | Phase 5 |

Data and information gathering

Data can be collected in **different ways**:

- Multi-disciplinary **meetings**;

- Direct **observation** of patient journey;

- One-on-one **interview**;

- Patient's **self experience**;

- Content (document) **review**.

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4. How to conduct a Process Mapping exercise

Phase 1	Phase 2	**Phase 3**	Phase 4	Phase 5

Map generation

- Gather perspectives from **multiple stakeholders**.

- Determine the **level of detail** needed.

- Decide on process-mapping **medium** (e.g. sticky notes, paper, white board, mapping software).

- Decide on process-mapping **modeling language**.

- Don't try to solve the problems **until you have fully mapped** the process.

- Use a **simple** approach.

- Create an **environment** which people find **safe**.
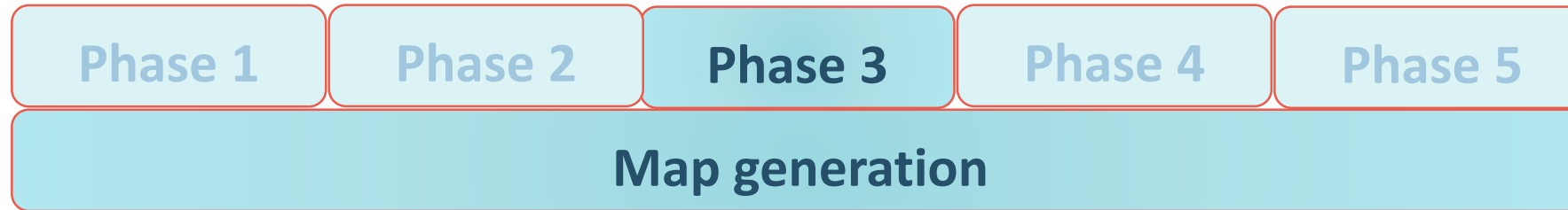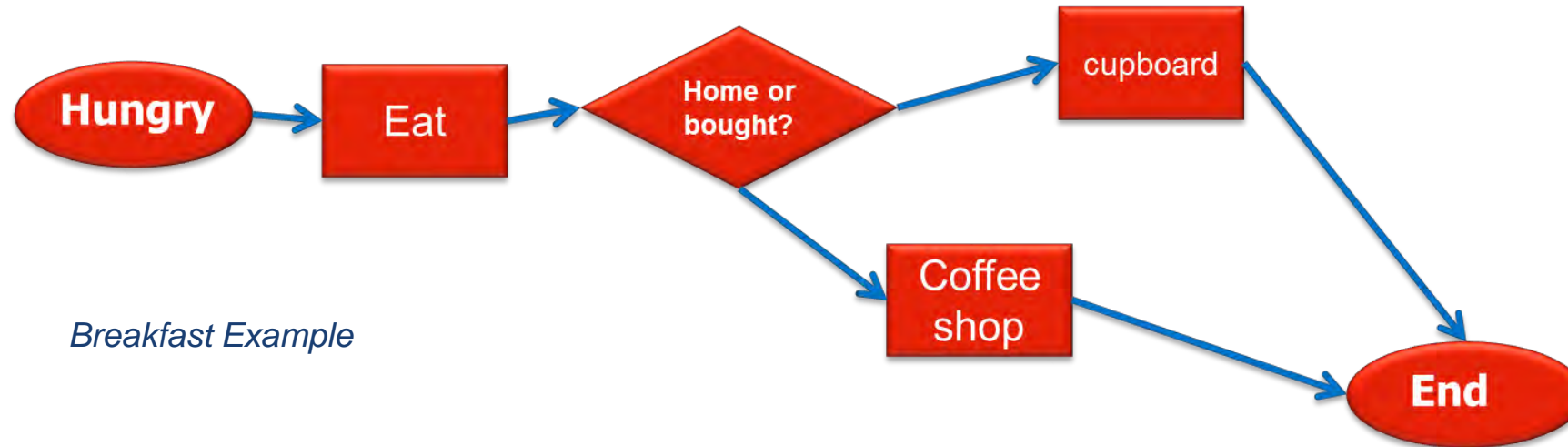
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4. How to conduct a Process Mapping exercise

