



Introduction & Background

High concentrated electrolytes are classified as High Alert Medications (HAM). It is managed by a combination of control measures as specified in HAM policy; Limit access to approved locations; Follow specific recommendations on storage, prescribing, dispensing, preparation, and administration; Use labels and other methods to alert staff. ALPS team is responsible of supplying HAM concentrated electrolytes to non-pharmacy users within the hospital. Nurses are able to order high alert electrolytes under Pharmacy items listed in Ariba catalogue as required via e-procurement system on ad-hoc basis. Some clinic nurses may not be aware that their clinical areas are not listed under approved locations as per policy. ALPS team refers to HAM policy appendix 2 to check for approved locations before processing incoming request. There were 2 reported incidents on supply of HAM concentrated electrolytes to unapproved locations in 2021. ALPS team has reviewed and revised supply process with an aim to improve overall safety.

Problem Statement

HAM policy is a comprehensive document for reference of various users in the hospital. Staff are required to refer the table in HAM policy appendix 2 below prior to processing orders of HAM concentrated electrolytes (Figure 2). ALPS Pharmacy warehouse operation team which consists of logistic associates had challenges policed the supplies of HAM concentrated electrolytes.

Analysis

Root cause analysis tree diagram was adopted to facilitate analysis of the problem. A few root causes were identified.

