REDUCING DIAGNOSTIC ERROR IN MEDICINE

THROUGH THE INTEGRATION OF SYSTEMS AND COGNITIVE PROCESSES - SYSCOG

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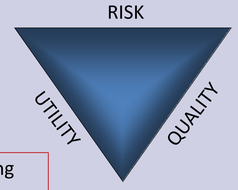

1. Describe how advances in our capacity to diagnose, when combined with more effective therapy has led to greater frequency and significance of diagnostic error. **2.** Explain how introducing Failure Mode and Effect Analysis as an organizing imperative allows for integrating systems and cognitive level processes. **3.** Discuss how the resulting schema can be used to generate a comprehensive taxonomy for Diagnostic Errors in Medicine.

SITUATION

Accelerating improvements in healthcare have created a paradox of increased capability offset by increased complexity, societal and technological. This has impacted latent organizational **system** problems under which the clinician's diagnostic **cognition** delivers health care. Present taxonomy of diagnostic error addresses systems and cognition separately leading to an inherent weakness in identification, classification, and prevention of errors. The result; a body of work lacking a unified architecture that hinders the **REDUCTION OF DIAGNOSTIC ERROR IN MEDICINE**.

PROBLEM

How can we integrate two seemingly dichotomous fields to:

RISK	*Maximize patient safety* with correct and timely diagnoses, accurately communicated and acted upon
QUALITY	*Minimize* discomfort and the pain *suffered* due to wrong, delayed, or miscommunicated diagnoses
UTILITY	*Minimize expenditure* of scarce resources through improved cost effective diagnostic processes

SOLUTION

A modified form of **Failure Mode and Effect Analysis** [**mFMEA**] was used to assemble systems and cognitive components into an integrated whole for ease of classification, investigation and resolution. The result? A more unified taxonomy that provides the means to:

➡ **Prospectively** Identify and avoid errors before they occur
➡ **Concurrently** monitor for diagnostic errors to mitigate effects
➡ **Retrospectively** investigate and patch [system + cognitive] error

IMPLEMENTATION

An analysis of the literature provides a means of standardizing terminology and so, the means of developing a generalized schema by which system logic and cognitive processes [**SYSCOG**] can be integrated. And this provides a means for proposing a method of classifying both areas under the **mFMEA** headings.

The result, a more comprehensive taxonomy under which all **Diagnostic Errors in Medicine** can be classified and therefore effectively identified, monitored for, investigated, and solved.

FMEA/SYSCOG ACTIVITY CROSS WALK [ABBREVIATED]

mFMEA	DESCRIPTION	COGNITIVE COMPONENT
SYSTEM [Logic]	Input - Signals/Work Flow/Branch **Logic**/Output - Signals	**System Design** & Implementation **Response**: Decision/Action
COMPONENTS [Tools]	**Physical Environment**: Plant, Equipment, Devices, and Supplies	Design, Manufacture, Application, and **Use of Tools**
PROCESSES [Procedures]	Ordered **Sets of Tasks** Designed to Achieve Specified Outcomes	**Processing** Signals to Symbols to Information to Knowledge
SERVICE [People]	Orientation/Priming/Training/ Education/Experience/Judgment	**Competency** [do it right] and **Proficiency** [do it efficiently]

FMEA/SYSCOG GAP ANALYSIS IDENTIFIES CULTURE AS AN ISSUE

PECEPTION: Capacity of a person or persons to sense [**Receive and Perceive**] a stream of signals of a particular type/density/complexity/clarity [**Signal/Noise**]/amplitude/duration, so that they can be processed by the mind within a specified amount of time under prevailing conditions [**The Culture - System**].

COGNITIVE PROCESSING: [**Signal ➡ Symbol ➡ Information ➡ Knowledge**]: Capacity of a person or persons to **translate** a stream of **sensed signals** within a specified amount of time under prevailing conditions [**The Culture - System**] into symbols for immediate **pattern recognition/reflex-action** skills [**Fast – Intrinsic Form**], into information that can be interpreted through application of **rules** via internal recall or external retrieval [**Intermediate - Heuristic**], and associated through application of **knowledge** via internal recall or external consultation [**Slow – Extrinsic Meaning**].