| Phase 1 | Phase 2 | **Phase 3** | Phase 4 | Phase 5 |

Map generation

Levels of detail

Breakfast Example

4. How to conduct a Process Mapping exercise

Phase 1	Phase 2	**Phase 3**	Phase 4	Phase 5

Map generation

Levels of detail

Breakfast Example
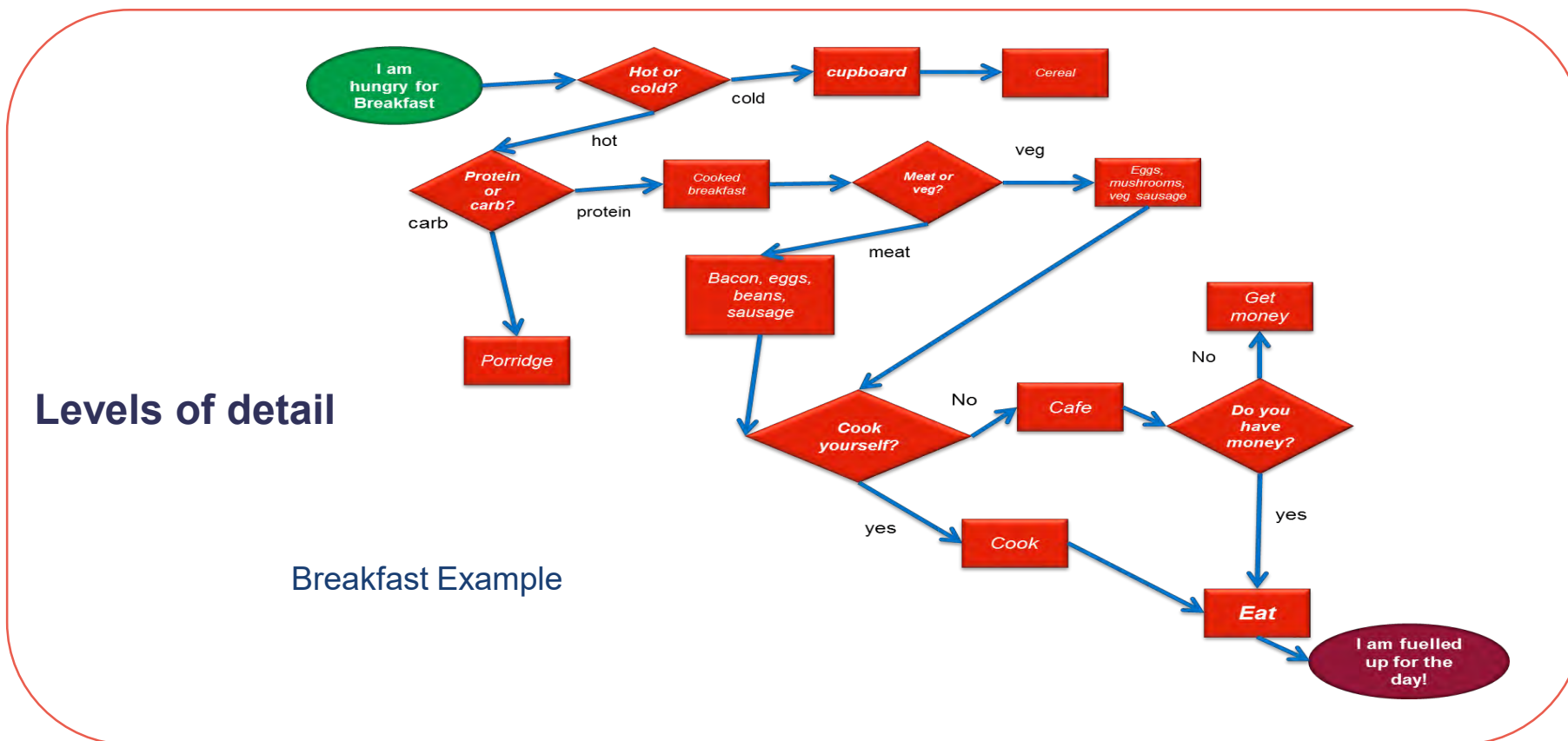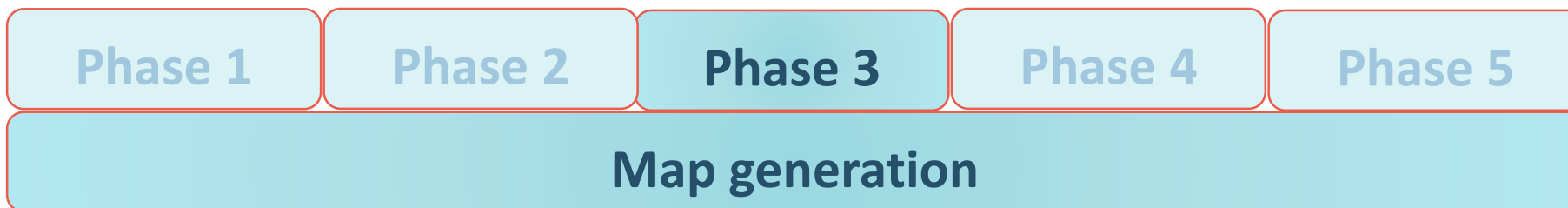
4. How to conduct a Process Mapping exercise