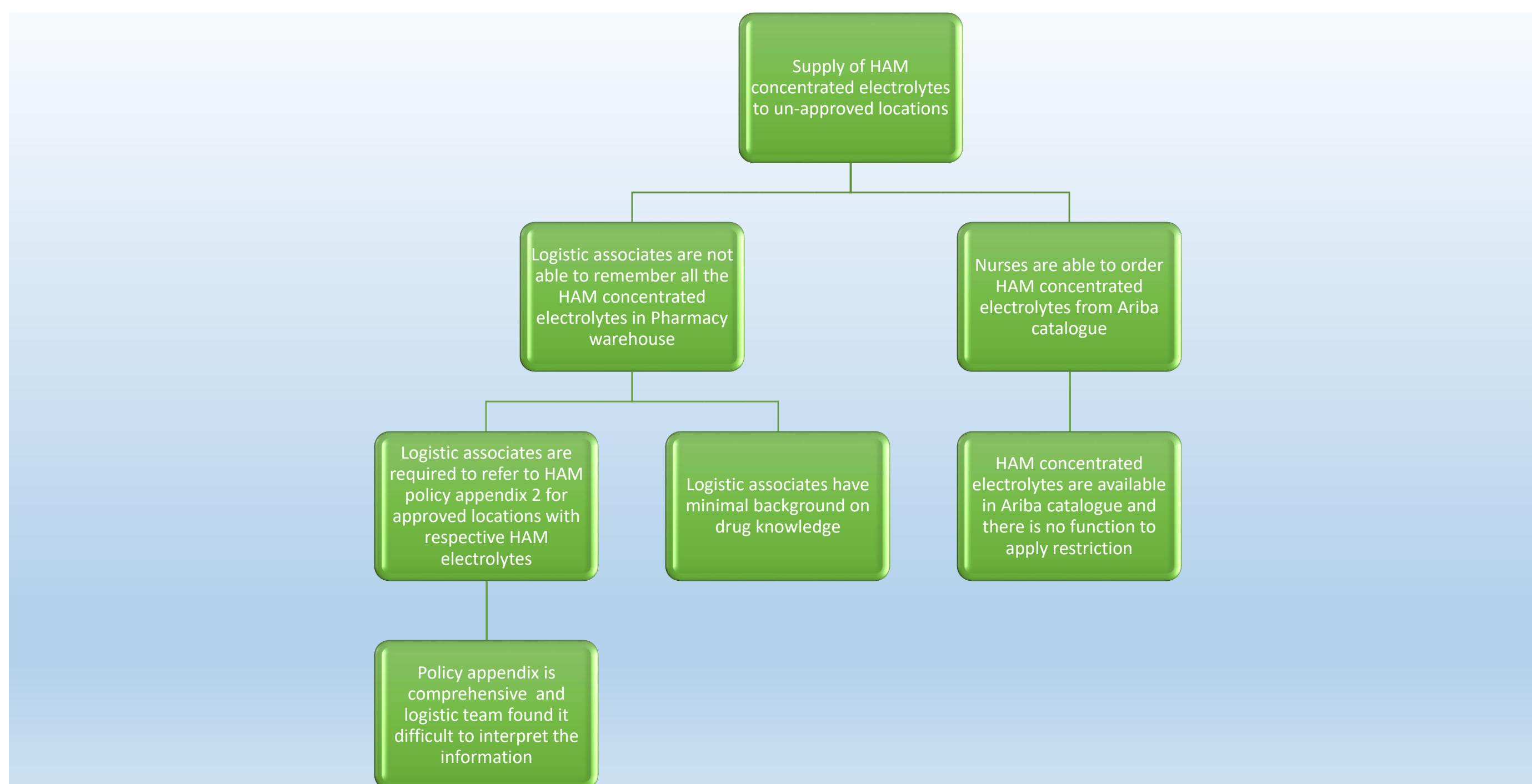


Figure 1. Root Cause Analysis Tree Diagram

Name of Drug	Allowed non-Pharmacy Locations	Recommended Indications for prescribing	Compatible Diluents	Recommended Concentration	Rate of Administration	Additional remarks
Potassium Chloride 7.45% (10ml) 0.745g per 10ml = 10mmol potassium Refer to KCL guidelines (73600-SD-023)	*All ICUs, 68 high dependency units (standby ICUs), CTS OT.	- Electrolyte replacement in fluid restricted patient on cardiac monitoring, in ICUs and cardiac operating theatres - High potassium replacement of more than 60mmol per day - Termination of late-stage pregnancy (O&G) (neat solution) - Electrolyte additives into renal replacement therapy dialysate fluids	WFI, D5, NS, LR	Peripheral line: 10mmol in 100mL (max 0.1mmol/mL) Central line: 20mmol in 100mL (up to 40mmol/100mL at discretion of physician) (uptodate) Must be used in diluted form for IV use. Can use undiluted for termination of pregnancy	Not allowed. General Ward: 10 mmol/hr (max: 20mmol/hr) ICU: 10-40 mmol/hr (with cardiac monitoring) ** If prescribing >20mmol/hour, a Registrar should take responsibility and ECG monitoring considered.	Infusion pump is recommended for solutions >40mmol/1000mL. For infusion of solutions <40mmol/1000mL, an infusion pump is preferred. However, an infusion burette is an acceptable alternative.
Magnesium Sulphate 49.3% w/v (5mL) 2.47g per 5ml = 10mmol elemental magnesium, sulphate ions	*All ICUs, all high dependency units, Adult e-kits, MOT, O&G S2 A, DEM, BVH.	- Preeclampsia - Magnesium replacement esp in patient nil by mouth or malabsorption - Replacement for Mg level < 0.75mmol/L - Moderate/severe asthma - Torsade de pointes or refractory ventricular tachyarrhythmia	NS, D5, D5, LR	Must be used in diluted form for IV use. Dilute 10mmol in 50 to 100mL. Max conc during emergency: 5mL of injection added to 7.5mL of diluent (200mg/ml)	Generally: 10mmol/hr (max: 20mmol/hr) IV push rate during emergency: not more than 150mg/min Max rate for loading during pre-eclampsia: 4g over 10-15min	Suitable for IM dosing (undiluted) if IV route not available. Incompatible with sodium bicarbonate, calcium or phosphate-containing solutions

Figure 2. HAM Appendix 2: Guidelines for Administration of Intravenous Electrolytes – administration, storage, and indications

Results

Staff were educated on the importance to restrict supply of concentrated electrolytes to only approved clinical locations before the start of new supply process in May 2022. Since the interventions, a total of 167 requests of HAM concentrated electrolytes was processed. Of which, there was one near miss discovered in June 2022. We continued to re-inforce to the operation team to be vigilant and follow new workflow step by step. There is no reported incident of issuance to unapproved clinic locations since then. A survey for ALPS operation team was conducted; the team has better understanding of HAM electrolytes (100%); familiar with the supply workflow and can handle the task confidently (96%).

