The Patient Safety Education Program™
CANADA

Module 1: Systems Thinking:
Moving Beyond Blame to Safety

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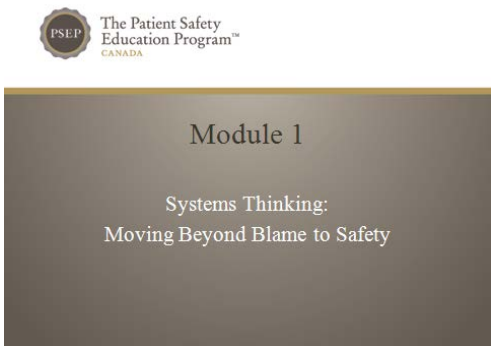
PSEP – Canada Objectives	Related CPSI Safety Competencies
The knowledge elements include an understanding of: • Why we blame • Systems thinking • The relationship between systems thinking, blame and accountability • Why system approaches to safety are superior to traditional approaches to safety in healthcare • The definition of a safety program The performance elements include the ability to: • Describe the elements of a healthcare delivery system • Explain how system elements interact to impact safety	**Domain: Contribute to a Culture of Patient Safety** *2. Health care professionals who are able to describe the fundamental elements of patient safety, understand:* 2.1. Core theories and terminology of patient safety and the epidemiology of unsafe practices 2.2. The characteristics and capacities of organizations with respect to patient safety, namely: 2.2.1. A commitment to patient safety as a major organizational or institutional goal demonstrated at the most senior levels 2.2.2. The establishment and maintenance of a just culture 2.2.3. The implementation of patient safety best practices 2.2.4. The conduct of adverse event and incident (e.g., close call) analysis 2.2.5. The involvement of patients and their families as key players in patient safety 2.2.6. The provision of an environment of support and safety for health care professionals 2.3. The use of evaluative strategies to promote safety 2.4. The risks posed by personal and professional limitations 2.5. Principles, practices and processes that have been demonstrated to promote patient safety 2.6. The nature of systems and latent failures in the trajectory of adverse events 2.7. The emotional impact of adverse events on patients, families and health care professionals 2.8. Methods by which health care professionals can advocate for patient and health care system safety 2.9. The elements of a just culture for patient safety, and the role of professional and organizational accountabilities 2.10. The concept that health care is a complex adaptive system with many vulnerabilities, (e.g., space or workplace design, staffing, technology) *4. Health care professionals who demonstrate a questioning attitude as a fundamental aspect of safe professional practice and patient care:*

	4.1. Recognize that continuous improvement in patient care may require them to challenge existing methods 4.2. Identify existing procedures or policies that may be unsafe or are inconsistent with best practices and take action to address those concerns 4.3. Re-examine simplistic explanations for adverse events to facilitate optimal changes to care **Domain: Manage Safety Risks** *3. Health care professionals who anticipate, identify and manage high-risk situations:* 3.1. Recognize health care settings that may lead to high-risk situations

Abstract

Slide 1



An individual (e.g. physician, nurse, pharmacist, physiotherapist, occupational therapist, respiratory therapist, social worker) working in a hospital can do their best in treating and caring for their patients, but that alone will not be enough to provide a safe and quality service. This is because patients depend on many people doing the right thing at the right time for them; in other words, they depend on a system of care. Quality healthcare requires that the people caring for the patient understand the complexity of healthcare delivery systems. Healthcare organizations such as hospitals are made up of many interacting parts comprising individuals (health professionals, administration and management staff, patients and family members) infrastructure (policies, procedures, protocols, administration, governance arrangements) and technology (drugs, equipment, diagnostics). These components make up the healthcare system. The various ways these components interact with one another and how they collectively act is highly complex and variable.

Understanding the system of healthcare is as important as understanding the tasks one is required to perform at work. Understanding the nature of complexity in healthcare is essential if we are to design processes that minimize patient safety incidents. This module provides a basic understanding of complex organizations using a systems approach. It also describes lessons from other industries and examines the characteristics of high reliability organizations. When we think in systems we are better able to understand why things break down and have a context for thinking about solutions.

Keywords

Systems thinking, complexity, workplace structures, processes, high reliability organizations, adverse events, patient safety incidents, active failures, latent conditions, errors, just culture.

Teaching methods

Interactive lecture, trigger tape guided case-based teaching

Objectives

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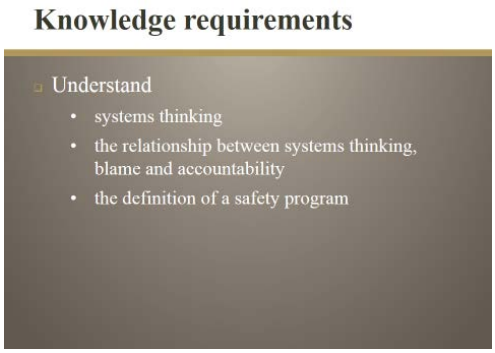

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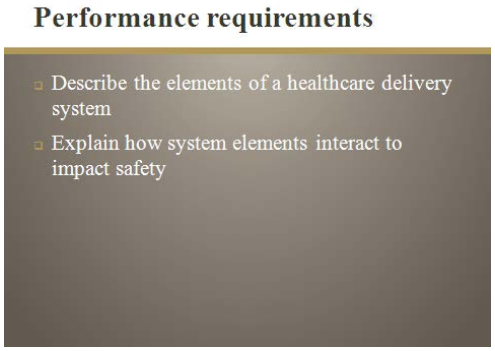

The overarching learning objective of this module is to be able to explain systems thinking and system engineering approaches to patient safety.

Knowledge requirements

The knowledge elements include an understanding of:

- systems thinking;
- the relationship between systems thinking, blame and accountability; and
- the definition of a safety program.

Performance requirements

The performance elements include the ability to:

- describe the elements of a healthcare delivery system, and
- explain how system elements interact to impact safety.

Clinical case on trigger tape

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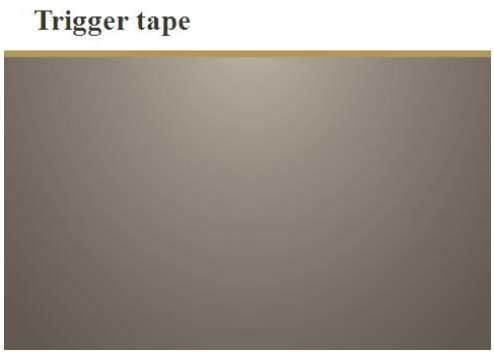

A physician is on the phone with a recently discharged patient. The patient has confused the names of her medications and accidentally taken the wrong dose of a medication. Following the phone call, the physician and her colleague discuss systemic problems with medication instructions at patient discharge and how the system could be improved.

What is systems thinking?

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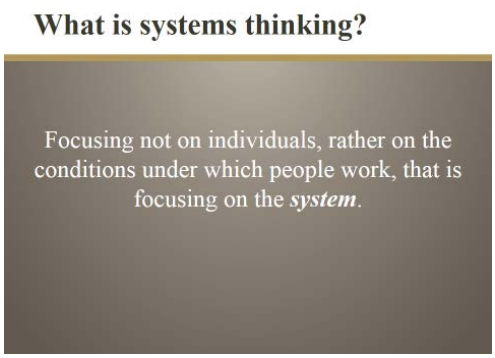

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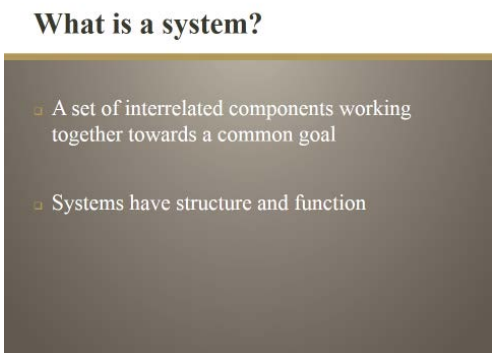

In general, a system is defined as a set of interrelated components working together towards a common goal. A system has a defined structure and function. Healthcare professionals routinely apply systems thinking to organic systems. Organic systems have much to say about systems generally. Whether the organism is a single cell, complex organism or whole population, it exists in a state of continuous exchange of information with the environment, characterized by inputs, internal transformation output, and feedback. There is a continuous interaction and mutual dependence between the environment and the internal functioning of the system. It is not difficult to apply these same principles to healthcare.

