Singapore Healthcare Management 2015

Review of Medication Errors: A Human Factors Approach

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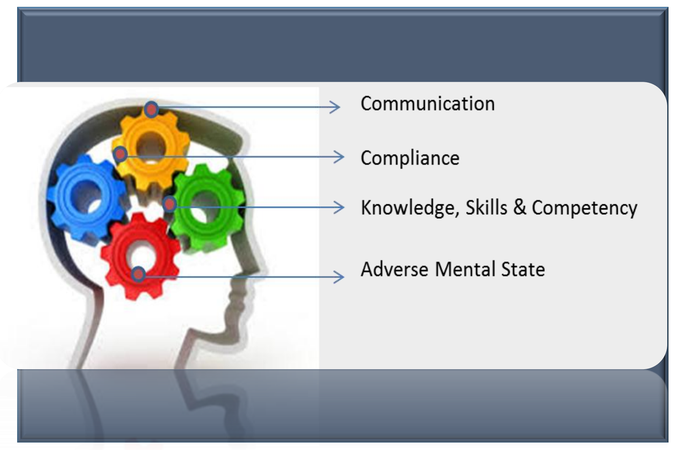
Introduction

Root Cause Analysis (RCA) was integrated in the Risk Management System (RMS) to provide a framework for evaluation of medication error incidents. However, the key root causes identified through RCA for medication errors rarely addressed the human factor aspects of contributory factors such as adverse mental state, personal readiness, physical/ mental limitations etc.



Our primary aim is to classify the human causal factors of medication error caused by wrong drug based on the Human Factors Analysis Classification Systems (HFACS) Framework.

Methodology

Data collection

- A 3-year retrospective review of medication errors secondary to wrong drug were extracted from the RMS for the period 01 January 2011 to 31 December 2013.
- Review of the existing root cause classification and framework of the 80 medication related errors was conducted.

Test

- A pilot evaluation of the root causes of 10 random cases of wrong drug were classified using the HFACS® Checklist for Operational Factors by Shappell and Wiegmann as shown in Figure 1.
- However, some codes/items in the Shappell and Wiegmann HFACS checklist were not applicable to healthcare.

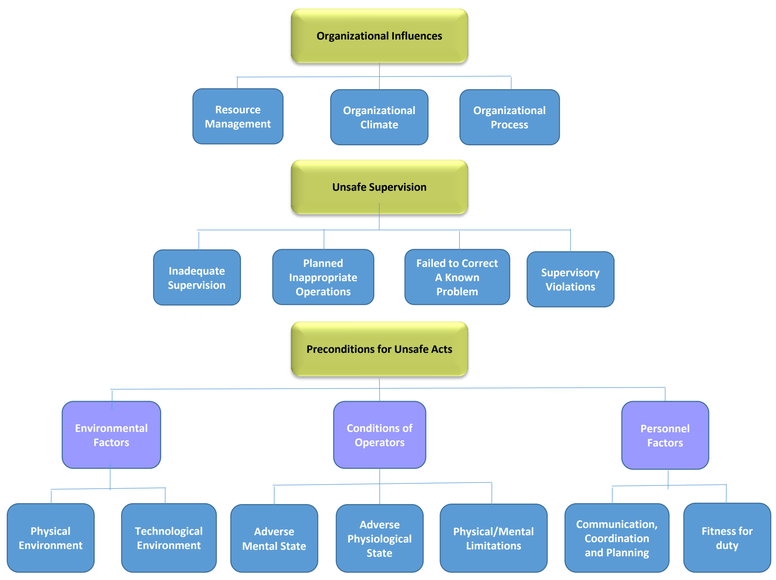
Intervention

- Drawing up a Modified Human Factors Checklist for Medication Error (Figure 2).
- The modification made were mainly on the contributory factors of unsafe acts and preconditions for unsafe act.

Data Analysis

- The Modified HFACS checklist was used to classify the 52 incidents of wrong drug errors identified.
- Classification of each incident according to the levels of failure and the contributory factors were evaluated by counting the number of times it was occurred as the cause factor.