Phase 1	Phase 2	**Phase 3**	Phase 4	Phase 5

Map generation

Modelling language

Flow Chart
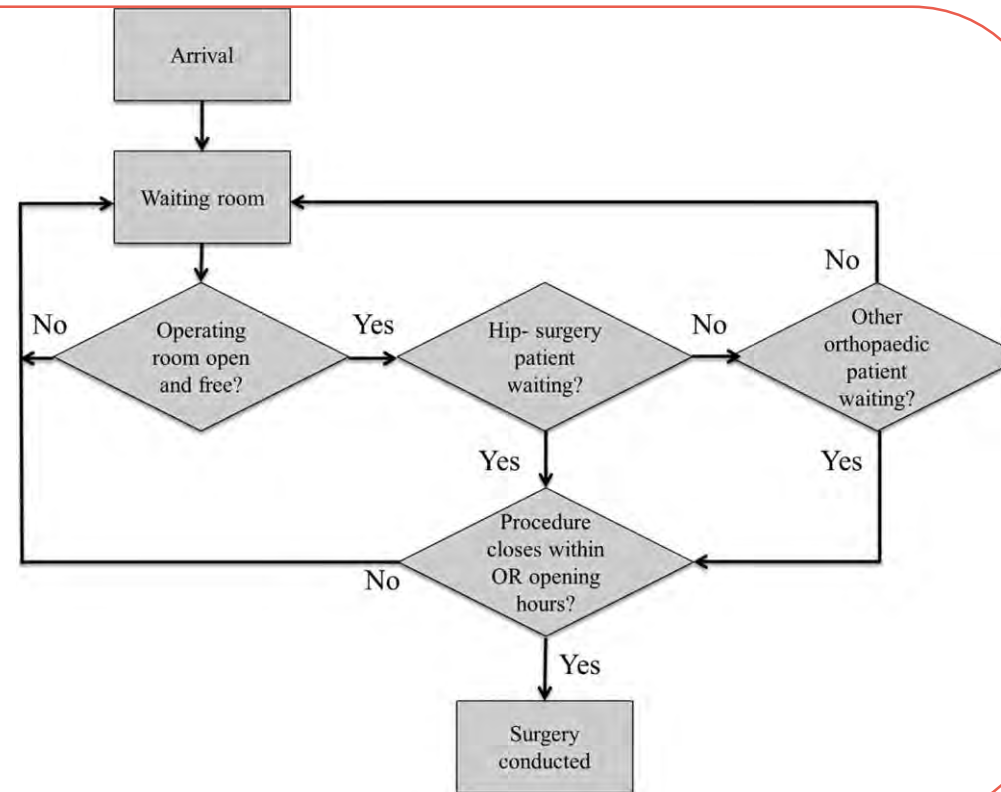
4. How to conduct a Process Mapping exercise

| Phase 1 | Phase 2 | **Phase 3** | Phase 4 | Phase 5 |

Map generation

Modelling language

Value Stream Mapping
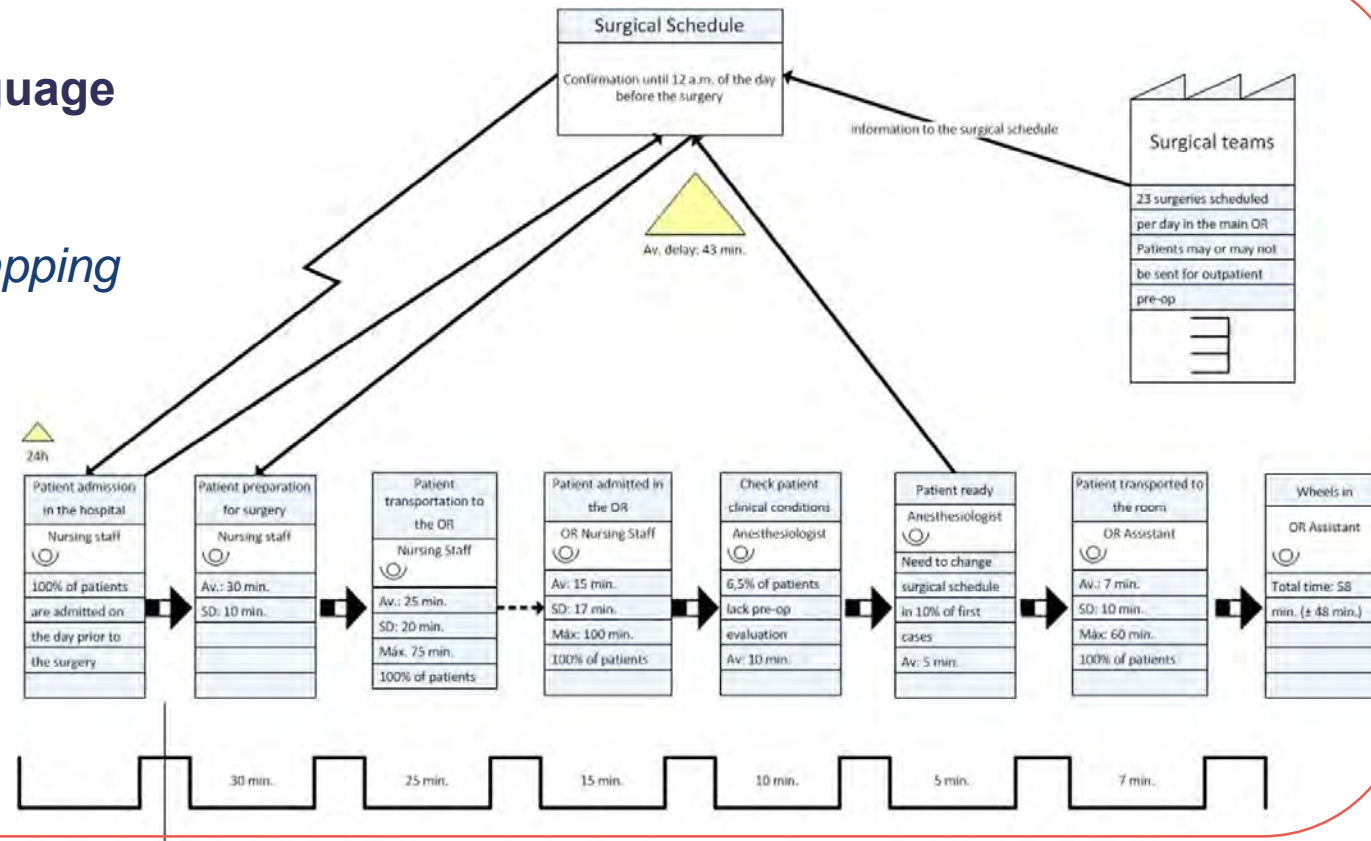
4. How to conduct a Process Mapping exercise