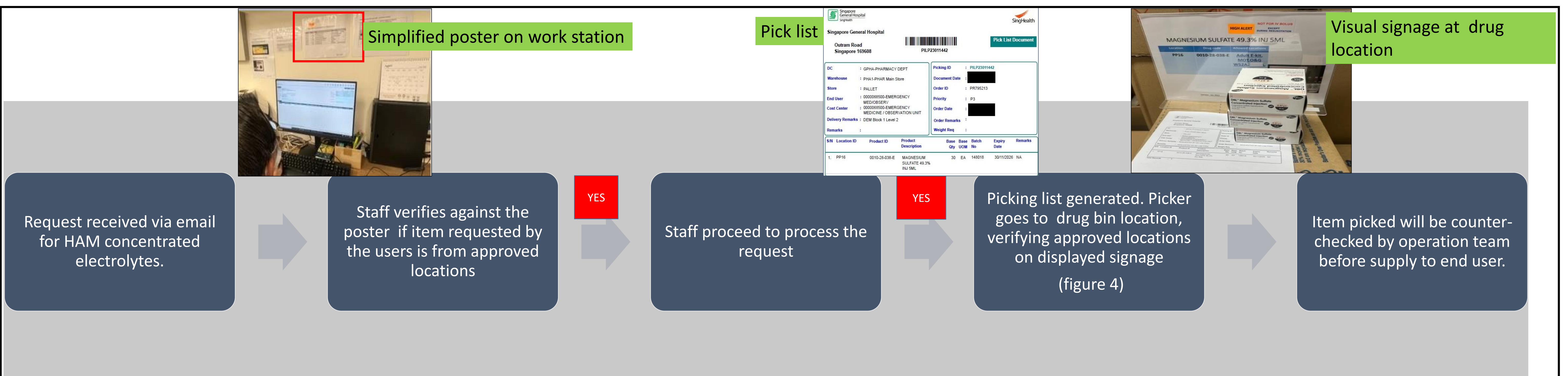


Figure 5. New workflow since May 2022

Conclusion

Staff on the ground find it challenging in interpreting complex information available in HAM policy. Relevant information in the policy was transcribed into a simplified version for easy reference. The new workflow has improved overall safety in the supply management of high concentrated electrolytes to non-pharmacy users within the hospital. Handling HAM module has been included as part of orientation program for new hire. Refresher session will be conducted to ensure consistency for ALPS team in handling supply of HAM concentrate electrolytes.

Intervention

- HAM electrolytes were removed from Pharmacy catalogue to prevent any wrong orders by nurses. Clinical areas which require HAM electrolytes will contact ALPS team to place a request via email instead of Ariba catalogue.
- ALPS team refers to a simplified poster of concentrated electrolytes with approved locations before processing the request. (Figure 3) The poster is displayed at all the operation team's work station.
- In addition, visual signage were put up at respective drug bin locations indicating only approved locations. Logistics associates can perform counter check during the picking process. (Figure 4)
- Pharmacist conducted training for ALPS team prior to implementation of new supply process.

Product ID	Location	Drug	Allowed location
0010-28-038-E	PP16	MAGNESIUM SULFATE 49.3% INJ 5ML	Adult E-kit, MOT,O&G S2A, DEM, Pharmacy
0010-40-023-W	DU-OC-02-02	CALCIUM CHLORIDE 10% INJ 10ML	MOT kit for Liver transplant, Pharmacy
0010-40-002-J	PP08	CALCIUM GLUCONATE 10% INJ 10ML	MOT, Adult E-kit, DEM, Pharmacy
0010-40-024-K	PP-1Q-01-01	POTASSIUM DIH PHOSPHATES 10MMOL/10ML INJ	Pharmacy
0010-40-008-I	PP-1T-01-01	POTASSIUM CHLORIDE 7.45% INJ 10ML/25ML	MOT, Pharmacy
0010-40-025-I	UD-OC-01-04	SOD CHLORIDE 20% INJ 10ML	Pharmacy
0009-40-030-E	PP-2J-03-01	SOD CHLORIDE 3% INJ 500ML	DEM, Pharmacy, Pulmonary Function Lab

Figure 3. HAM concentrated electrolytes for approved clinical locations (in blue)

MAGNESIUM SULFATE 49.3% INJ 5ML

Location	Drug code	Allowed Locations
PP16	0010-28-038-E	Adult E-kit, MOT,O&G W52A, DEM, Pharmacy

CALCIUM GLUCONATE 10% INJ 10ML

Location	Drug code	Allowed Locations
PP08	0010-40-002-J	MOT, DEM, Adult E-kit, Pharmacy

Figure 4. Signage is placed at drug bin location as visual reminder for logistic associates