

# A Summary of Techniques for FMEA & FTA

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## 8.1 FMEA & FTA

Two good Techniques to examine possible failures are:

1. FMEA( Failure Mode and Effect Analysis)
2. FTA( Fault Tree Analysis).

# Failure Mode Effects Analysis (FMEA)

## ❑ An FMEA:

- ❑ Identifies the ways in which a product or process can fail (bottom up analysis)
- ❑ Estimates the risk associated with specific causes
- ❑ Prioritizes the actions that should be taken to reduce risk

## ❑ FMEA is a team tool

## ❑ There are two different types of FMEAs:

1. **Design**
2. **Process**

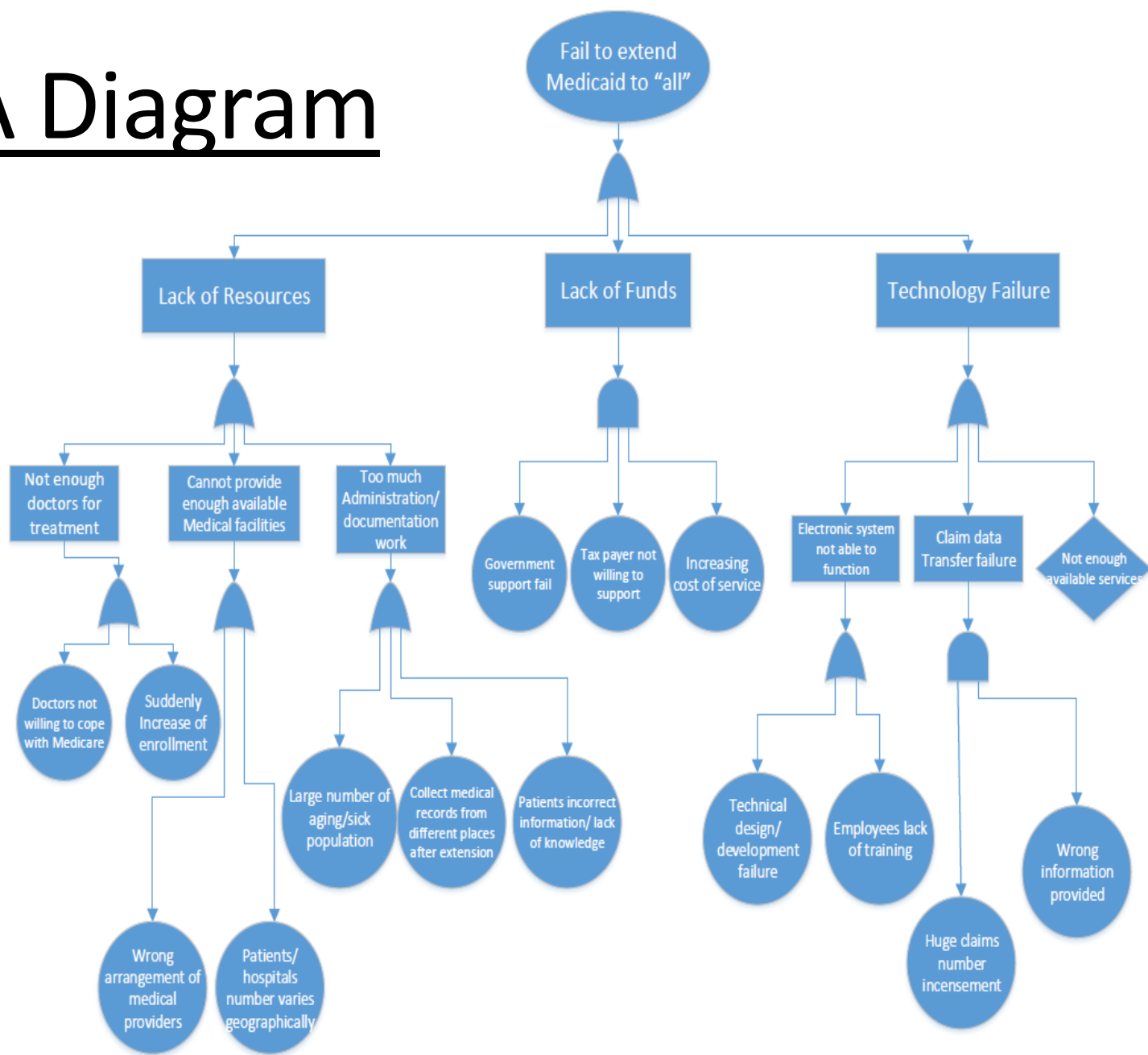
# FMEA

Function	Failure Mode	Effects	Severity	Causes	Occurrence	Detection Action	Ease of detection	Risk Priority Number	Recommended Actions
Medicare	Cannot see Doctor	Long wait time to see doctor	5	Claims Processing Times	5	None	5	125	Training
	Eligibility	No Insurance	9	No/Little insurance opportunities	5	None	5	200	Creation of Additional Healthcare Options
Medicare for All	Not enough Doctors	Long wait times to see doctor	8	Doctors not willing to work with Medicare	5	None	6	200	Expand Medical Network
				Mass enrollment	7	None	7	392	Limit Number of new enrollees, Phased approach
				Large Sick/Aging Population	6	Update Notice	7	336	Expand Medical Network

