Medication Errors: A Human and Systemic Review

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Conflict of Interest Disclosure

- I have no conflicts of interest with any ineligible companies to disclose.

Learning Objectives

- Examine how human errors can occur, even in the best situations.
- Analyze system processes that can enable errors.
- Evaluate methods to translate errors into a systemic review of a process.
- Assess how treating human and systemic errors can influence workplace cultures.

Why Medication Errors Matter.

Medication Administration Error Rates[1]

- 44,000 – 98,000 hospital death annually
- Responsible for 5% - 41.3% of all hospital admissions
- Also, for 22% of all readmissions after discharge

Costs of Adverse Events[1]

- $37.6 - $50 billion of added care and disability

Patient-Related Errors[1]

- Errors made by patients/caregivers between 2% - 33%
- 28% of patients were not given sufficient information

Where Do Medication Errors Happen?[1]

Types of Errors

Human

System

Images AI generated by Stephanie Thewlis, 2026, ChatGPT

Types And Causes of Human Error

Cognitive Load

- High workloads, long shifts, and multitasking can lead to fatigue and lapses in judgement, attention, and memory.[2]

Interruptions and Distractions

- There is a 12.7% increased risk of a medication error per interruption. This is compounded when interrupted 4-6 times, which also increases the risk of a harmful medication error.[2]

Types and Causes of Human Error

Communication Breakdown

- Misinterpretation or unclear instructions, particularly verbal or written, can promote errors. Colloquial language or abbreviations can lead to misunderstandings.[1]

At Risk/Reckless Behavior

- Behavioral choices due to a loss of perception of risk; failure to follow safety procedures. Reckless behavior is a conscious disregard of risk; diversion, retaliatory breaches of confidentiality, working under the influence.

Types And Causes of Human Error

Time Pressures

- Staffing shortages and a rush to complete work can create shortcuts that may bypass important steps, processes, or alerts.[2]

Personal Stressors

- Sickness, exhaustion, home issues that are hard to leave behind at work can cause focus to shift on themselves, rather than the task at hand.[2]

Physical & Environmental Distractions

- Fluctuating climate, lighting, and ergonomic dysfunctions can also pull focus from tasks to attempt to fix or mitigate the environment.[2]

Human Error Probabilities[2]

Task	Probability of Error
Unfamiliar task performed at speed/no idea of consequences	50%
Task involving high stress levels	30%
Complex task requiring high comprehension or skill	15%
Ambiguously labeled product	5%
Failure to perform a check correctly	5%
Error in routine operation when care is required	1%
Well designed, familiar task under ideal conditions	0.04%

Cognitive Biases and Heuristics[3]

Biases

- Unconscious and systemic errors in thinking when processing and interpreting data within surroundings.

Heuristic

- A mental shortcut that allows a person to make decisions quickly with minimal cognitive effort

Leads to Incorrect Information

- This results in distorted perception of reality and inaccurate interpretation and rational decision-making.

Frequency of Occurrence

- Some biases occur more frequently than others; sometimes dependent on the individual

Potential Biases and Heuristics[2]

Implicit Bias

- Involuntary attitudes or stereotypes we hold toward other people

Confirmation Bias

- Favoring information that aligns with current beliefs

Outcome Bias

- Response to the error is based on the results, instead of the actions leading up to the error.

Affect Heuristic

- When actions are swayed by emotional reactions instead of rational reasoning.

Potential Biases and Heuristics, cont.[2]

Framing Effect

- Drawing different conclusions dependent on how the information is presented.

Authority Bias

- Believing the opinion of someone with greater authority than yourself

Decision Fatigue

- Quality of our choices declines as our cognition begins to wear itself down and can lead to choice overload.

Just-World Hypothesis

- Believing that the world in inherently good, so bad things are believed to be deserved to the person who made the mistake.

Scenario:

A 62-year-old is driving a vehicle without a seatbelt on the interstate at 70mph. The driver loses consciousness, causing the vehicle to veer into a secondary lane, hitting another vehicle driven by a 39-year-old. Both drivers sustain major injuries. The 62-year-old was found to have had a myocardial infarction while driving and was also treated for the heart blockage.

Afterwards, the 39-year-old's lawyer pushes charges for aggravated reckless driving, and questions why the seatbelt was not fastened. The 62-year-old later reveals that the seatbelt was always uncomfortable and has been driving this way for decades. They attest the reckless driving was due to a medical emergency and had lost control after losing consciousness.

Regardless of fault, what bias is present?

A. Implicit

B. Authority

C. Outcome

D. Decision Fatigue

Regardless of fault, what bias is present?