A systems thinking approach is different than the traditional person-focused approach of healthcare safety. In person-focused organizations, individuals are blamed for a lack of safety and interventions to improve safety are targeted at improving the blamed individuals by imploring them to be more careful or sending them to more training. In contrast, a system-focused approach to safety starts by guarding against all of the biases that make us leap to blame. The focus is not on individuals, but on the conditions under which people work, that is, the system. Interventions to improve safety focus on redesigning the system to make it both more difficult to err in the first place and to make those patient safety incidents that do happen easily identifiable so that their effects can be quickly mitigated.

By using a systems approach, we then begin to appreciate that most patient safety incidents and safety problems are the result of the many interactions among processes and workflows, technology designs, teamwork, staff, patients, financial restraints, training and education that occur within the healthcare system. An example of not using system thinking would be telling a medical resident that they must attend all their educational sessions even if they are the only one working on a unit at the time of the education session; this is not a systems approach because the training program has not been designed taking into account other competing demands on the resident's time, such as their need to be available to patients. In a person-focused tradition, the resident's non-attendance at the educational session is seen as a failure of the physician. A systems approach would include reviewing the overall role of residents in the team and in the hospital and then a training program would be designed taking into account the availability of other physicians and the timing of the educational sessions in relation to busy times on the unit. Maintaining a person-focused approach also stimulates a belief that it is impossible to fix problems such as low attendance. A systems approach takes into account the complexity of all the activities and seeks to understand what works and what doesn't work.

Why care about systems thinking?

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Systems in healthcare are highly complex and are "characterized by multiple actors, multiple choices, multiple hand-offs…no ownership, no natural team and no one with hospital-wide authority to make changes and insure quality" (Leape 1997).

Some examples of systems in healthcare include:

- operating rooms;
- medication delivery systems;
- patient care units;
- nursing homes; and
- neurosurgery clinics.

Consequently, the design of the healthcare system has a far reaching impact. System design can affect:

- patient safety incidents and risks;
- quality improvement;
- performance (including economic);
- satisfaction and comfort; and
- health.

Most importantly, the design of a system will affect the quality of care provided. As will be explained, the way the components of a system interact, determines all of these different outcomes.

The National Academy of Medicine (NAM), formerly the Institute of Medicine (IOM) has repeatedly emphasized a systems thinking approach to healthcare in their publications. Some examples are given below:

- "systems view of errors and error prevention is based on research findings from a variety of fields…This research has revealed that errors typically result from problems within the system in which people work – not from poor individual worker performance – and typically originate in multiple areas within and external to an organization." (IOM, 2004)

- "The goal of a learning healthcare system is to deliver the best care every time, and to learn and improve with each care experience. This goal is attainable only through system-wide changes…." (IOM, 2011)

In addition, the Royal College of Physicians and Surgeons of Canada (RCPSC) emphasizes systems thinking in the seminal 2002 publication *Building a Safer System - A National Integrated Strategy for Improving Patient Safety in Canadian Health Care* stating:

- "The [Canadian healthcare] system is complex, dynamic and characterized by many competing pressures, particularly the relationship between funding and quality of care. An unprecedented level of collaboration across all sectors must occur to ensure a co-ordinated and effective strategy for improving patient safety."
- "Systemic identification should be carried out reactively, in response to a recognized adverse event or outcome, and more importantly, proactively, before problems have occurred. This identification must be followed by reporting and recording of these hazards (and any associated adverse events and near misses) to a network of databases."

The importance of applying systems thinking for improving patient safety is well understood, and the module will now focus on further defining healthcare systems, how they function, and their implications for safety.

Healthcare delivery is a complex system

Slide 8

A first step in designing better healthcare delivery systems is to understand the complexity of our own environment and its unique features. Healthcare is complex for a myriad of reasons including:

- the diversity of patients, families, clinicians and other staff within the system;

- the huge number of relationships between patients, caregivers, healthcare providers, support staff, administrators, policy-makers, economists and community members as well as the relationships among the various health and non-healthcare services;
- the vulnerability of patients;
- the means for carrying out care (access to resources);
- the variations in care and diversity of tasks;
- variations in physical layout;
- differing, lack of, or unrealistic regulations, policies and procedures; and
- increased specialization of healthcare professionals. While specialization and the implementation of new technology allows a wider range of patient treatments and services, it also provides more opportunity for things to go wrong and incidents to occur.

Health also differs from other industries because of the nature of the health professions. In 1984, Hilfiker observed that physicians are trained in a way that assumes they can always perfectly diagnose and perfectly treat patients. At the heart of the perfectibility model is the belief that if only physicians and nurses would try harder and were more knowledgeable and skilful then errors would not happen. This out-dated view does not take into account the role played by other factors such as the other components of the healthcare system.

Healthcare delivery system model

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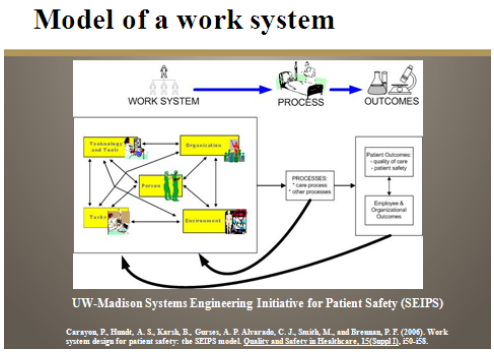

The University of Wisconsin-Madison Systems Engineering Initiative for Patient Safety (SEIPS) model of a healthcare delivery system combines Donabedian's well-known structure-process-outcome model of quality with human factors engineering and systems engineering ideas. Quoting directly from the paper:

> "According to the work system model, a person (the person could be a care provider, another employee of a healthcare institution such as a biomedical engineer, a unit clerk, or the patient) performs a range of tasks using various tools and technologies. The performance of these tasks occurs within a

> certain physical environment and under specific organizational conditions. The five components of the work system (person, tasks, tools and technologies, physical environment, organizational conditions) interact with each other and influence each other. The interactions between the various components 'produce' different outcomes: performance, safety and health, and quality of working life…. Overall, the work system in which care is provided affects both the work and clinical processes, which in turn influence the patient, employee, and organizational outcomes of care."
>
> (Carayon et al, 2006)

In systems parlance, the work system is considered the "inputs", the processes are the "transformations" and the outputs are just that, outputs. Importantly, the model also shows that feedback mechanisms operate in systems. All of these terms will be expanded upon in the following sections.

This systems model demonstrates several important points relevant to patient safety.

- The healthcare providers and patients are part of the system. This demonstrates that "systems thinking" does not exclude individual contributions to safety, or a lack thereof.
- The placement of the individuals, the providers, patients, support staff, managers, at the center means that an effective system is one that is designed for those individuals.
- It is the interaction among the five system components (person, tasks, tools and technologies, physical environment, organizational conditions), not the individual components themselves, that matters most for safety. Healthcare providers, for example, do not operate in a vacuum. They work in a system defined by the other components. Therefore, when it comes to safety, we need to understand how the different components interact as it is the interactions that produce safety, or a lack thereof. That is another reason why just focusing on individuals, such as physicians or nurses, makes little sense from a systems perspective.
- It is not just patient safety that is affected by the design of the system, but also employee (physician, nurse, support staff, management) safety and organizational outcomes such as regulation compliance.

Inputs

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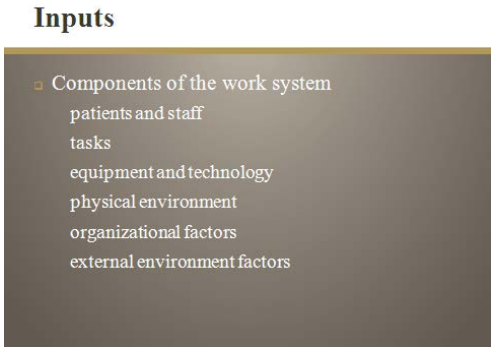

Karsh et al. (2006) provides a detailed explanation of healthcare delivery system inputs.