# Fault Tree Analysis (FTA)

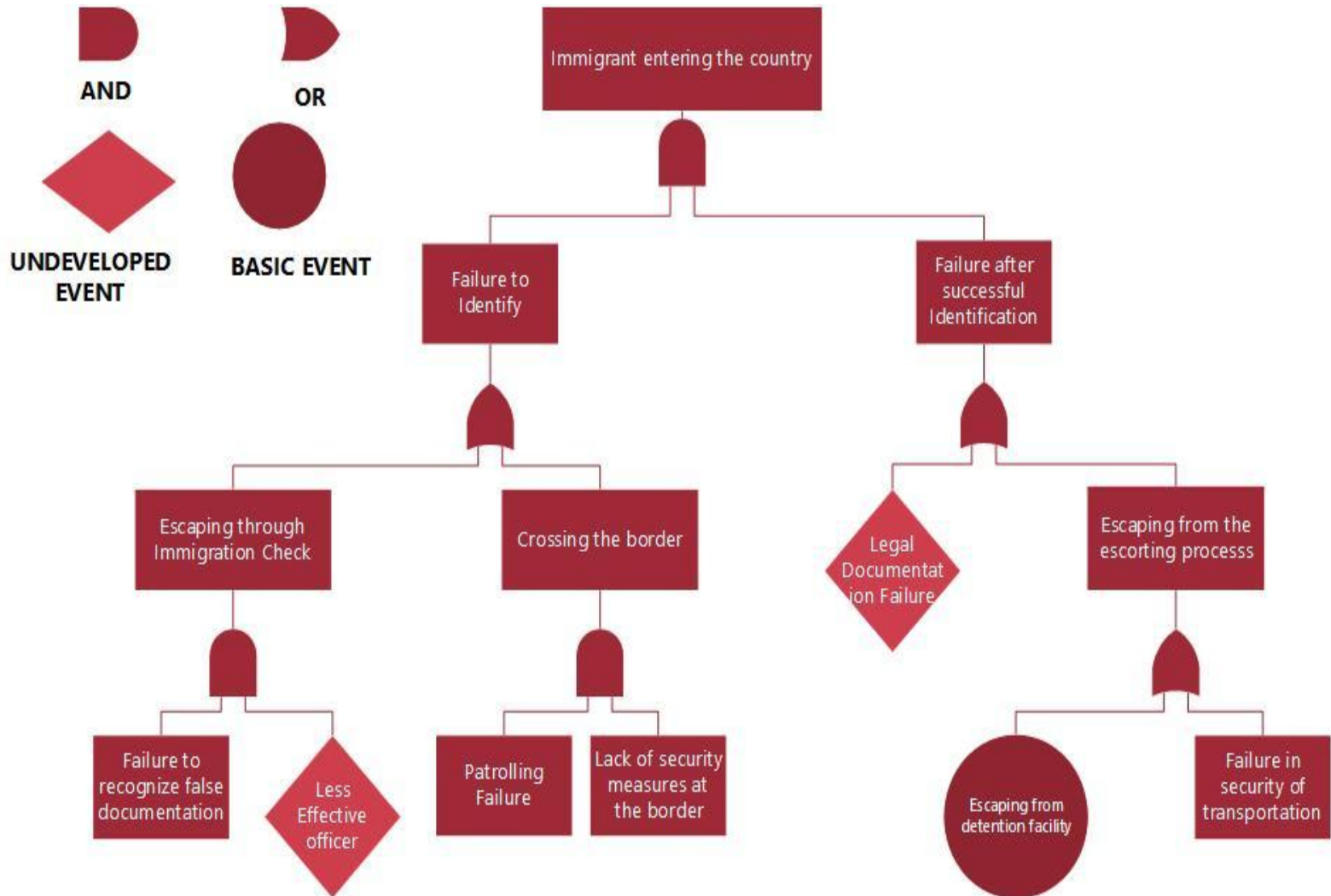
- ❑ A top down failure assessment technique for identifying safety concerns:
  - ❑ Identification of a single failure point and safety concerns
  - ❑ Evaluation of software, non-machine interfaces and design change impacts
  - ❑ Simplification of maintenance and trouble-shooting procedures
  - ❑ Assessment of modification or enhancements