Automaticity/Implicit Processes

Habitual and/or Repetitive Tasks

- A person's ability to complete habitual and/or repetitive tasks without the mind occupying a higher level of cognition.

Shifting into Automatic Pilot

- This allows a person to shift focus between multiple tasks or thoughts. While this is efficient for your cognition, a lower cognition may allow errors to seep through. .

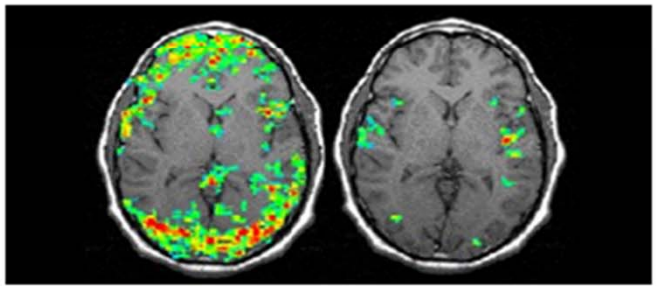
Automaticity is characterized by its lack of:

- Awareness
- Intention
- Control

Automaticity/Implicit Processes

Skill Acquisition and Automaticity

- fMRI differences with transition from skill acquisition to automatic pilot
- Load on working memory reduced by 90%



Schneider W. Automaticity in complex cognition. Center for Cognitive Brain Imaging at Carnegie Mellon University; 2003.

Inattentional/Selective Blindness[6]

A person's failure to perceive unexpected things during a task or situation.

This can cause a person to become temporarily blinded to any unexpected intrusions.

This can be due to cognitive load, a failure in memory, or lack of expectations.

All individuals react differently; the ability to switch focus efficiently might be more likely to notice unexpected objects.

Inattentional/Selective Blindness[7]

The Invisible Gorilla Experiment

- An experiment where participants were shown a video of two teams, one in white and one in black, passing a ball to each other.
- The question is asked as to how many passes done by the team in the white shirt.
- Then, afterwards, they ask another question: Did you see the gorilla?
- Nearly 50% of participants did not.

The Grand Illusion

A perception we hold that the brain creates a seamless, detailed, and stable conscious experience of the world

Our brain receives limited, fragmented, and constantly shift sensory input.

Our brain constructs this illusion by filling in and predicting information based on past experiences

It will only fill in minute details when we focus purely on the subject.

What I if told you

You the read first line wrong

Same the with second

And also the third.

How do We Tackle Human Errors

- Lessen Cognitive Load
- Independent Double Check
- Reducing interruptions
- Training
- Communication
- Knowledge

However, There is Still a Problem

Focusing on the person

- This leads to the potential of more procedures, naming, blaming, shaming, disciplinary actions, or threats of litigation

Perpetuating a Culture of Fear

- Because of potential threats to their job, title, license, and litigation, people will not come forward with mistakes.

Isolating the error from a systemic context

- The above does not fix the error; it simply lies in wait, until another person makes the same error again.

Blaming individuals is emotionally more satisfying than targeting an institution.

Error Management

Change the Target

- We cannot change the human condition; we CAN change the conditions under which people work.

Change the Focus

- Look at the workflow, the team, task, the workplace, even the institution.

Change the Process

- Looking at surrounding and processes can help find the error traps, and change it, so we can find a way to ensure the trap is never tripped.

Types and Causes of Systemic Issues

Staffing levels

- Low staffing levels push people to multitask, increasing cognitive load.

Disconnected Systems/Data Latency

- Systems that fail to talk well, or delays in data transmission can cause delays in patient care or attempts to supersede established processes.

Electronic/Automation Downtimes

- Reverting to manual orders via paper or phone can lead to transcription errors and can encourage the use of shortcuts to maintain patient care.

High-Risk Medications

- Inherent risk of these mediations means that errors can slip by if mishandled.

Types and Causes of Systemic Issues

Poor or Excessive Alerts

- Ill-timed alerts can perpetuate alert fatigue.

Invisible Decision Making

- Lack of transparency during process changes leads to confusion, and potentially lead people to ignore these changes

Accessibility and Cost

- For patients, the lack of care and treatment due to cost, insurance, or implicit bias, failure to accommodate accessibility can push patients away from seeking out care and increasing morbidity and pushing further strain on healthcare systems.

How Do We Tackle Systemic Issues?

Standardization

- Processes and procedures, formularies, order sets and/or panels, rates of infusion.

Appropriate Staffing and Training

- Alleviate multitasking, help is available when needed,

Technology

- Barcode scanning, ADCs, EMRs, Smart pumps, adding redundancies in case of failures.

How Do We Tackle Systemic Issues?