Phase 1	Phase 2	**Phase 3**	Phase 4	Phase 5

Map generation

Modelling language   *BPMN*
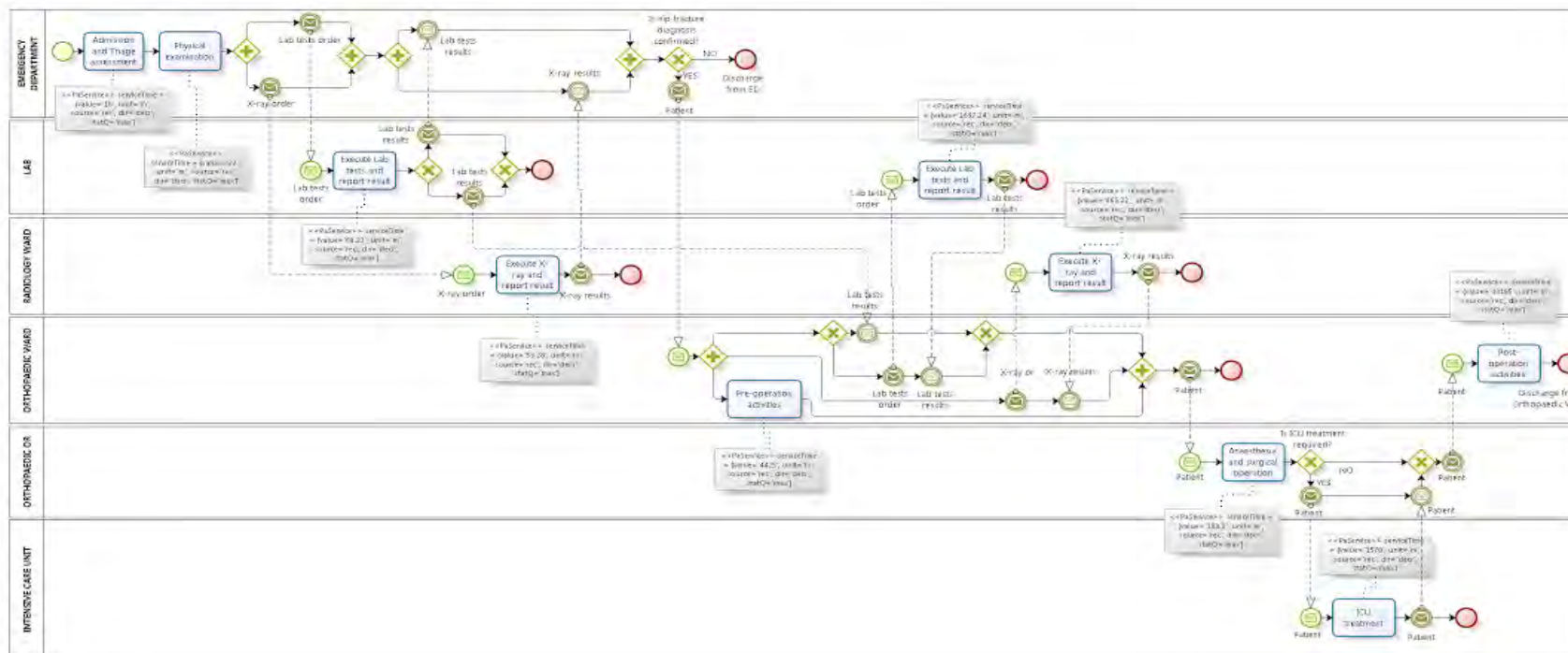
4. How to conduct a Process Mapping exercise

Phase 1	Phase 2	Phase 3	**Phase 4**	Phase 5
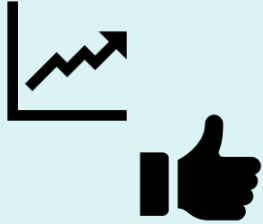
Process analysis

- Analyse the **process map** (e.g. quality, efficiency, costs).