Figure 1. Human Factors Analysis Classification System (HFACS®) Framework by Shappel & Weigmann



Unsafe Acts	
Errors	
Skill-based Errors	
Memory-based errors (lapses)	
Action based errors (slips)	
Routine activity without thought	
Timing errors (performed task at the wrong time)	
Habit transference with new equipment/procedure	

Preconditions for Unsafe Acts	
Environmental Factors	
Physical Environment	**Technological Environment**
Facility not available	Failure of information technology
Poor housekeeping	Inadequate / defective warnings/ alarms
Noise level too high or low	Outdated checklists
Fixture or fitting not available	
Lighting too dim or bright, or lack of	
Inappropriate room layout	
Inadequate ventilation	
Temperature extremes	
Excessive clutter or debris	
Inadequate / improper design for patient care	

Unsafe Supervision	
Inadequate Supervision (Role of Supervisor)	
Inadequate Training Provided	**Inadequate Oversight**
No training provided	Lack of / inadequate mentorship / coaching / instruction
Need for training not identified	Lack of accountability
Inadequate design of training program	Failed to communciate policies / procedure
No measurement of training effectiveness	Lack of appropriate incentives
Training records incorrect / not recorded	Failure to conduct work - site walk through
	Lack of / inadequate promotion / enforcement of safety meetings

Organisational Influences		
Resource Management		
Human Resources	**Monetary / Budgetary Resources**	**Equipment / Facility Resources**
Inadequate staffing	Excessive cost cutting	Purchasing unsuitable equipment
Inadequate matching of qualifications for a job	Lack of funding	Failure to correct known design flaws
High staff turnover		Improper handling / storage of materials
		Inadequate material packaging
		Exceeded shelf life

Organisational Influences	
Organisational Climate	
Structure	**Culture**
Accessibility & visibility of supervisor	Norms & Rules
Delegation of authority	Values, beliefs & attitudes
Formal accountability / responsibility of actions	Inadequate incident reporting / investigation
Inadequate safety terms & conditions of contracts	
Hierarchical structure / governance structure not conducive to discussion, problem sharing, etc	

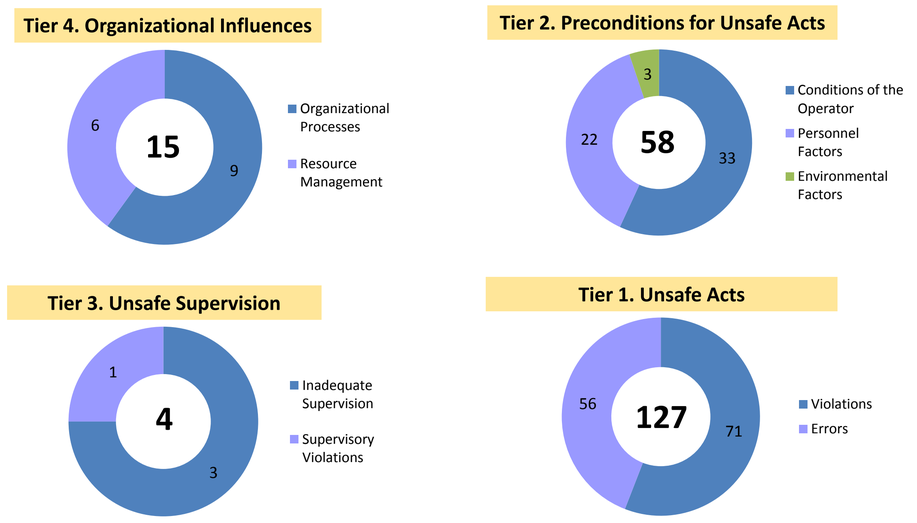
Organisational Influences	
Organisational Processes	
Operations	**Policies and Procedures**
Operation tempo (all activities of the unit being conducted; pace of an operation)	Lack of work instructions / policies & procedures
Time pressure	Policies & procedures inconsistent with work processes
Schedules	Outdated policies & procedures / no revision schedule (not reviewed / monitored)

