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Research paper

Impact of LEAN implementation in restocking ambulances in an emergency department and on ambulance rotation within the Hamad Medical Corporation Ambulance Service

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ABSTRACT

Background: With the advent of the Fédération Internationale de Football Association (FIFA) World Cup 2022 in Qatar, all healthcare systems were gearing up for an influx of patients. The Hamad Medical Corporation Ambulance Service (HMCAS) has also refined its patient supply chain (SC) processes to improve ambulance turnaround times (ATATs) at the emergency departments (EDs). International ambulance services (AS) are complex, and these ambulances are equipped with approximately 500 individual items, which include various types of medical consumables and equipment used during emergencies. By organizing individual medical items into stock units called "pre-packs", according to the needs of the patients and type of clinical interventions, the inventory or stock-taking time of items stored in ambulances can be significantly reduced. Implementing reduced inventory lists of items and standardized pre-pack storage across the ambulance fleet has significantly improved the efficiency and accuracy of ambulance checking, restocking, and recovery time, improving overall ATAT at the ED.

Aim: This study evaluates the staff's perceived impact of modular pre-pack kits on ambulance restocking processes and ED ATAT.

Methods: In this cross-sectional study, a fit-for-purpose survey was designed and distributed to all operational staff at HMCAS. The survey aims to assess HMCAS staff's opinions about the implemented LEAN pre-pack system. Cronbach's alpha was calculated to assess the reliability of the survey. The Mann-Whitney U-test was conducted to compare if there was a difference between the group's opinions. The Shewhart control chart was created to monitor the impact of the implemented intervention on the ATAT at the ED. IBM-SPSS® (Statistical Package for Social Sciences) Version 26 was utilized for data analysis.

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Results: A group of 287 employees with different backgrounds participated and completed the survey. The Cronbach's alpha was equal to 0.739, indicating a satisfactory level of reliability of the Mann-Whitney U-test. The descriptive analysis and the Shewhart chart revealed that most staff found that the pre-pack concept helped improve LEAN restocking processes, access to clinical applications, and ambulance checks. Overall, this concept matched the international benchmarks for turnaround time.
Conclusion: The pre-pack concept promoted easy and quick processing of clinical applications, restocking procedures, and ambulance checks, and this positively impacted the ATAT at the ED. Further, it improved responses to emergency calls and enhanced access to effective care for patients. This approach also simplified the tasks above when many locum staff is employed on a short-term basis to cover mega-events such as the FIFA World Cup.

Keywords: LEAN concept, pre-packs, disposable items restocking, ambulance turnaround time, FIFA 2022 World Cup, Qatar

INTRODUCTION

Although there is a wide array of research on supply chain (SC) and innovation within its specific domains, there has been little focus on the patients' SC and innovative ideas at the Hamad Medical Corporation Ambulance Service (HMCAS). International ambulance services (AS) are complex, diverse, and unique, and they often operate under adverse conditions while responding to various emergency cases.[1] Ambulances are equipped with approximately 500 individual items, including various medical consumables and equipment used during emergencies. When the demand rises, these items must be quickly and readily available for immediate use. The storage of individual medical items in ambulances is inadequate in delivering efficient and effective access to these items during emergencies.[2] However, individual items create disorganized clutter, overstocking, unprofessionalism, and potential patient risks. Furthermore, overstocking of items can make the process during shift changes or at the Emergency Department (ED) tedious and time-consuming, thereby delaying the availability of ambulances.[3] By grouping individual medical items into stock-keeping units called "pre-packs", according to the needs of the patients and type of clinical interventions, the inventory lists of items stored in ambulances can be significantly reduced.[4] These pre-packed items are placed in assigned locations of all ambulances and medical response bags. This approach eases the process of restocking and also provides easier access to these items.[5] Implementing a reduced inventory of items and standardized storage of pre-packs across the ambulance fleet have significantly improved the efficiency and accuracy of ambulance checks, restocking procedures, and recovery time, which has improved the overall ambulance turnaround time (ATAT) at the ED. The ultimate and primary focus is to provide access to effective care for patients in need.