- Add **information derived** from analysis on the process map (e.g. bottlenecks, personnel type, activity duration).

- Transfer sticky notes or **paper-based** maps to an **electronic format**.

- Review for accuracy and **validate** the final map.

4. How to conduct a Process Mapping exercise
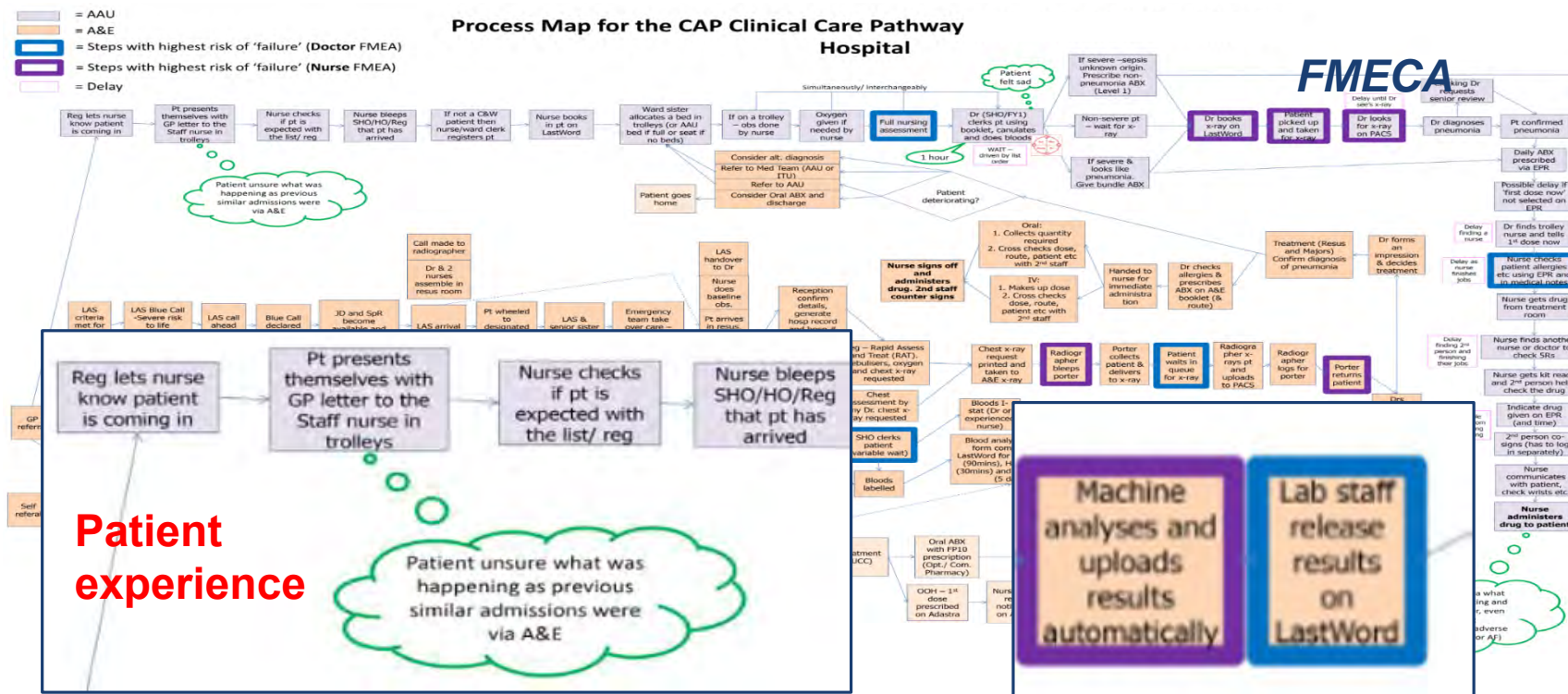
Process analysis

4. How to conduct a Process Mapping exercise

Phase 1	Phase 2	Phase 3	**Phase 4**	Phase 5

Process analysis

TDABC
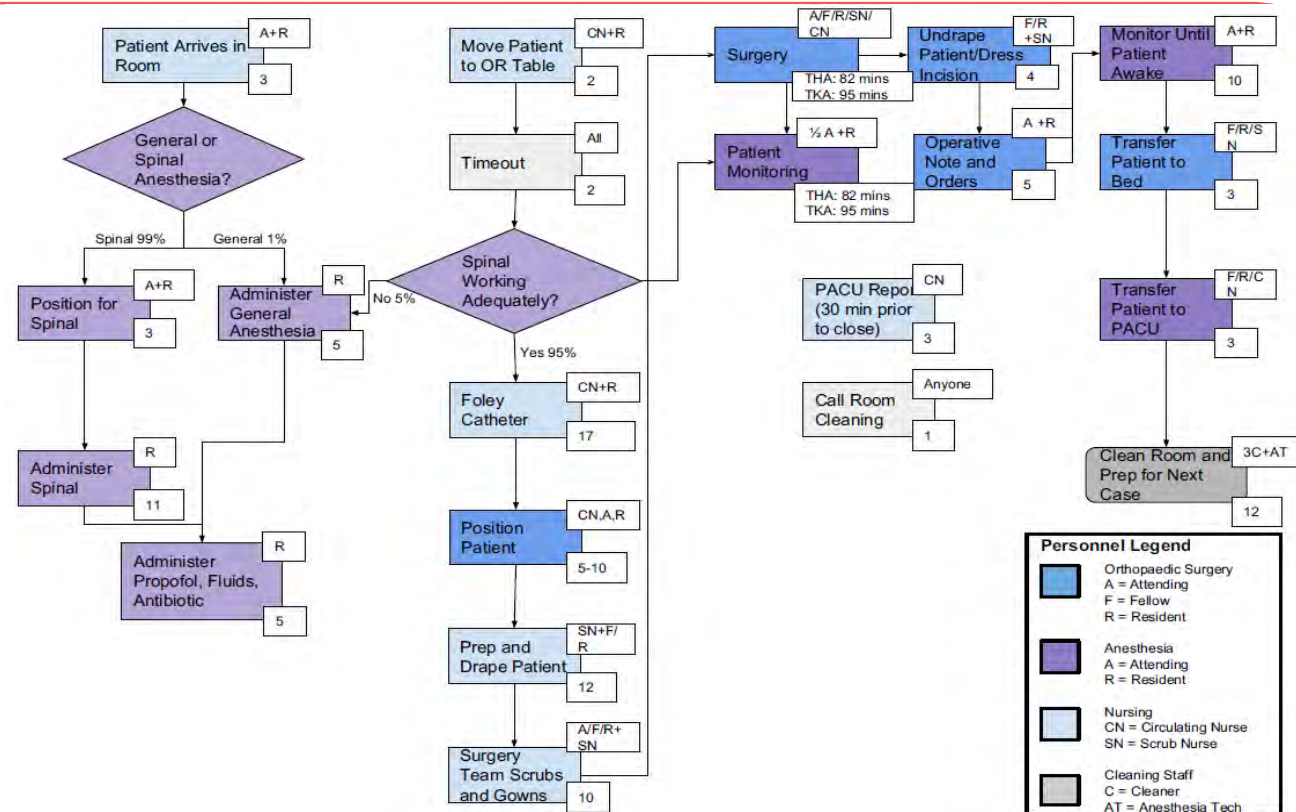
4. How to conduct a Process Mapping exercise

Phase 1	Phase 2	Phase 3	Phase 4	**Phase 5**

Take it forward