Patient and provider factors

These are characteristics of individuals such as health, age, weight, needs, mood, personality, knowledge and experience, intelligence, language and cultural background. Some characteristics are less dependent on the situation, such as personality and intelligence, while others such as mood, fatigue, and stress may vary depending on the situation.

Task factors

These are characteristics of the tasks or jobs healthcare providers must execute, including what the tasks themselves are, as well as characteristics such as work flow, time pressure, job control, and workload.

Technology and tool factors

Technology factors refer to quantities and qualities of technologies in the organization. Such factors include the number and types of technologies and their availability and location. The design of tools and technologies, including their integration with other technologies, propensity to breakdown or crash, responsiveness, and other design characteristics would also be included.

Environmental factors

These are the features of the environment in which healthcare providers work. These features include lighting, noise, and physical space and layout.

Organizational factors

These are the structural, cultural, and policy related characteristics of the organization. Examples include leadership characteristics, work culture, regulations and policies, levels of hierarchy, and supervisor span of control.

External environment factors

The external environment of any given system is anything outside of that system. The external environment of a patient room is the unit in which it resides, but also includes the hospital, local, provincial/territorial and federal laws, and the economic conditions and demographic makeup of the community. Karsh et al. (2006) go on to explain:

> "Also, none of these factors may be important to patient safety in and of itself; rather, it is typically the interaction between inputs that can influence patient safety. For example, lighting is not good or bad by itself, but lighting can be problematic for certain tasks or create glare on certain displays. Similarly, a technology such as computerized physician order entry may or may not influence patient safety; rather, it will have a positive or negative impact on safety depending on many factors such as (a) how well it is integrated into the physical environment and the workflow, (b) how much training is provided to end users, and (c) how end users perceive its ease of use and usefulness."

Transformations/processes

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Karsh et al. (2006) provides an explanation of transformations. Transformations—also sometimes referred to as processes or performances—are the actual acts of transforming inputs into outputs. Physical transformations result in new configurations of the system, such as when a transferred patient now resides in a new location or when a surgery is completed and a patient is physically transformed. Cognitive and social/ behavioral transformations also result in new system states— for example, after a difficult diagnosis a physician is more mentally fatigued and the patient more informed than he/she was initially (cognitive); or when the presence of a manager leads a pharmacist to recheck a

medication cart before it is transported to the unit by a pharmacy technician (social/ behavioral).

Outputs

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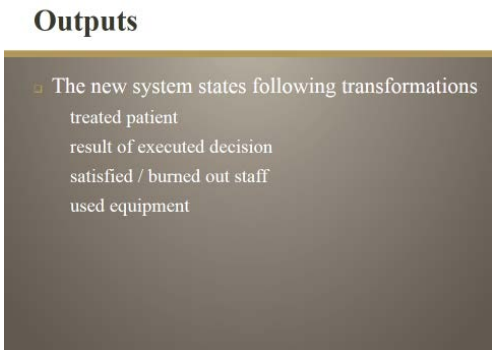
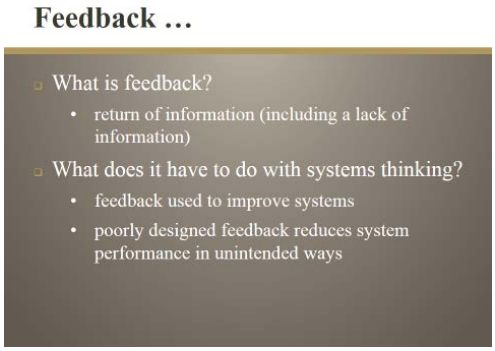


From Karsh et al. (2006):

> "An output of performance can be as general as 'surgery completed' or as specific as 'tablet placed in mouth of patient' or 'nursing knowledge of a policy improved'. Output can be thought of as a new state of the pre-transformation system and is evaluated by referring to a relevant set of objectives and standards—for example, must give right patient the right medication at the right time, and so on. Relevant outputs for patient safety might include achievement of the five rights of medication administration (Right Patient, Right Route, Right Dose, Right Time, Right Medication), the correct information handed off between healthcare providers (HCPs), or adequate knowledge and skill to correctly use a new computerized provider order entry system."

Feedback

Slide 13



From Karsh et al. (2006)

> "The idea of feedback is central to the system model because feedback from outputs affects subsequent inputs and thus affects performance and patient safety.

> This feedback operates in two main ways: (1) it acts as an input into other processes and (2) it influences the same process when it recurs in the future. Consider medication dispensing, which is influenced by a variety of inputs. The output of medication dispensing is either the right or wrong drug dispensed. If data on dispensing errors are tracked and problems are identified in the inputs-transformation-outputs sequence, knowledge about how the output (wrong medication) comes about could be used as corrective feedback to change some of the inputs into the dispensing process (for example, policies, personnel or technology) in order to provide better HCP performance and, subsequently, better patient safety. At the same time, the output of the dispensing activity (which is a dispensed medication) is one of the main inputs into the medication administration process, which follows dispensing in the medication use process."

The idea that outputs of one process, such as medication dispensing, act as inputs to another process, such as medication administration is an important point for understanding system operations. This phenomenon means that changes to one part of a process will likely impact processes that flow from it. Processes that feed into it may also be affected as the inputs needed for the changed process may change. For example, if a hospital or clinic implements electronic health records (EHR), then the way patients are checked in at admission (a process that serves as an input to the EHR) will have to change and processes that follow use of the EHR, such as charting or medication ordering may also change.

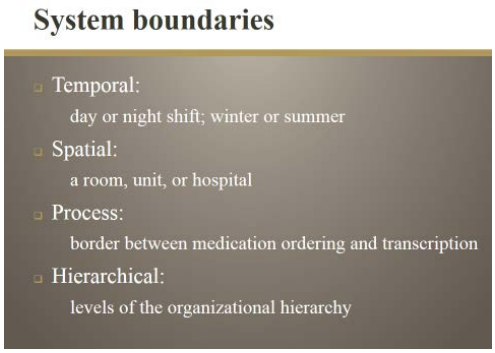
Perhaps the most critical point about feedback is that feedback is that which allows a system to adapt to changes. On a basic level, imagine trying to walk without visual feedback. We would be unable to correct our path for obstacles in our path. Or imagine trying to walk without feedback from our feet about the ground (slippery). We would surely fall without that feedback. The same principle applies to system operation. Similarly, consider how patient treatment would change without being able to use the feedback about patient status provided by vital monitors. Feedback about the status of system operations allows individuals in the system to adapt to changing circumstances. When individuals operate in an environment that lacks feedback about the status of the system they are put in a position of making decisions without important information. If a lab test were ordered in a clinic that tracked specimen processing, any member of the clinical team could know whether the specimen reached the lab and how much longer they would be waiting for the test, and with that information they could make adjustments to use their time productively and also give better information to the patient on when to expect the results of the test. On the other hand, in a clinic that did not track specimen status, the clinicians would be operating under uncertainty (short of making a call to the lab).

Feedback processes operate continuously, whether we realize it or not. If a nurse questions a physician and the physician ignores the nurse, then that is feedback to everyone who witnessed the event. Each witness, though, may interpret the meaning of

the information differently. Some may interpret it as the physician not hearing the nurse or not wanting to be interrupted at that time. Others may interpret it as the physician not valuing nursing input. Each interpretation carries with it important information for subsequent behavior. People with the former interpretation may wait to talk to this physician until he/she is not busy. Those with the latter interpretation may never attempt to interrupt this physician, even if they think they need to. This brings up another important point; feedback needs to be specific and meaningful. Because the feedback from the physician was ambiguous, each person is left to interpret the action. If there is a pattern, the interpretations may converge. However, had the physician said "please give me one moment while I concentrate then I'll be happy to chat" it would have told the witnesses what they could do differently the next time. Or the physician might have said "Don't ever interrupt me!" which would have provided very different feedback to the witnesses and affected each of their subsequent behaviors with this physician differently. So feedback constantly informs us about how to behave and operate within a system, whether we realize it or not. Realizing that now, you can be more aware of how your own behavior and communication provides feedback to others.

