



Singapore Healthcare Management 2017

FAILURE MODE EFFECT ANALYSIS (FMEA) PROJECT ON SAFE ADMINISTRATION OF EMERGENCY DRUGS (E-DRUGS) DURING RESUSCITATION

LEE Ang Noi¹, LEE Siew Kum¹, GOH Annie¹, KONG Yoke Kuan², LO Bo Chu³, SEOW Meow Kwei⁴, MATHUR Bela⁵

1: Division of Nursing, Singapore, 2: Children's Intensive Care Unit, KK Women's and Children's Hospital, Singapore, 3: Neonatal Intensive Care Unit, Singapore, 4: Pharmacy, KK Women's and Children's Hospital, Singapore, 5: Medical Informatics, Singhealth, Singapore



Introduction

Medical resuscitation is an extremely chaotic and stressful situation for both nursing and medical staff. There is no time for discussion and verification of patient's treatment plan including medications. Every second counts and every miss-steps or inaction can result in patient harm or death. Calculating drug doses under these conditions is very challenging. Through the use of FMEA, we want to prevent the occurrence of medication error during resuscitation.

Aim

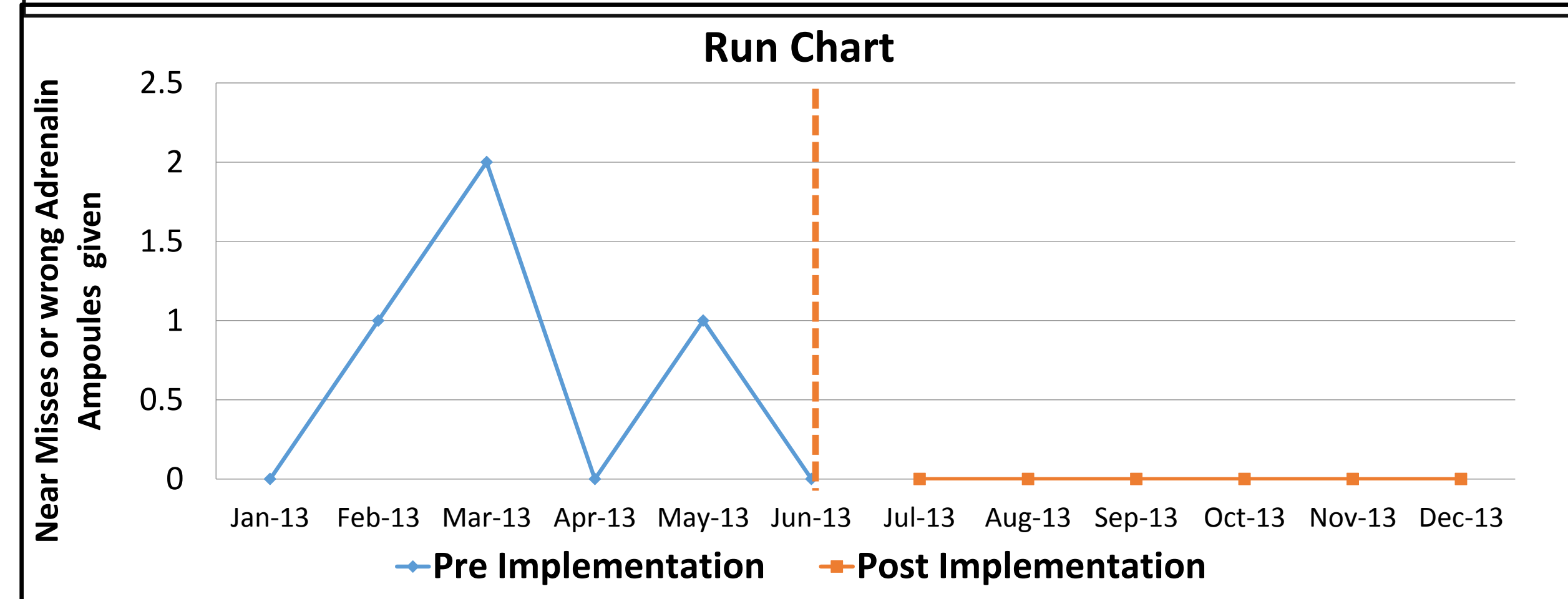
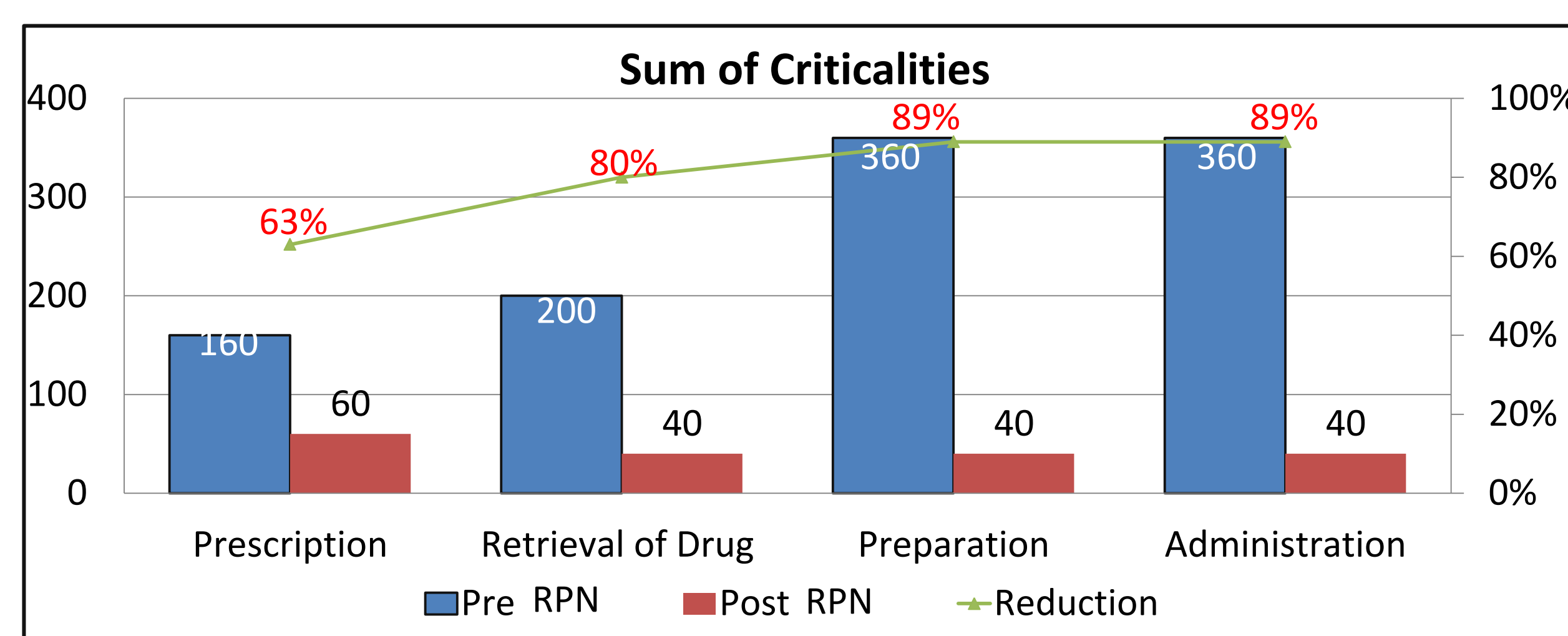
1. To enhance patient's safety with the implementation of an individualised E-Drug Chart during resuscitation
2. Eliminate the risk of errors in calculation during a chaotic resuscitation situation.
3. Eradicates the risk of wrong verbal orders or orders that are misheard and not read back