The short turnaround time of ambulances at the ED after transferring a patient is essential to ensure that the ambulance is readily available to respond to another emergency patient. Mass gathering events such as the FIFA World Cup 2022 attracted approximately 1.7 million people to the State of Qatar.[6] Temporary healthcare workforce increased to proportionally match the influx of additional people entering into the country during the events, especially in the pre-hospital care domain to attend to emergencies around the stadia and fan zones.[7] Hence, the plans to enhance health services have created improvements in the efficacy of HMCAS to ensure optimal operations. This is because the demand for emergency services was expected to rise significantly during this international competition.

Outside the clinical care element, AS can be perceived as a logistics organization, which is more relevant to a "Patient Supply Chain" system. SC dominates the fundamental pillars that support AS operations.[5] During the FIFA World Cup 2022 event, HMCAS planned to operate approximately 80 additional ambulances as part of the medical support for the event; In addition, they also planned to increase the number of foot, bicycle, and golf cart patrols at the various official locations of the mega event. Historically, data from similar events have recorded a low number of trauma-related incidents and therefore implying that most of the patient encounters were medically related.[8] This emphasizes that mass gathering events can potentially lead to mass casualty incidents, thereby changing the dynamics of patient encounters. Therefore, AS must prepare and organize itself to deal with such situations when required. In both cohorts of cases, various types of medical consumables/sundries are consumed in unusual quantities.[5] From a planning viewpoint, it also implies recruiting many

temporary staff from various healthcare systems internationally who need to quickly adapt to new equipment, supplies, and clinical practice guidelines (CPG) to perform well during any crisis.[9] Simplifying access to medical supplies through using pre-packs enables a smooth transition of recruits into the local healthcare system.

The ability of HMCAS to provide access to effective patient care depends greatly on how the HMCAS fleet is prepared and equipped with up-to-date technology.[10] Essentially, an HMCAS fleet that is well-serviced, sufficiently stocked, effectively cleaned and sterilized, and adequately manned ensures that all patients receive the best possible care.[11] According to Hutton and Alinier,[5] a short ATAT at the ED is imperative to ensure effective fleet utilization and rapid response to emergencies. This must be achieved rapidly after properly transporting the patients to the ED.[12,13]

ATAT is defined as the period measured from the time the ambulance arrives at the ED to the time it is available to respond to the next emergency call.[14,15] But the "turnaround interval" can be separated into sub-intervals: the "delivery interval" and the "recovery interval".[16] The delivery interval, known as the "ambulance off-load time" (AOLT), begins when the ambulance arrives at the ED and ends after the patient is transferred to the ED staff.[3] The "recovery interval" starts from the time the patient is transferred to the ED team, along with the time taken for cleaning and restocking of the ambulance. It ends when the ambulance crew signals that the unit is ready and available for the next service. This period may take up to an average of 10 to 15 min.[17]

Medical consumables are sourced from various manufacturers and suppliers due to their wide variety, brands, and unique characteristics. Historically, they were routinely stocked in medical response bags and ambulances as individual loose items for emergency use. With the recent changes and development across the medical arena, several studies reveal that this type of practice has since proven to be inadequate in delivering efficient and effective access to these items during emergency care of patients.[11,12,17–19]

Restocking loose medical consumables in the medical response bags and an ambulance is time-consuming and may affect ambulance turnaround. Further, the monitoring of restocking accuracy and quality assurance of a "stocked and ready" ambulance during its turnaround from the ED may therefore be negatively affected.

To mitigate the complexities of individually stocked medical consumables, the HMCAS SC has introduced modular-type treatment kits or "pre-packs, "designed from the loose medical consumables into several single specialized pre-pack units. These units are intended to be ready for use during clinical interventions on patients. These specialized pre-packs (Appendix 1, Figure 1) are uniquely designed according to specific emergency interventions performed on patients 'medics' clinical skills, which are set by CPG and clinical standards of HMCAS set counts for about 50 specialized medical pre-packs used by the trained paramedics of different levels of care credentialing within the pre-hospital environment at HMCAS.