System boundaries

Slide 14



It is also important to understand that systems have different kinds of boundaries. These boundaries are rarely hard boundaries, but the implications of the boundaries are important for system design and redesign. Karsh and Alper (2005) describe four types of boundaries:

1. temporal;
2. spatial;
3. process; and
4. hierarchical.

Temporal boundaries

A temporal boundary is a boundary in time, such as between shifts or among seasons. These are important because any design or redesign must work across temporal boundaries. For example, any change to medication ordering or administration must work

for the day shift, where staffing is typically highest, as well as night shift, when unit staffing levels are typically lower, patients are sleeping, and the pharmacy may have less staff. As another example, more pediatric cases might be seen during certain times of the year when infections with respiratory viruses are more common and therefore staffing levels might need to be higher.

Spatial boundaries

A spatial boundary is a physical boundary such as a patient room, surgery suite, unit, central pharmacy, or a hospital. Different spaces may be designed differently, for example patient rooms or unit designs may be different, and therefore any system design or redesign must fit with the different spaces. If a hospital elects to implement bar-coded medication administration using a barcode scanner tethered to a computer on wheels, the computer on wheels needs to be able to fit within the different spaces it will travel.

Process boundaries

A process boundary is the point at which one process is considered to end and another begins. For example, in the medication use system, it might be the boundary between ordering and transcription or dispensing and administration. These boundaries are important to identify because if a change is made to one process, the processes that come before and after may be impacted and also need to be changed.

Hierarchical boundaries

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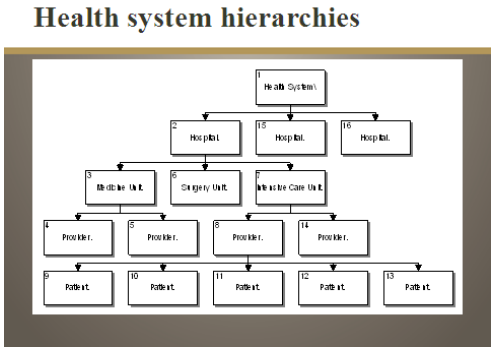


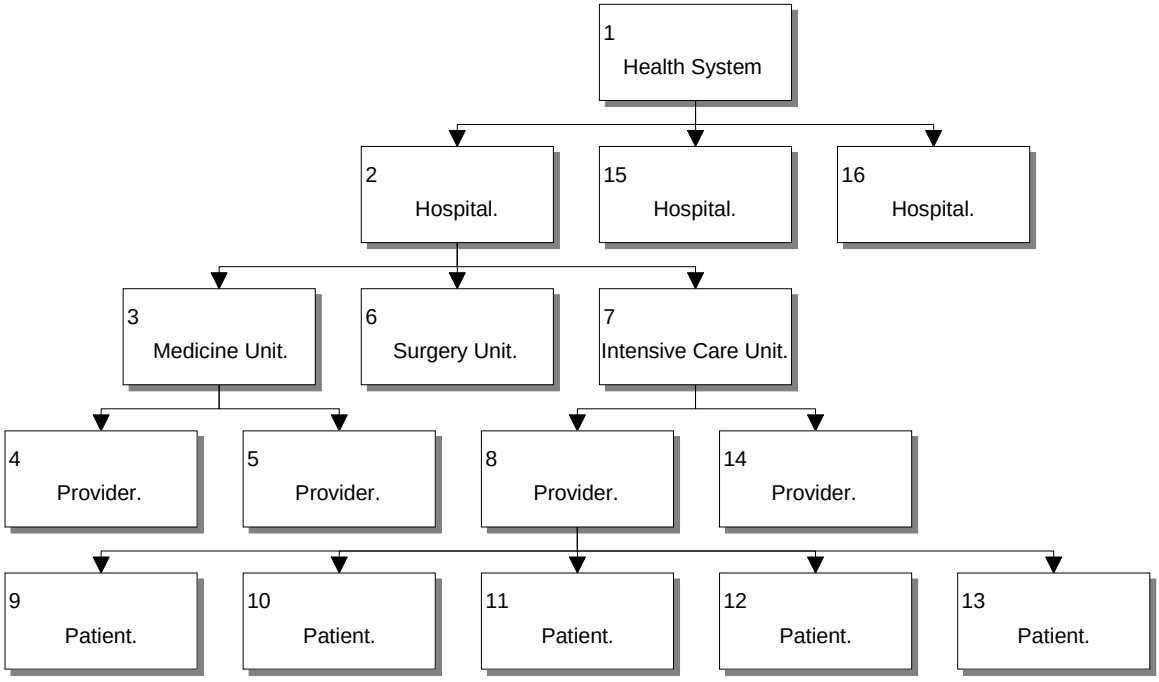
Finally, there are also hierarchical boundaries, which represent different levels within an organization. As Karsh et al. (2006) explained:

> "… any given system is part of a larger system and also contains subsystems. For example, an inpatient nursing unit—which is itself a system—exists within a larger system such as a hospital. Also, that nursing unit contains subsystems such as patient rooms, medication administration systems, and within unit communication systems. These hierarchies (or nestings) of systems are important to understand for patient safety because they influence [provider] performance,

and thus patient safety. This implies that (re)design of healthcare delivery systems must involve careful consideration of (a) the context in which the system resides (higher level systems), (b) the influence of and impact on lower level subsystems, and (c) the impact on the inputs and outputs of other systems. Unintended negative consequences may otherwise occur."

Figure 1 shows an example of such nested systems in healthcare delivery systems.

Figure 1: Hierarchies under a healthcare system



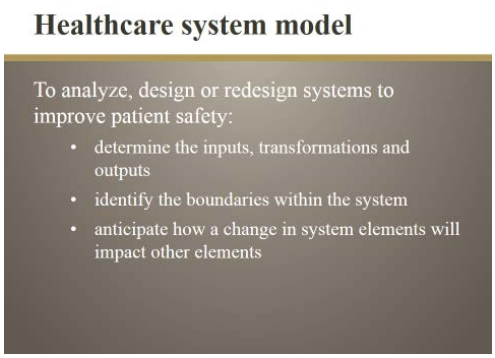
As the previous sections explain, the care of a patient is influenced by many systems and their interacting dynamics. Looking at healthcare in this way shows just how complicated the cause of any single patient safety event really might be. This is all the more reason to carefully guard against jumping to blame and instead consider the system dynamics that influenced the unwanted event. The idea of system hierarchies provides an especially important point.

As Karsh and Brown (2005) explained "Because these organizational hierarchies exist, they may exert as yet untested influence on the levels below; that is higher level organizational variables may impact medical errors through their influence on the lower level structures in the hierarchy. By ignoring these hierarchies, patient safety researchers may be inadvertently assigning erroneous causes and effect size magnitudes to variables that are in fact influenced by such dependencies." The problem is that if you only look for causes at the sharp end, then you can only find causes at the sharp end. But if you cast

a wider net and look at other parts of the system, you may find the underlying contributing factors. For example, if a patient is the victim of a wrong site surgery, and you only look for causes related to the surgeon, you will likely only find causes related to the surgeon. But if you use system thinking, and instead examine the information flow prior to the surgery, the technologies that were used leading up to the surgeries, and at cultural influences, you might find other underlying contributing factors. Consider a case of a patient receiving a wrong medication and a nurse being found photocopying patient identification barcodes. If we just look at the nurse, we conclude that the nurse was at fault for photocopying the barcodes. But if we look at the entire system under which the nurse works, we might find (or not) that the computer on wheels to which the scanner was tethered could not reach patients furthest from the door in the double occupancy rooms, and that management had told nurses to "do what you have to do". In such a case, the underlying problems of the computer on wheels not fitting is what needs to be addressed, not the nurses.