- Share the **finalized version** of the process map and analysis with **all participants**.

- Undertake **actions to improve the process -** plan, implement and perfect improvements (PDSA cycles).

- Use the process maps to **guide process improvement** initiatives (identify, prioritize and monitoring).

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5. Benefits, Success factors and Challenges

Look at problems from diverse perspectives
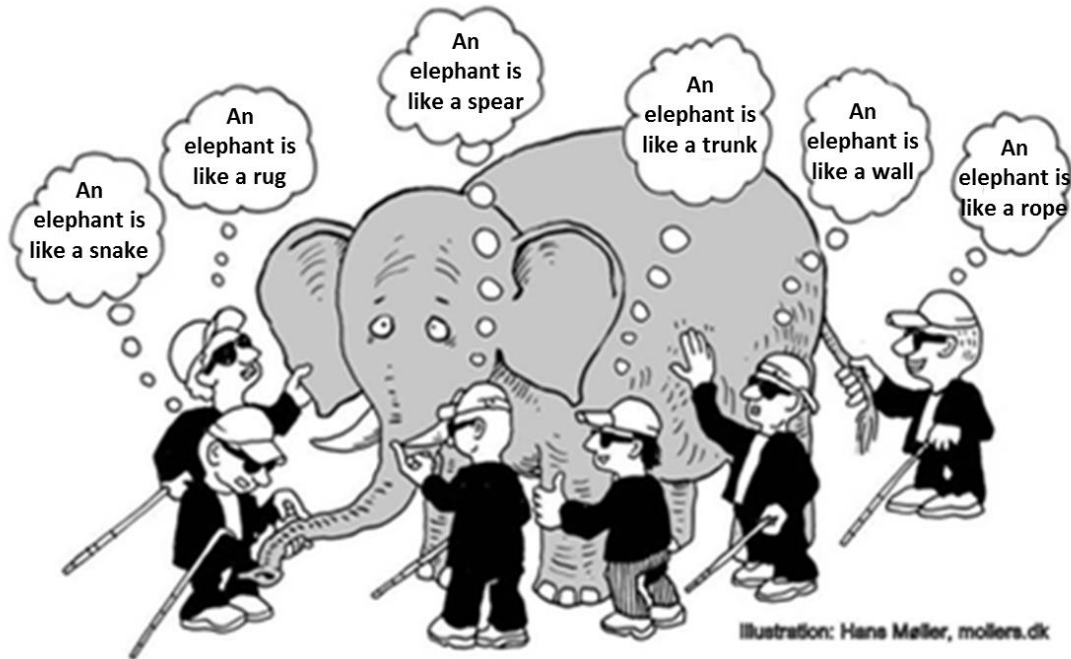
Each in his own opinion
Exceeding stiff and strong,
Though each was partly in the right,
And all were in the wrong!