Figure 2. Modified Human Factors Checklist for Medication Errors

Results

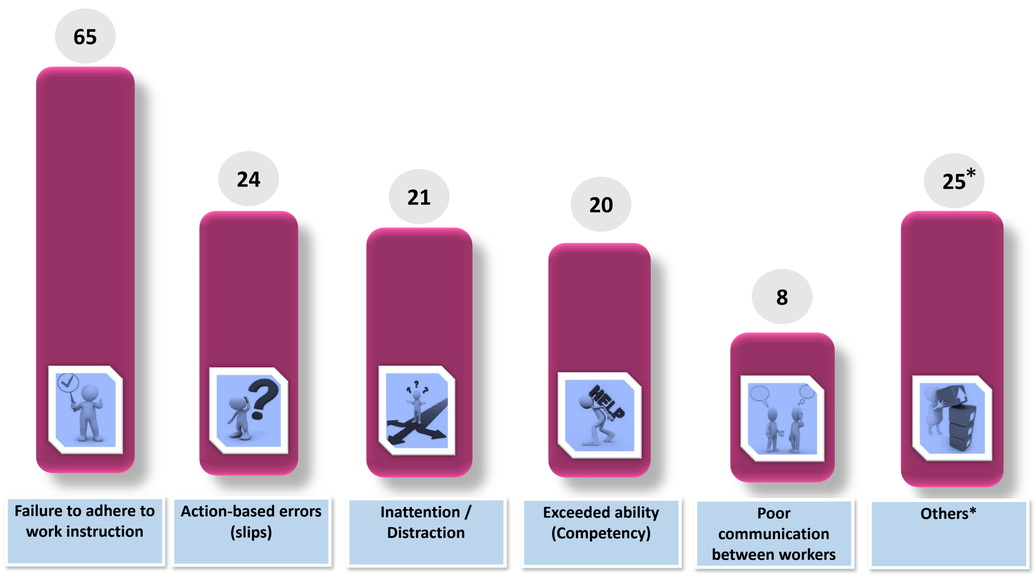
The HFACS® framework describes the human factor causes of accidents in 4 tiers. The 1st tier begins with unsafe acts which is defined as the actual action that led to the incident. The preconditions for unsafe acts explained why the incident happened by understanding the environment and the circumstances leading to the error. The 3rd tier is the unsafe supervision which contributed to the active failure committed by staff. The final level of HFACS® is organisational influences which are conditions left unnoticed that may affect the supervisor and frontline staff.

Figure 3. Human Factors Analysis Classification System of Wrong Drug Incidents from the period 2011-2013



Depicted in Figure 3 are the level of failure and causal categories identified for wrong drug whereby unsafe acts has the highest number of occurrence. The causal categories were further categorized into causal factors. The highest causal factors identified are routine violation (71), followed by adverse mental state (32), skill-based error (29), decision error (27) and communication / coordination / planning (21).

Figure 4. Top 10 Contributory Factors Identified in Wrong Drug Incidents for the period 2011-2013



**Others include: Verification techniques not used (7), Time Pressure (5), Inadequate staffing (5), Task Overload (4), Memory-based errors (lapses) (4).*

Detailed analysis showed majority of the wrong drug incidents occurred due to failure to adhere to work instructions and policies and procedures as reflected in Figure 4. These findings will give the organization the opportunity to relook at the policies and provide mitigating solutions targeted to correct failures occurring at any level.

The plans for phase 2 are in the process to conduct a prospective study of medication errors using the modified checklist to validate the comprehensiveness, reliability and usability of the checklist.

Conclusion

In general, the HFACS® framework by Shappel and Weigmann can be used as an alternative or adjunct tool for RCA for investigating incidents or adverse events in healthcare.

The creation of the Modified Human Factors Checklist for Medication Errors in KKH provided the opportunity to clearly classify the root cause of wrong drug incidents. HFACS® framework can be customised to the healthcare system of the individual organization.

Looking at the causal factors for medication errors, the organisation could anticipate the problems and work on specific interventions to help improve human performance and reduce the risk of errors.

References:

1. Wiegmann DA, Shappell, SA. *A Human Error Approach to Aviation Accident Analysis: The Human Factors Analysis and Classification System.* Burlington, VT: Ashgate Publishing; 2003.
2. Diller T, Helmrich G. Dunning S, Cox S, et al. *The human factor analysis classification system (HFACS) applied to healthcare.* American Journal of Medical Quality 2014; 29 (3): 181-190.
3. KKH Guide to Root Cause Analysis for Incident Management