# FTA Diagram



Process Step	Failure Mode	Severity 1-10 10 = most severe	Occurrence 1-10 10 = highest prob. of occurrence	Detection 1-10 10 = lowest prob. of detection	RPN <sup>1</sup>	Improvement Action
1 DHS identifies illegal immigrants	Immigrants Escape	10	2	9	180	Trained officers and Improved checking
2 Prepare Legal Documentation	Incorrect Documentation and Data entry errors	7	3	6	126	Training Employees for Legal documentation
3 Determining Detention of Immigrants	Wrong Determination	9	6	7	162	Identify the legal and political flaws
4 Accommodate Detained Immigrants	Lack of facility	5	8	2	80	Improve accommodation capacity
5 Escorting detainees back to their home country	Lack of resources And political reasons	9	3	5	135	Improving Political ties and arranging better transportation

# Fault Tree Analysis





## **Failure Modes And Effects Analysis (FMEA)**

- FMECA is a step by step approach for identifying all possible failures in a design, manufacturing or assembly process, or product or service.
- FMECA is one of the most important and most widely used tool of reliability analysis.

## Failure Modes And Effects Analysis (FMEA)

FUNCTI ON	FAILUR E MODE	EFFECTS	CAUSES	OCCU RRENC E	SEVERIT Y	DETECT ION	RP N	ACTIONS
ZIKA VIRUS SPREA D CONTR OL	Pregna ncy	Infant death	Body fluids	4	8	6	19 2	Medica= Tion
	Mosqu itos	Rapid Spread	Unhygi enic	7	8	7	39 2	Use repellants
	Travel	Transmi ssion	Travel to affect ed areas	5	7	7	24 5	Avoid affected areas
	Sex	Transmi ssion	Semen	6	5	4	12 0	Use Condoms

# Failure Modes And Effects Analysis (FMEA)

## Criticality Analysis

A relative measure of the consequence.

Difficult to perform for a functional FMEA due to the lack of detailed failure data at this level.

**Failure Mode Criticality Number =  $\alpha \times \text{frequency} \times \text{hours of cycles} \times \beta$**

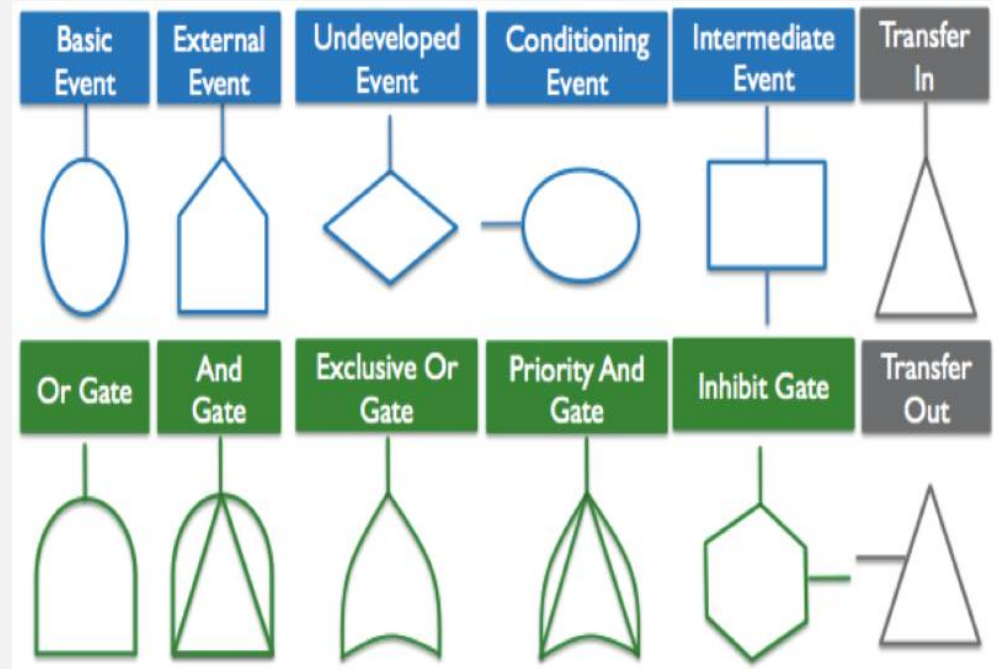
$\alpha$  -the percent of occurrence of each failure mode.

Frequency – the rate of occurrence.

$\beta$  – Probability that the failure effect will occur.

# FAULT TREE ANALYSIS (FTA)

- FTA is a top down failure consequence assessment technique to identify safety concerns
- Will identify the causes of product failures which may then be eliminated
- Updating the FTA to reflect design changes will assess whether previous problems have been eliminated, or new problems have been introduced.



(FTA)