John Godfrey Saxe (1816 -1887)
Blind Men and the Elephant

The use of process mapping in healthcare quality improvement projects

The use of process mapping in healthcare quality improvement projects

Grazia Antonacci[1,2,3], Julie E Reed[1,2], Laura Lennox[1,2] and James Barlow[3]

Abstract
Introduction: Process mapping provides insight into systems and processes in which improvement interventions are introduced and is seen as useful in healthcare quality improvement projects. There is little empirical evidence on the use of process mapping in healthcare practice. This study advances understanding of the benefits and success factors of process mapping within quality improvement projects.
Methods: Eight quality improvement projects were purposively selected from different healthcare settings within the UK's National Health Service. Data were gathered from multiple data-sources, including interviews exploring participants' experience of using process mapping in their projects and perceptions of benefits and challenges related to its use. These were analysed using inductive analysis.
Results: Eight key benefits related to process mapping use were reported by participants (gathering a shared understanding of the reality; identifying improvement opportunities; engaging stakeholders in the project; defining project's objectives; monitoring project progress; learning; increased empathy; simplicity of the method) and five factors related to successful process mapping exercises (simple and appropriate visual representation, information gathered from multiple stakeholders, facilitator's experience and soft skills, basic training, iterative use of process mapping throughout the project).
Conclusions: Findings highlight benefits and versatility of process mapping and provide practical suggestions to improve its use in practice.

Objective

Understand:

1. the main **benefits achieved** by the use of PM in healthcare practice;

2. the main **success factors** of PM within QI projects.

5. Benefits, Success factors and Challenges

Empirical Setting:

QI projects led by Collaboration for Leadership in Applied Health Research and Care Northwest London – NIHR CLAHRC NW London.
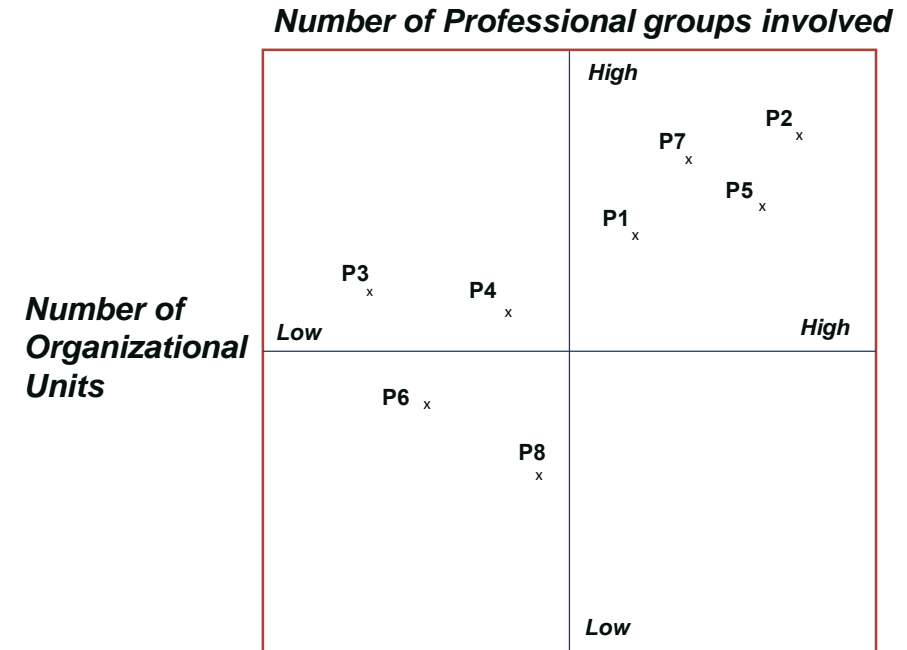
Number of Professional groups involved

High

P2 x

P7 x

P5 x

P1 x

P3 x   P4 x

Low   High

Number of Organizational Units

P6 x

P8 x

Low

5. Benefits, Success factors and Challenges

Results: Benefits of Process Mapping within Quality Improvement projects

a. Break down the complexity and gather a shared understanding of the reality	Better understanding of how the process actually works.
	Shared understanding of reality between the different process stakeholders.
	Break down process complexity.
	Understanding the process and identify the value from the patient's perspective.
b. Identify gaps and improvement opportunities adopting a system perspective	Identification of gaps and improvement opportunities across different organizations and care settings.
	Design of a new process.
	Make a compromise within the team and find shared solutions.
c. Engage stakeholders in the project	Enhance stakeholders' engagement in the project.
d. Identify and align project's objectives and fit intervention to the context	A key starting point for improvement projects allowing the scope, desired objectives and boundaries to be identified.
	Fit the improvement intervention to the specific local context.
e. Identify responsibilities and monitor project progress	Understand who has the ownership of the different parts of the project and identify responsibilities for improvement.
	Keep the emphasis on project progress.
f. Learning	Learning about good practices and "system-thinking".
g. Increased empathy	Increased empathy between professional groups and learn about people.
h. Ease of use and simplicity of the method and of the physical outcome: the process map	Ease of use and simplicity of the method.
	Provides a physical output, a process map, which is highly visual and easily understandable.