System Design

- Avoidance of LASA stocking, cohesive, intuitive design and processes.

Limiting or Restricting Access

- Remove or limit high-risk medications from easy use; i.e., paralytics, chemotherapy, anticoagulants, high concentration opioids.

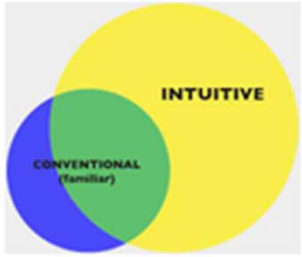
Trust Your Gut!

Where Human and System Errors Cross Paths

System Design Strategies

Use affordances

— Human-centered design



System Function	Control Movement
On	Up, right, forward, pull
Off	Down, left, rearward, push
Right	Clockwise, left
Left	Counterclockwise, left
Up	Up, rearward
Down	Down, forward
Increase	Up, right, forward, clockwise
Decrease	Down, left, rearward, counterclockwise

Scenario: System Design

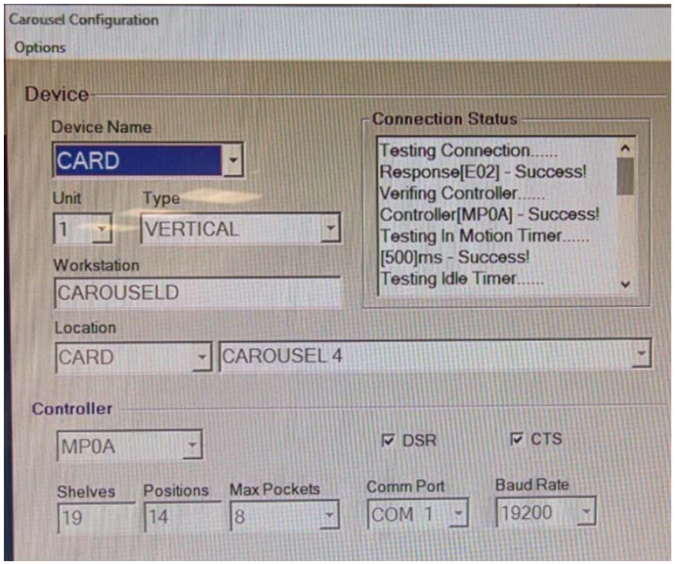


Image by Stephanie Thewlis, 2026, St Francis Medical Center

You come across this dialog box by accident, and you are trying to close it. If the red “x” is not seen on this dialog box, where would you find the “Close” button?

A. Top Right Corner
B. Bottom Right Corner
C. Bottom Left Corner
D. Middle Right Side

Just Safety Culture

Recognize and Recover

- The expectation is that human error WILL occur, but training people to recognize and recover from them

Encourage Reporting

- Allow people to report errors without fear of punitive actions against them.

Visibility

- Make the errors visible, without including the people involved, so everyone can learn.

Just Safety Culture

Research and Change

- Look into why the error happened; can a process or procedure be changed to reduce or eliminate the error from happening again?

Promote Prevention and Proactive Approach

- Create a robust system in the face of the potential of errors

Create Resilience

- No one is immune, but we can be capable of converting errors into enhanced resilience within ourselves and in our organizations.

Discussion:
The Chernobyl Disaster – April 26th, 1986[5]

Government Power

- The Soviet government pushed construction and completion of the plant as fast as possible, creating illogical timelines, shortages, and structural issues.

RBMK Reactors

- The government was aware that the RBMK reactors used in the Chernobyl Plant were faulty. Other plant within the USSR has meltdowns, including Chernobyl itself. Since they were contained and didn't cause significant damage, the knowledge was never released to the public, and manuals and safety procedures were amended to account for the faults.

Discussion:
The Chernobyl Disaster – April 26th, 1986[5]

The Human Error

- The power plant was undergoing testing to ensure the plant could operate under blackout conditions. Anatoly Dyatlov, Deputy Chief Engineer, pushed the workers to lower the power than required, despite warnings from the engineers. Even though it seemed the reactor was working as intended, it had instead started a chain reaction that when Dyatlov then ordered a full shutdown, Reactor 4 catastrophically exploded.

Soviet Investigation

- Dyatlov, along with Viktor Bryukhanov; Plant Manager, and Nikolai Fomin; Chief Engineer were charged with ten years in labor camps for failure to follow safety procedures. Dyatlov testified that the operation and safety manuals were hard to follow and were contradictory.

Discussion:
The Chernobyl Disaster – April 26th, 1986

What type of human and system errors do you find?

What could have prevented the disaster?

Should the plant operators have been punished?

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