Methods

A multidisciplinary team was formed to map out the entire process of IV administration of e-drugs during resuscitation, identify potential "Failure Mode" that can occur and then use the FMEA scoring system to look at probability of occurrence, severity of effects and detectability. Risk priority numbers were solicited from all members to identify failures most in need of attention. The results were collected by the number of incidences reported post resuscitation

Results

Four main process steps and 20 sub-processes were outlined. RPN of more than 100 were found in the four main processes indicative that the prescription, retrieval of drugs, preparation and administration processes have the high potential for hazardous errors. Since the implementation of safety measures, patient safety and quality care are evidenced by no reported incidence of medication error till date and the high risk failure modes were reduced by 63% for prescription, 80% for retrieval of drugs and 89% for preparation and administration processes. Before intervention: 4 near misses or actual errors (9%) and 40 correctly administered. After intervention result showed 0 near misses or actual errors (0%) and 70 correctly administered. Using Fisher Exact test, P value = 0.020344. P value < 0.05 indicates that near misses or actual errors after intervention is significantly lower than before at 95% confidence level.



Process	Potential Failure Mode	Potential Causes	Potential Effect (s) of failure	Severity	Detection	RPN	Post-solution RPN	Reduction	Actions to Reduce Failure Mode
Prescription	Wrong dose	1. Knowledge deficit 2. Listen wrongly 3. Fail to read back 4. Fail to check emergency drug dosage guide	- Overdose or underdose - Lethal cardiac arrhythmias - Death	10 10	4 2	4 3	160 60	63%	- Nursing and medical attend in-house Mock Code training - Read back doctor's order - Refer to emergency drug dosages guide attached at E-trolley - Doctor to generate auto compute emergency drug dosages list in EXCEL spreadsheet in high risk areas- CICU, NICU and HD
Retrieval of Adrenaline ampoule from E-trolley	- Wrong drug - Wrong Dose	1. Knowledge deficit 2. Unfamiliar with E-trolley 3. Difficult access to Adrenaline 1:10,000 as this is placed in the inner compartment and the drawer of E-trolley can only be opened partially 4. Easy access to Adrenaline 1:1000 as it is placed in front compartment of the drawer 5. Look-alike drugs 6. Stressful environment (situation) 7. Distraction - multiple orders from doctors.	- Overdose - Lethal arrhythmias - Death	10 10	5 2	4 2	200 40	80%	- To place different strength of Adrenaline far apart from each other - Medications are placed in alphabetical order - Staff orientation / Induction program - To place common use Adrenaline 1:10,000 in an easily accessible compartment in the E-trolley - To get vendor to modify the drawer to allow full view of the drawer on hold due to budget constraint. - To use zip-lock bag to store 1:1000 adrenaline prior to putting in the trolley's compartment to ensure that concentrated adrenaline only use when necessary
Preparation	- Wrong drug - Wrong Dose - Inadequate labelling - Wrong dilution	1. Drawing out whole ampoule of 10mls Adrenaline 1:10,000 for doctor to give accordingly when required 2. No standardised label used 3. No labelling 4. Fail to check emergency drug dosage guide 5. No counter-checking with doctor upon handing over the prepared Adrenaline 1:10,000 6. Rush for time during stressful situation. 7. Under staff 8. Distraction	- Overdose or underdose - Lethal cardiac arrhythmias - Death	10 10	6 2	6 4	360 40	89%	- Take order from doctor prior to preparation - Specific doctor to give order - Refer to emergency drug dosages guide attached at E-trolley if unsure of dosages. - There are three practices for preparing Adrenaline 1: 1000 for administration - (1) syringe out the whole ampoule of 10ml and pass it to doctor to administer as required. (2) Syringe out exact volume as per doctor order. (3) Dilute 1: 1000 Adrenaline in 10 ml to and pass syringe to doctor to administer as required. - No standard stickers for labelling syringes. Use any sticky labels such as micropore, patient's sticky labels for labelling syringes during emergency. - Standardized preparation practice by syringing out exact volume as per doctor order - Syringe out subsequent doses from the ampoule as required. Do not leave open ampoule around. - To use standard stickers to label syringes immediately after syringing out the exact dosage from ampoule - To refer auto-compute emergency drug dosages guide prior to preparation of drug
Administration	- Wrong dose - Wrong drug - Wrong infusion - Wrong route	1. Miscommunication between the RN and doctor 2. Syringe not labelled clearly 3. No read-back of medication dosage when handing medications to doctors. 4. Wrong labelling 5. Take wrong syringe	- Overdose or underdose - Lethal cardiac arrhythmias - Death	10 10	6 2	6 4	360 40	89%	- The doctor will confirmed correct drug by checking the label on the syringe before administration - Mandatory to read back order dosage. - Doctor to refer auto-compute form if necessary. - Label syringes clearly with standard drug stickers.

Pre implementation - Location of Adrenaline ampoules in E-trolley drug drawer



Placement of Adrenaline 1:10 000 ampoules at back of drawer

Placement of Adrenaline 1:1000 ampoules at front of drawer

Pre implementation - Re-location of Adrenaline ampoules in E-trolley drug drawer



Adrenaline 1:10 000 ampoules placed at front of drawer for easy accessibility

Adrenaline 1:1000 ampoules placed at the back of the drawer in a closed container with a metal 'bridge' over the compartment labeled highly concentrated Adrenaline on red sticker



Pre Implementation: Preparation of E drugs - no standard labels used and drug in ampoule is fully drawn out into a syringe



Post Implementation: Preparation of E-drugs - standardized drug labels used with exact volume prepared

Old Process

- Prescription Process:**
- Verbal order of emergency drugs to be given by doctor during resuscitation
 - RN read back to doctor to confirm order
 - A laminated drug guide as a reference

New Process

Electronic Drug Prescription

Conclusion

FMEA is a useful safety improvement tool. It is a risk assessment methodology used to identify weaknesses in a complex hazardous process and generate corrective control measures to counteract these weaknesses before they result in adverse event.