Applying the healthcare delivery system model

Slide 16

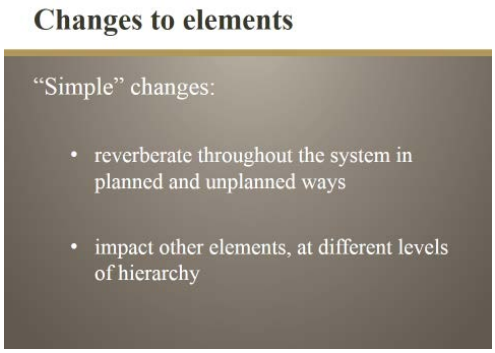


To successfully analyze, design or redesign a system to improve patient safety, one must:

- be able to determine the inputs, transformations and outputs;
- be able to correctly identify boundaries within the system; and
- be able to anticipate how a change in system elements will impact other elements.

Changes to system elements

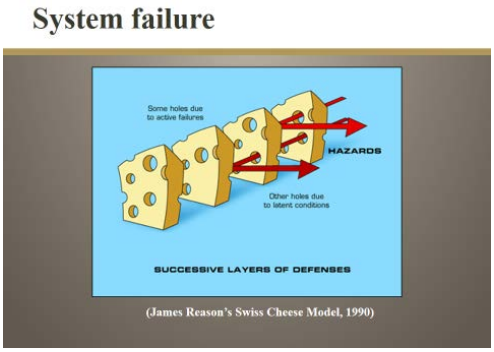
Slide 17



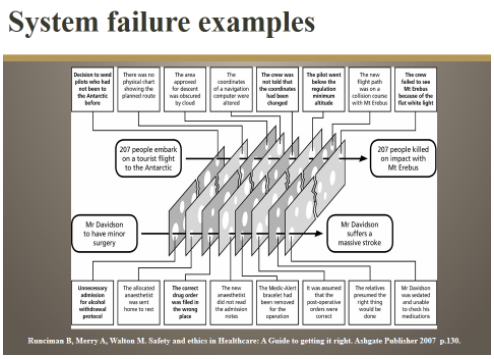
Considering the complex interplay between system elements, changes to these elements are likely to have broad consequences. Any "simple" change is likely to reverberate throughout the system in planned and unplanned ways. Additionally, any "simple" change is likely to impact other elements, at different levels of hierarchy. That means if you change part of a system (computerized order entry, new alarms, new policies) you will impact the performance of your staff and the other components of the system. When thinking about making a change to a system, by implementing a new policy, changing a layout, hiring a new manager, or implementing a new information technology, it is important to consider all of the different outcomes for which your system change must be designed. An important lesson from systems thinking then is that "good design" means a system that is designed to be able to achieve all of the different goals it may have. Those goals include patient safety, employee safety, productivity, efficiency, quality, fit with other technologies, fit within the physical environment, compliance with external and internal regulations and policies, and others. While this may sound impossible, evidence from other industries shows that if you take all of those goals into consideration in the first place, you can design a system to meet all of them. It used to be thought that achieving safety meant compromising productivity, but it is now well recognized now that is a myth. In PSEP – Canada Module 2: Human Factors Design: Applications for Healthcare, examples are provided that show why you can achieve both safety and productivity simultaneously. The important point here is to realize that anytime you plan to design or redesign a system, you need to consider all of the different goals the system must achieve and take those into account.

Applying systems thinking

Slide 18



Slide 19



The core principle underpinning most "accident" frameworks is that multiple factors invariably are involved in accidents: individual situational factors, workplace conditions and latent organizational and management decisions all have a causal relationship with the underpinning processes leading to the accident. More complex processes and structures usually present greater potential for multiple factors and latent errors in the system.

Reason's analysis of large scale disasters occurring in the 1980s noted that latent human errors rather than technical failures were dominant. Even when faulty equipment or components were present he observed that human action could have averted or mitigated the bad outcome. Healthcare providers at the sharp end most often catch the multiple failures that are cascading to cause the harm, but these individuals are fallible and eventually a patient may be harmed.

Pidgeon, who analyzed the findings of the Chernobyl nuclear investigation, observed that some large-scale investigations failed to examine the wider organizational cultural issues. He argues that organizational errors and violations of operating procedures are often viewed as evidence of a poor safety culture rather than organizational characteristics contributing to the incident. (Pidgeon, 1991)

Reason says that only a systems approach (as opposed to a person approach) will create safer work cultures. His theory is strongly supported by evidence from the technological

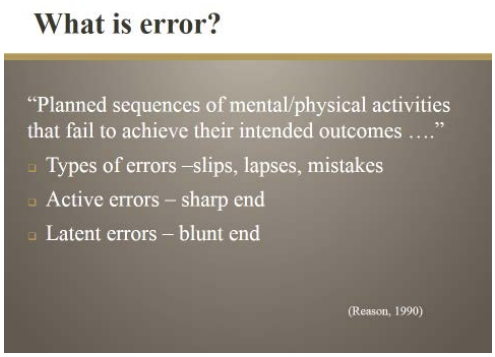
hazard industries which show the benefits of built-in defenses, safeguards and barriers. Engineered defensive systems include automatic shut-downs (alarms, forcing functions, physical barriers). Other defensive mechanisms are dependent on people, such as pilots, surgeons, anesthetists, and control room operators. Procedures and rules are also defensive layers.

For Reason, the pivotal post incident/accident question is why safeguards fail, rather than who caused it. Reason is credited with creating the 'Swiss Cheese' model to explain how vulnerabilities in the different layers of the system lead to incidents.

The above diagram building on Reason's Swiss cheese model shows that a failure in one layer of the organization is usually not enough to cause harm. Bad outcomes in the real world usually occur when a number of failures occur in a number of layers (for example, rule violations, inadequate procedures, faulty equipment) and momentarily line up to permit a trajectory of accident opportunity. To combat this happening Reason invokes the "defense in depth" principle. Successive layers of protection (understanding, awareness, alarms and warnings, restoration of systems, safety barriers, containment, elimination, evacuation, escape and rescue) are designed to guard against the failure of the underlying layer.

Applying systems thinking to the concept of human error

Slide 20



Reason defined errors as "**planned sequences of mental or physical activities that fail to achieve their intended outcomes**, when these failures cannot be attributed to the intervention of some chance agency." Errors may occur by doing the wrong thing (commission) or by failing to do the right thing (omission).

The definition contains three elements: a plan or intervention that includes a goal and the means to achieve it; a sequence of steps or actions initiated by that plan; and the extent to which steps or actions are effective in achieving their purpose. He developed three categories – slips, lapses and mistakes – to help analyze and understand the nature of errors.

Slips and lapses: errors resulting from some failure in the execution and/or storage stage of an action sequence regardless of whether or not the plan which guided them was adequate to achieve its objective.

Mistakes: deficiencies or failures in the judgmental and/or inferential processes involved in the selection of an objective or in the specification of the means to achieve it, irrespective of whether or not the actions directed by this decision-scheme run according to plan.

Irrespective of whether errors are described as slips, lapses or mistakes, they all involve a deviation from the goal. When a person making one of these types of errors is in direct contact with another person, equipment or system, Reason calls these **active failures**. These are also referred to as active errors or errors at the sharp end of the system. The origins of the events leading to an active failure may have commenced days, months or even years earlier.

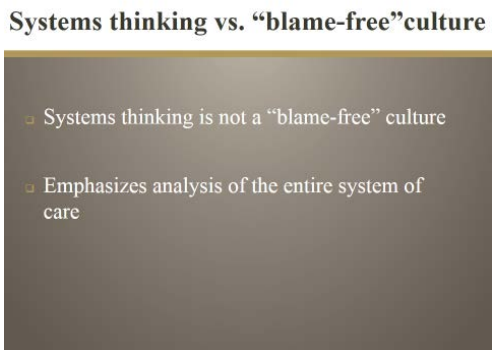
Reason says two primary elements are always involved in accidents: active failures and **latent conditions**. Active failures are errors made by humans (for example, pilots, taxi drivers, crews, factory operators) which have an immediate adverse effect. Latent conditions involve poor decisions, poor designs, poor supervision, inadequate tools and equipment and actions by humans long before a given incident.

Reason describes latent conditions as "resident pathogens" which may or may not lead to a patient safety incident. Management decisions, instructions by designers, builders and clinicians all have the potential to lead to future errors. In other words, the system thinking approach to error, as explained by Reason and others, is that underlying active errors (e.g. ordering or administering the wrong dose, unintentionally) are latent conditions or system design failures that create the conditions for the active error to occur.

