Lucian Leape, "Error in Medicine"

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November 20, 2015

Leape, Lucian L., "Error in Medicine." *JAMA* 272(23):1851-57. 1994.

- Florence Nightingale's principle: "first, do no harm"
- evidence suggests that a substantial number of patients suffer injuries from treatment in hospitals
- most iatrogenic events are due to errors and are preventable
- most errors do not result in patient injury
- the high error percentage is partially due to the complexity of medical practice but is still problematic

Why is the error rate in the practice of medicine so high?

- generally medical staff are very careful
- it is possible that they don't understand the magnitude of the problem
  - events are very dispersed
  - serious injuries appear as isolated events or outliers
  - most errors do no harm
- medical staff have difficulty in dealing with human error for cultural reasons
- socialized to strive for error-free practice
- need to be infallible creates intellectual dishonesty
- errors are rarely admitted or discussed
- physicians feel that admission of errors would have adverse consequences
- even if physicians learn from their errors, learning happens in a vacuum
- threat of malpractice litigation

The medical approach to error prevention

- perfectibility model: with proper training and motivation, there would be no mistakes
- training + punishment
- punishment: social opprobrium or peer disapproval
- errors are regarded as someone's fault, but they are actually systemic problems
- approach to error is reactive and often attempts to prevent the same individual from making a repeat an error rather than exploring the underlying causes

A theory of cognition

- most errors result from aberrations in mental functioning
- schematic control mode: mental functioning is automatic, rapid, and effortless
- attentional control mode: cognitive activities are conscious and controlled
- three levels of human performance:
  - skill-based: governed by stored patterns of preprogrammed instruction (schemata), largely unconscious
  - rule-based: governed by stored rules
  - knowledge-based or synthetic: conscious analytic processing and stored knowledge used in new situations
- departures from routine require rule-based or knowledge-based solutions
- humans prefer pattern recognition so they search for rules before resorting to knowledge-based functioning

Mechanisms of cognitive errors

- slips: skill-based errors
- mistakes: rule-based and knowledge-based errors
- slips occur in automatic skill-based activity because of monitoring failures
- types of slips: capture, description error, associative activation, loss of activation

- internal (busyness, boredom, frustration, fear, etc.) and external (noise, heat, visual stimuli, etc.) can lead to slips because they divert attention
- rule-based mistakes occur usually when the wrong rule is chosen because of a misperception
- knowledge-based mistakes occur because of lack of knowledge or misinterpretation of the problem
- pattern matching is preferred to calculation but sometimes we match the wrong pattern
- some common processes: biased memory, availability heuristic, confirmation bias
- stress can lead to mistakes: coning of attention under stress, reversion under stress

Latent errors

- latent errors have delayed effects, "accidents waiting to happen"
- proximal cause of an accident might be operator error but the root cause is in the system
- latent errors can produce psychological precursors: pathologic situations that create working conditions that predispose to errors
- successfulaccident prevention must focus on root causes

Prevention of accidents

- multiplicity of mechanisms and causes of errors means that there cannot be a simple or universal means of reducing errors
- need to pay attention at all stages: design, construction, maintenance, resource allocation, training, development of operational procedures
- primary objective of system design for safety: make it difficult for individuals to err
  - system should automatically correct errors
  - mechanisms should be in place to detect errors in time for corrective action
- design work environment to minimize psychological precursors
- provide feedback through instruments that provide monitoring functions

- build in buffers and redundancy
- design features to minimize errors:
  - simplification
  - constraints
  - standardization
  - operations reversible or difficult to perform when not reversible
- training should include consideration of safety issues

The aviation model

- similarities between aviation and medicine:
  - carefully selected and highly trained professionals
  - want to maintain externally and internally imposed high standards
  - high technology equipment
  - exercise high level of cognitive skills in complex domain with some unknown factors
- differences between aviation and medicine:
  - substantial measure of uncertainty in medicine
  - number and variety of disease states
  - unpredictability of the human organism
- system design: assume errors and failures inevitable, so design systems to absorb them
- standardized procedures to maximum extent possible
- institutionalized safety with anonymous reporting of errors

The medical model

- accident prevention has not been primary focus
- activities focused on incidents and individuals
- when errors are examined cause of the error is identified and corrected
- root causes, underlying system failures, are rarely sought
- system designers do not assume that errors and failures are inevitable and design systems that prevent or absorb them

- standardization and task design vary widely
- great emphasis on education and training but the idea of periodically testing performance is not accepted
- safety in medicine has not be institutionalized

Systems changes to reduce hospital injuries

- discovery of errors
  - efficient routine identification of errors
  - data collection and investigation
- prevention of errors
  - reduced reliance on memory
  - improved information access
  - error proofing
  - standardization
  - training
- absorption of errors
  - computer programs for error detection
  - duplication of critical systems
- psychological precursors
  - work schedules
  - division of responsibilities
  - task descriptions

Institutionalization of safety

- national hospital safety board to investigate every accident is neither practical nor necessary
- such activities should occur at the hospital level
- risk management activities could be broadened to include all potentially injurious errors and deepened to seek out underlying system failures
- provision of immunity/anonymity

Implementing system changes

- principles fit well in total quality management
- statistical quality control requires data regarding variation in processes
- errors and deviations are opportunities to improve the system
- grassroots participation to identify and develop system modifications to eliminate underlying failures
- commitment of leadership
- most important change is cultural: accept notion that errors are inevitable and are evidence of system flaws not character flaws