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5. Benefits, Success factors and Challenges

Benefits of using Process Mapping in improvement work

Understanding local systems
- gather a greater understanding of reality;
- breakdown complexity of healthcare processes;
- provide a structured visual picture of reality;
- understand interactions between different parts of the system;
- develop a shared understanding of local systems and practices.

Inform scope, design, development and evaluation of interventions
- identify problem areas and opportunities for improvement;
- develop solutions based on evidence and local knowledge;
- support the continuous cycle of improvement (identify objectives, plan and implement actions).

Co-production and knowledge exchange
- motivating those responsible for and affected by change in planning and implementing improvement;
- supporting stakeholders engagement in design and co-creation of change actions;
- facilitating dialogue between diverse stakeholders;
- supporting consensus and agreement toward a shared solution;
- encouraging a culture of ownership and responsibility for improvement work;
- supporting dissemination of information about care processes.

5. Benefits, Success factors and Challenges

Success factors of Process Mapping within Quality Improvement projects

- Information gathered from multiple stakeholders,

- Simple and appropriate visual representation

- Facilitator's experience and soft skills,

- Basic training,

- Iterative use of PM throughout the project.

Challenges of Process Mapping in healthcare

- Difficulty of involving and engaging front-line staff and patients in the process mapping exercise.

- Within process and simulation technique the main challenges are related to:

  - the communication gap between process analysts and other people involved;

  - lack of data to support analysis;

  - limitations related to technical skills which enable team members to interact with process analysts.

Engage stakeholders
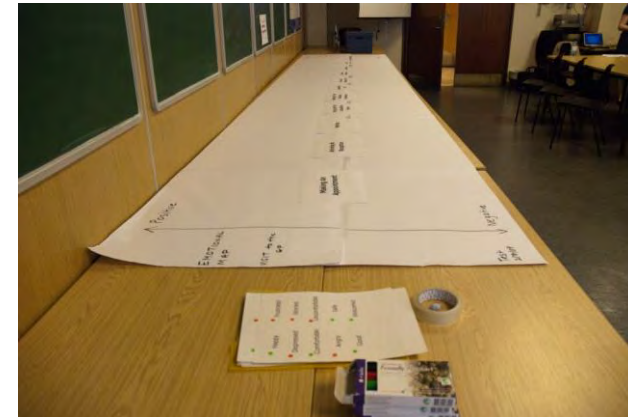
5. Benefits, Success factors and Challenges

Suggestions to improve the use of PM in practice

- Using **guiding principles** when planning and implementing a PM exercise.

- Using **an approach to PM as simple as possible** and near to the needs and language of clinical staff.

- Encouraging analysts and information system designers to develop and adopt **"user-friendly" approaches** when dealing with the healthcare environment (e.g. use of automated approaches based on BPMN).

- Paying **greater attention to patient involvement**.

- Systematic and **iterative use of PM throughout QI projects** to plan the improvement intervention and progressively compare achievements;

- training clinical staff on **QI methods** and its **inclusion in the academic curricula** of healthcare professionals.

References

- Antonacci G, Lennox L, Barlow J, Evans L, Reed J. Process mapping in healthcare: a systematic review. BMC health services research. 2021 Dec;21(1):1-5.

- Antonacci G, Reed JE, Lennox L, Barlow J. The use of process mapping in healthcare quality improvement projects. Health services management research. 2018 May;31(2):74-84.

- NHS Institute for Innovation and Improvement. Improvement leaders' guide. Process mapping, analysis and redesign. General improvement skills. Coventry: NHS Institute for Innovation and Improvement, 2005.

- Jacka JM and Keller PJ. Business process mapping: improving customer satisfaction. Hoboken, NJ: John Wiley & Sons, 2009, p.337.

- Damelio R. The basics of process mapping. 2nd ed.: CRC Press, 2011, p.186.

- Trebble TM, Hansi N, Hydes T, et al. Process mapping the patient journey: an introduction. BMJ 2010; 341: c4078.

- Jackson TL. Mapping clinical value streams. 1st ed. Boca Raton: Routledge, 2013, p.124.

- Bandara W, Gable GG, Rosemann M. Factors and measures of business process modelling: model building through a multiple case study. European Journal of Information Systems. 2005 Dec 1;14(4):347-60.

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