These latent conditions are also known as hazards. As such, the systems thinking approach to the idea of errors is that while they do occur, our focus needs to be on the conditions that allow them to occur. A nurse might accidentally connect an enteral feeding tube to an IV medication port. That would be an error, but the hazard or latent condition in this case is that the feeding tube could connect to an IV connector in the first place. Good systems thinking therefore deals with this unwanted outcome not by scolding the nurse or telling her to be more careful, but by making the connectors not connect.

Is systems-thinking the same as a “blame-free” culture?

Slide 21



Despite the fact that the systems thinking differs from the traditional blame culture, this does not imply that systems thinking is a “blame-free” culture. Systems thinking helps to ensure that when a patient safety incident occurs there is not a rush to blame the sharp end providers, instead the entire system of care is analyzed. If after carefully studying the system it is determined that one of the factors that contributed to patient harm was disregard for professional responsibility when it could have been executed, then holding the responsible people accountable is justified.

Systems thinking and safety culture

Slide 22

With a systems approach Reason cites that the culture of the organization should embrace a safety culture which encompasses the characteristics of an informed, just, reporting and learning culture. These elements take into consideration the following points:

- acknowledgment of the high-risk, error-prone nature of an organization’s activities – we make and will make errors;

- An environment where individuals are able to report errors or close calls without fear of reprimand or punishment – we must know about errors and near misses if we are to correct them;
- an expectation of collaboration across ranks to seek solutions to vulnerabilities – safety is everyone's concern from CEO to patients; and
- a willingness on the part of the organization to direct resources for addressing safety concerns – safety requires commitment and resources to improve.

Slide 23

A just culture has an:

- atmosphere of trust in which people are encouraged, even rewarded for providing essential safety information;
- but…knows where the line is drawn between acceptable and unacceptable behavior.

Slide 24

A learning culture embraces:

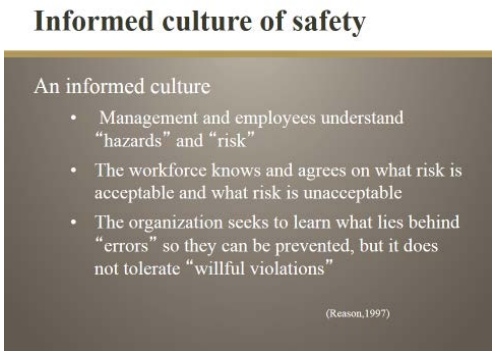
- encouraging people to develop and apply their own skills and knowledge to enhance organizational safety;
- updating staff on safety issues by management; and
- safety reports being fed back to staff so that everyone learns.

Slide 25

A reporting culture ensures:

- employees and management have mechanisms to voice safety concerns and are encouraged/ expected to do so, and
- when safety concerns are reported they are analyzed and appropriate action is taken.

Slide 26

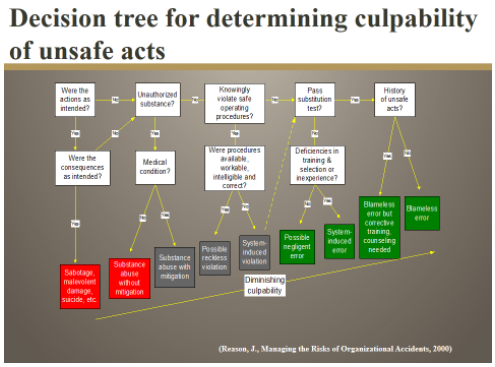


An informed culture ensures:

- management and employees understand "hazards" and "risk"
- that the workforce knows and agrees on what risk is acceptable and what risk is unacceptable
- that the organization seeks to learn what lies behind "errors" so they can be prevented, but it does not tolerate "willful violations"

Using systems thinking to determine accountability

Slide 27



The following case example illustrates how systems thinking can help determine accountability.

> A patient receives the wrong medication. It was determined that the nurse administered the medication without first scanning the patient's barcoded identification band. Instead the nurse had photocopied his three patient's identification barcodes and kept the photocopies in his pocket. Should the nurse be held accountable?

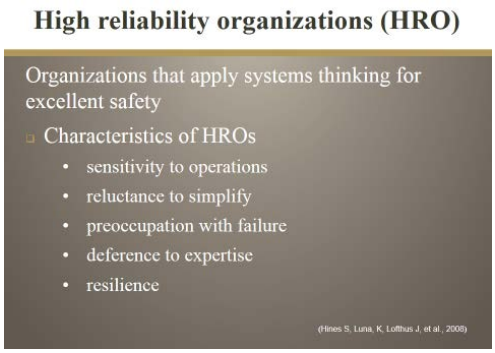
In this case, it depends on what factors contributed to motivating the nurse to not scan the patient's bar coded identification band. If the nurse did this because the scanner, which was tethered to a computer on wheels could not reach the patient because there was no room, then perhaps not. Perhaps that same nurse and others had been complaining that the scanners could not reach their patients, but nothing was done. Perhaps there had been tacit acceptance that nurses could not scan patient ID bands and everyone chose to look the other way. In all of these cases, it would seem the problem was that the system of care was not designed to support nurses scanning patient identification bands. The nurses had to still administer medications, and they did what they felt was a reasonable compromise. Systems thinking would suggest that holding the nurse personally responsible would not be appropriate. The nurse knew the correct procedures, but the environment prevented him from following the procedures.

On the other hand, in this same case, it might be determined that the patient's identification band could have been scanned, but the nurse still chose to make the photocopy of the identification barcodes because the time he saved allowed him to take a longer lunch break. The nurse in this case should be held accountable.

Typically, the circumstances surrounding an incident will be quite complicated. Systems thinking and systems engineering approaches to studying incidents will help to ensure that the right decisions for action are made. Healthcare providers within a Just Culture are still accountable for their actions

High reliability organizations

Slide 28



High reliability organizations refer to organizations or systems that operate in hazardous conditions but have successfully decreased incidents. They demonstrate to healthcare organizations that they too can improve safety by focusing on the system. Air traffic control systems, nuclear power plants, and naval aircraft carriers are complex organizations which were originally studied by a group from Berkeley (La Porte, Roberts, Rochlin) who coined the term High Reliability Organization (HRO). These organizations plan for failure and are skilful at avoiding or minimizing catastrophes through promoting creative problem solving.

Obviously, a nuclear disaster has a different magnitude than a patient safety incident in healthcare. HROs judge their success by ensuring 'failure free' performances. They have fewer incidents, but when they occur they have major impact and long term consequences for many. In healthcare, patient safety incidents are more numerous and when they happen usually only affect a few. Because of the advances in medicine there is now much common ground between HROs and healthcare.

Characteristics of HROs

At the core of high reliability organizations (HROs) are five key concepts, which are essential for any improvement initiative to succeed:

- **Sensitivity to operations** - Preserving constant awareness by leaders and staff of the state of the systems and processes that affect patient care. This awareness is key to noting risks and preventing them.

- **Reluctance to simplify** - Simple processes are good, but simplistic explanations for why things work or fail are risky. Avoiding overly simple explanations of failure (unqualified staff, inadequate training, communication failure, etc.) is essential in order to understand the true reasons patients are placed at risk.

- **Preoccupation with failure** - When near-misses occur, these are viewed as evidence of systems that should be improved to reduce potential harm to patients. Rather than viewing near-misses as proof that the system has effective safeguards, they are viewed as symptomatic of areas in need of more attention.

- **Deference to expertise** - If leaders and supervisors are not willing to listen and respond to the insights of staff who know how processes really work and the risks patients really face, you will not have a culture in which high reliability is possible.

- **Resilience** - Leaders and staff need to be trained and prepared to know how to respond when system failures do occur.