RESPONSE: DECISION MAKING: Capacity of a person or persons to **make** one or more available **choices** based on their state of understanding using the results of cognitive processing [**Competency**], in a timely manner [**Proficiency**], under prevailing conditions [**The Culture - System**].

RESPONSE: ACTION TAKING: Capacity of a person or persons to **initiate** one or more **actions** appropriate to one or more decision(s) [**Competency**], in a timely manner [**Proficiency**], under prevailing conditions [**The Culture - System**], using the correct physical plant, equipment, and supplies [**The Tools**].

COMPETANCY: Capacity for a person or persons to **complete** one or more decision(s) or task(s) [**The Process**] correctly, in the correct order, in a timely manner [**Proficiency**], under prevailing conditions [**The Culture - System**], using the correct physical plant, equipment, and supplies [**The Tools**].

THIS BRINGS TOGETHER ALL FOUR FMEA HEADINGS!

TOOL DESIGN: Capacity for a person or persons to **design**, and/or **assemble**, and/or **deploy** correct [**Competency**] physical plant, equipment, and supplies [**The Tools**], to support the execution of one or more tasks [**The Process**], in a timely manner [**Proficiency**], under prevailing conditions [**The Culture - System**].

SYSTEMS DESIGN: Capacity for a person or persons to **design** and/or **implement** an activity to effectively [**Competency**] receive, translate, and process input to achieve specified [**Cultural**] output based on a set of predefined **logic** that is driven by skills, rules, and knowledge attained through **Cognitive Progression** of **Orientation, Priming, Training, Education, and Experience** in executing the **processes** using the appropriate **tools** to drive **the system**.

COGNITIVE PROGRESSION TO DIAGNOSTIC ACUMEN

STAGE	CHARACTERISTIC	DESCRIPTION
ORIENTATION	Enculturation	Imprinting of societal and organizational cultural imperatives
PRIMING	Signal Processing	Developing library of pattern recognition associated with outcomes
TRAINING	Proficiency	Memorizing, recalling, and applying simple rules - Heuristics
EDUCATION	Knowledge	Learning, recalling, applying associations/solving complex problems
EXPERIENCE	Competency	Learning from outcomes of decisions and actions
JUDGMENT	Reliability	Learning to make better decisions under uncertain conditions
WISDOM	Insight	Learning to avoid getting into situations where there is no good decision

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COST BENEFIT ANALYSIS

The **SYSCOG** taxonomy requires that each organization and its diagnostic processes be mapped to the schema shown so as to identify where the most **likely** and/or **significant** errors in diagnosis may occur as well as to document where they actually do occur for prioritization, investigation and resolution. This is a prodigious undertaking requiring experienced personnel, much time, significant organizational backing, and adequate funding.

However, I believe that, in the long run, this effort will pay remarkable dividends in **REDUCING DIAGNOSTIC ERROR**

SCOPE OF THE PROJECT

CATEGORY	TIMELINESS	DESCRIPTION
AVOID	Prospective	**Systems redesign** – Change the system before it breaks or abandon activity
PREVENT	Prospective	**Cognitive redesign** – Change people before they err or replace them
MITIGATE	Concurrent	**Monitor key steps** to reduce impact of errors that cannot be prevented
RESOLVE	Retrospective	**Find** systems and/or cognitive based **causes** of error and patch them

EXAMPLE IN BRIEF [very brief]

THE [CULTURE ➡ SYSTEM ➡ COGNITION] COMPLEX

Societal imperatives will, in part, determine medical school educational **system design** leading to follow on **cognitive behavior** which may positively or negatively impact **Diagnostic Error**. For example, teaching from individual diagnoses back to presenting signs and symptoms defined in highly specialized medical terms [**hindsight**] does not prepare the student for a cluster of ill defined signs and symptoms communicated in the poorly defined language of the afflicted patient [**foresight**].

CONCLUSION

The establishment of an integrated systems – cognitive schema [**SYSCOG**] to provide a framework for the classification of diagnostic errors utilizing modified **FMEA** headings provides a means of establishing a comprehensive taxonomy. This provides a means to redesign systems and improve cognition through evaluation of healthcare organizations for systemic error risk and individual clinicians for cognitive error risk so as to:

REDUCE DIAGNOSTIC ERROR IN MEDICINE

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