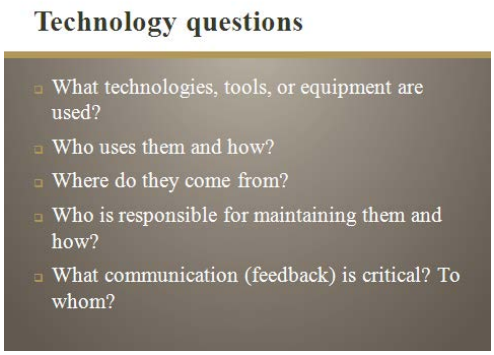
(Hines S, Luna, K, Lofthus J, et al., 2008**)**

Questions to ask

The next series of slides provide questions that can be asked whenever a change is being considered to a system. That means any technology, personnel, task, organization or environmental change. Regardless of the change, all of the questions should be asked. That means if a clinic is considering a new electronic health record, questions should not be restricted to those on the "technology" slide, but should come from all of the slides.

Technology questions

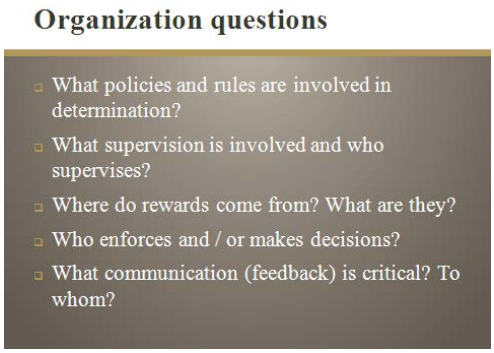
Slide 29



- What technologies, tools, or equipment are used?
- Who uses them and how?
- Where do they come from?
- Who is responsible for maintaining them and how?
- What communication (feedback) is critical? To whom?

Organization questions

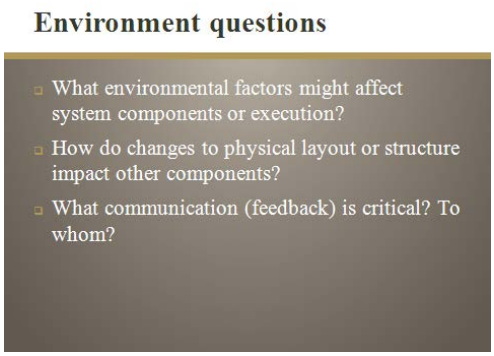
Slide 30



- What policies and rules are involved in determination?
- What supervision is involved and who supervises?
- Where do rewards come from? What are they?
- Who enforces and / or makes decisions?
- What communication (feedback) is critical? To whom?

Environment questions

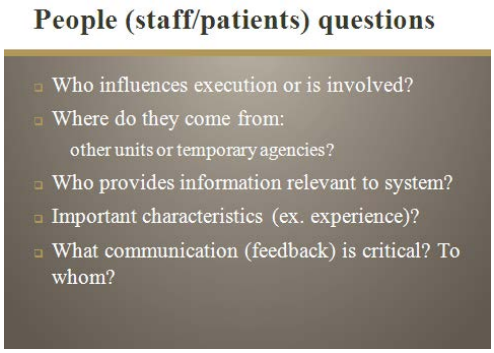
Slide 31



- What environmental factors might affect system components or execution?
- How do changes to physical layout or structure impact other components?
- What communication (feedback) is critical? To whom?

People (staff/patient) questions

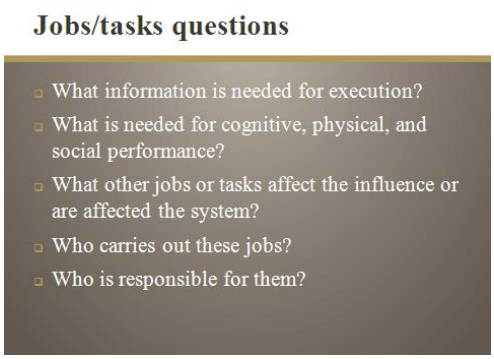
Slide 32



- Who influences execution or is involved?
- Where do they come from (other units or temporary agencies)?
- Who provides information relevant to system?
- Important characteristics (e.g., experience)?
- What communication (feedback) is critical? To whom?

Jobs/tasks questions

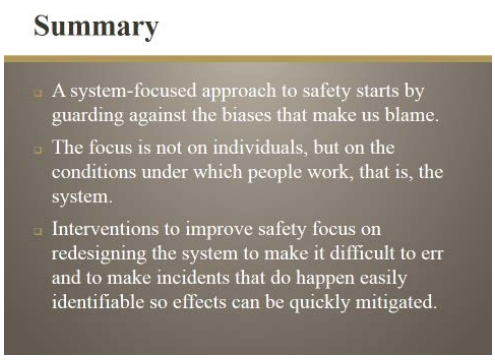
Slide 33



- What information is needed for execution?
- What is needed for cognitive, physical, and social performance?
- What other jobs or tasks affect the influence or are affected the system?
- Who carries out these jobs?
- Who is responsible for them?

Summary

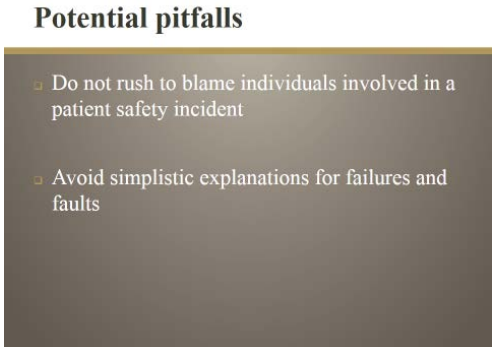
Slide 34



A system-focused approach to safety starts by guarding against all of the biases that make us leap to blame. The focus is not on individuals, but on the conditions under which people work, that is, the system. Interventions to improve safety focus on redesigning the system to make it both more difficult to err in the first place and to make those patient safety incidents that do happen easily identifiable so that their effects can be quickly mitigated.

Potential pitfalls

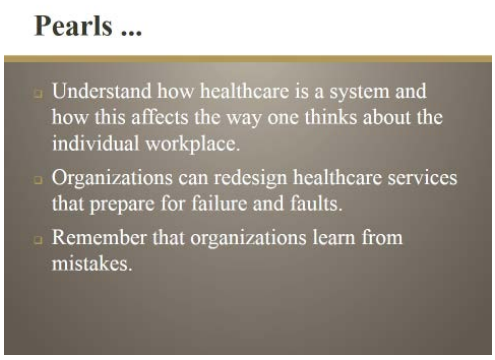
Slide 35



1. Do not rush to blame individuals involved in a patient safety incident
2. Avoid simplistic explanations for failures and faults

Pearls

Slide 36



1. Understand how healthcare is a system and how this affects the way one thinks about the individual workplace.
2. Organizations can redesign healthcare services that prepare for failure and faults.
3. Remember that organizations learn from mistakes.

Toolkits & outcome measures

- **The Safety Competencies**: *The Safety Competencies* were produced in collaboration with The Royal College of Physicians and Surgeons of Canada (CanMEDS Office). This important work was spearheaded by the Canadian Patient Safety Institute's Education and Professional Development Advisory Committee and was guided and crafted by an interprofessional team of educators (Steering Committee). Each domain was further developed by theme-based working groups.
  http://www.patientsafetyinstitute.ca/en/toolsResources/safetyCompetencies/Pages/default.aspx
  http://www.patientsafetyinstitute.ca/fr/toolsresources/safetycompetencies/pages/default.aspx
- **IHI Clinical Microsystem Assessment Tool**: Batalden PB, Nelson EC, Edwards WH, Godfrey MM, Mohr JJ. Microsystems in health care: Part 9. Developing small clinical units to attain peak performance. Joint Commission Journal on Quality and Safety. 2003 Nov; 29(11):575-585. http://www.ihi.org/resources/Pages/Tools/ClinicalMicrosystemAssessmentTool.aspx
- **Learning to Improve Complex Systems of Care:** Headrick LA. Learning to improve complex systems of care. In: Collaborative Education to Ensure Patient Safety. Washington, DC: HRSA/Bureau of Health Professions. 2000; 75-88.

- **Learning from adverse events: Fostering a just culture of safety in Canadian hospitals and health care institutions.** Ottawa, ON: Canadian Medical Protective Association; 2009.
- ***Safer Healthcare Now!*** http://www.saferhealthcarenow.ca 

Resources

- **Becoming a High Reliability Organization: Operational Advice for Hospital Leaders:** AHRQ Publication No. 05-P024-3, August 2005. Agency for Healthcare Research and Quality, Rockville, MD.
- **Safety and Ethics in Health Care: A Guide to Getting it Right**: Runciman B Merry A Walton M. Ashgate Publishers 2007.
- **To Err Is Human: Building a Safer Health System**: Kohn L, Corrigan J, Donaldson M, eds. Washington, DC: Committee on Quality of Health Care in America, Institute of Medicine. National Academy Press; 2000. http://psnet.ahrq.gov/resource.aspx?resourceID=1579
- **Building a Safer System - A National Integrated Strategy for Improving Patient Safety in Canadian Health Care**: Royal College of Physicians and Surgeons of Canada. National Steering Committee on Patient Safety. (2002). *Building a Safer System - A National Integrated Strategy for Improving Patient Safety in Canadian Health Care.* Ottawa, Ontario. http://www.royalcollege.ca/portal/page/portal/rc/common/documents/advocacy/building_a_safer_system_e.pdf 
- **Incidence of adverse events and negligence in hospitalized patients: Results of the Harvard Medical Practice Study I**: Brennan TA, et al. New England Journal of Medicine. 1991;324(6):370-376. http://www.nejm.org/doi/full/10.1056/NEJM199102073240604#t=article
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- **The Report of the Manitoba Pediatric Cardiac Surgery Inquest: An Inquiry into Twelve Deaths at the Winnipeg Health Science Centre in 1994**: Sinclair, C. M. *The Report of the Manitoba Pediatric Cardiac Surgery Inquest: An inquiry into twelve deaths at the Winnipeg Health Science Centre in 1994.* Winnipeg, Manitoba: Provincial Court of Manitoba. http://www.pediatriccardiacinquest.mb.ca/ 
- **Crossing the Quality Chasm: A New Health System for the 21st Century**: Committee on Quality of Health Care in America, Institute of Medicine,

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Module 1 Trainer's Notes

Principal message

The single most important message your audience should come away with is that *seeing healthcare in terms of systems is a powerful way to understand how to make care safer*. As a part of this insight, the participant should come away convinced that *focusing not on individuals, rather on the conditions under which people work, that is focusing on the system will improve patient safety within their organization.*

Module overview

Patients depend on many people doing the right thing at the right time with interactions, medicines and equipment that work and in a suitable environment; in other words, they depend on a system of care. Understanding systems of healthcare is therefore essential.

Health systems are made up of many interacting parts comprising individuals (health professionals, administration and management staff, patients and their caregivers) infrastructure (administration, governance arrangements) and technology (drugs, equipment, diagnostics). The ways they interact with one another and how they collectively act is complex and variable. Understanding the nature of complexity in healthcare is essential for understanding why things break down and for finding solutions.

This module defines systems, and describes their components. It describes system boundaries, how systems interact and how to apply systems thinking to healthcare. The module describes how system thinking applies to the concept of human error and outlines the characteristics of high reliability organizations. Finally, an approach is set out to handling safety information and for preparing for change.

Preparing for a presentation

1. Assess the needs of your audience

Choose from the material provided in the module according to the needs of your expected participants. It is better for participants to come away with a few new pieces of information, well learned, than to come away with a deluge of information from which they can remember little or nothing.

2. Presentation timing

The suggested timing for each part of this module is:

Introduction	2- minutes
Trigger tape & discussion	5- minutes

Presentation	35 minutes
Summary	3 minutes
Total	45 minutes

3. Number of slides: 36

4. Preparing your presentation

The text in the module was not designed to be used as a prepared speech. Instead, the text provides material you may want to use. The slides have been designed to trigger your presentation. Although the slides closely follow the text of the module, they do not contain all of the content. Their use presumes that you have mastered the content.

You may want to make notes on the slide summary pages to help you prepare your talk in more detail and provide you with notes to follow during your presentation.

Remember that you can adjust the slides to suit your presentation content, your style, and to make it feel fully familiar and your own.

Practice your presentation using the slides you have chosen, and speaking to yourself in the kind of language you expect to use, until it is smooth and interesting and takes the right amount of time. The most accomplished presenters and teachers still practice prior to a presentation; don't miss this step.

5. Preparing a handout for participants

The module text and slides were designed to be reproduced and provided to participants as a handout. Take the portion you need; they can be used in their entirety, module by module, or for just one specific topic. Please ensure to acknowledge the source of the material, the PSEP – Canada Acknowledgment Page at the front of the module provides the formal citation.

6. Equipment needs

- Screen, computer and projector
- Flipchart, and markers for recording discussion points

Test your equipment beforehand to ensure that it works.

Review your video to assess which portions you would like to use.

Have a back-up plan so that if there is any equipment failure you can move without panic to your back-up plan. For instance, have in mind that:

- if the video fails, you can read the vignette of the trigger tape story;
- if the slides cannot be shown, you can refer to the hand out slides; and

- if the markers do not work, you can have participants list items on their hand outs that you would have written up for all to see.

Making the presentation

1. Introduce yourself

If you have not already done so, introduce yourself. Include your name, title, and the organization(s) you work for. Briefly describe your professional experience related to the information you will be presenting.

2. Introduce the topic

Show the title slide for the module. To establish the context for the session, make a few broad statements about the importance of topic as a patient safety matter. Tell participants the format and time you will take to present the session. Identify the teaching styles that you intend to use.

3. Review the session objectives

Show the slide with the session objectives listed. Read each objective and indicate those that you are planning to emphasize.

4. Show the trigger tape

After reviewing the objectives for the session, show the trigger tape. The trigger tape should engage the audience and provide appropriate context for the session. The trigger tape does not need to demonstrate an ideal interaction, but to "trigger" discussion.

Trigger tape content

Keep in mind that the facilitator may choose to use any one of a number of trigger tapes.

This module's specific trigger tape depicts a physician on the phone with a recently discharged patient. The patient has confused the names of her medications and accidentally taken the wrong dose of a medication. Following the phone call, the physician and her colleague discuss systemic problems with medication instructions at patient discharge and how the system could be improved.

A teachable moment: discussion after the trigger tape

After the trigger tape, ask the participants for their comments about the issues and the interaction they have just seen. To affirm what they contribute, consider recording the important points on a flipchart.

If the discussion is slow to start, you may want to ask more direct questions, like:

- How does this situation illustrate that healthcare delivery is a matter of systems?

- Has a patient ever had something like this happen in your institution? What did you / your colleagues do?
- What is challenging about dropping the inclination to blame?

Use the discussion to set the stage for the material to follow. Do not let the discussion focus on a critique of the technical quality of the tape or how "real" the players seemed. If the participants do not like something that was said or done in the tape, acknowledge that there is always room for improvement and ask them how they would do it themselves.

Setting limits to discussion time

It is usually best to limit discussion of the tape to no more than five minutes, then move on to the presentation. To help move on if the discussion is very engaged, try saying something like:

- let's hear two last points before we move on, and
- now that you have raised many of the tough questions, let's see how many practical answers we can find.

For the more advanced facilitator who is confident of both the patient safety material and his or her pedagogic skills, it is possible to use the trigger tape as a form of case-based teaching and to facilitate the discussion to draw out the teaching points of the module. If this approach is used, it is essential to write up the points on a flip chart as they arise, to fill in any gaps and to summarize at the end. The hazard of this approach is that the discussion will not yield the desired teaching points. Return to the slides if this happens.

5. Present the material

Recommended style: interactive lecture

An interactive lecture will permit you to engage your audience, yet cover your chosen material within the time. You can use as your interactive components the trigger tape stimulated discussion, perhaps with some resulting case-based teaching, and an interactive exercise.

6. Key take-home points

1. A system-focused approach to safety starts by guarding against the biases that make us leap to blame.
2. The focus is not on individuals, but on the conditions under which people work, that is, the system.
3. High reliability organizations have 5 key characteristics: sensitivity to operations; reluctance to simplify; preoccupation with failure; deference to expertise; and resilience.
4. Healthcare organizations must learn from their mistakes.

7. Summarize the discussion

Briefly, review each part of the presentation. Recap two or three of the most important points that were discussed.