The ambulance make-ready model focuses on a team of logistics (Figure 2) staff (they are non-clinical staff who are referred to as "Ambulance Attendants" (AA)), who are responsible for cleaning, arranging, and restocking the ambulances with medical consumables and equipment at the ED. This team plays a vital role in ensuring that the ambulances are stocked and ready to

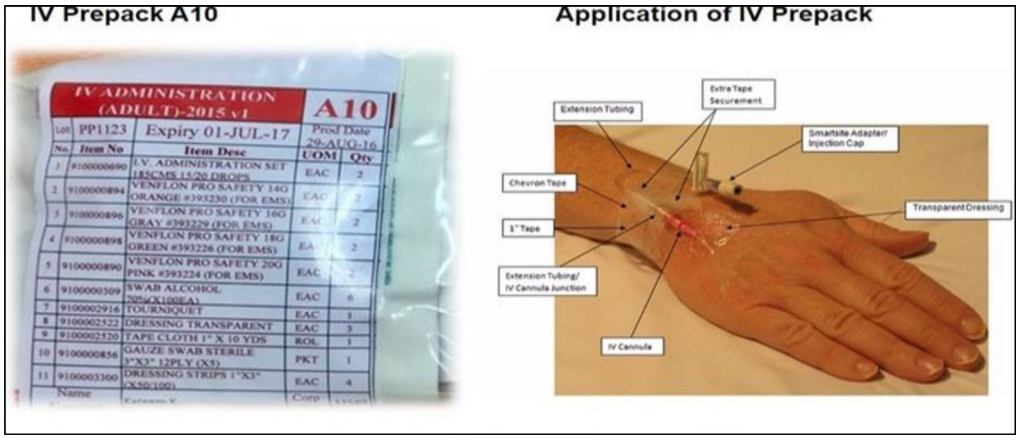

Figure 1. Example of a pre-pack used by HMCAS for intravenous cannulation.

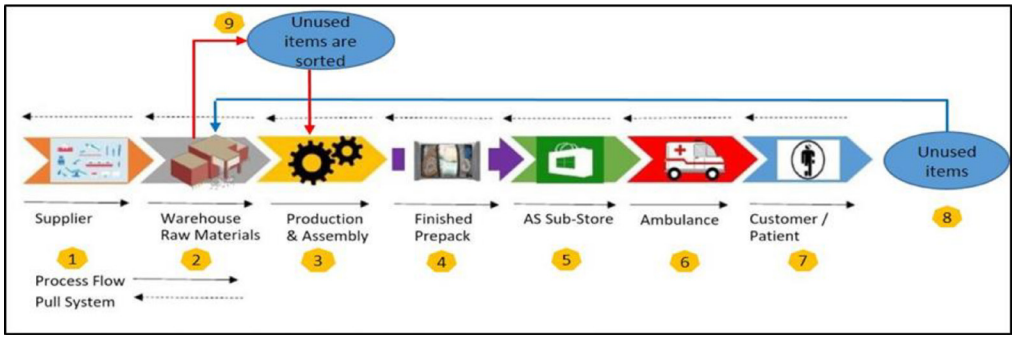

Figure 2. Ambulance pre-pack flow process at HMCAS.

respond to the next emergency with minimum turnaround times. It is complemented by each crew performing a thorough equipment inventory and filling in a checklist at the start of their shift. Once a pre-pack is opened, all unused and unsoiled items are kept inside the ambulance. When they arrive at the ED, these items are collected by the AA during the recovery phase and eventually taken to the ambulance service warehouse where they are repacked (Figure 2). This reduces wastage and prevents pre-pack cost escaper-packable (Table 1).

The study aims to evaluate the staff perceived impact of modular pre-pack kits on the restocking processes of ambulances and ATAT at the ED.

Ethical approval

The HMCAS Group, Research Oversight Committee, approved this project as a Quality Improvement project, which was exempt from Institutional Review Board approval.

METHODS

Study design

A fit-for-purpose survey was designed and distributed to all operational staff at HMCAS (Table 2). HMCAS reviewed this survey for face and content validity. The survey was then pilot tested before final approval and distribution. The results from the pilot study were excluded from the study findings. The survey focused on the paramedic's knowledge and perception of the make-ready pre-packs concept (Figure 1), and its effect on ambulance restocking and accessibility of medical supplies during clinical applications. The survey included two to five answer formats, including the Likert scale format or the Trichotomous format. The invitation to the study was sent through email to all prospective participants and reminder emails and SMS were sent to staff every seven days over three weeks in May 2021. Additionally, secondary data about ATAT at ED was extracted by the business intelligence team at HMCAS.

Participants and sample size

The HMCAS target population consisted of a total of 850 potential participants, including ambulance paramedics (AP), critical care paramedics (CCP), nurses, and AA. The participants of this study were recruited using the convenience sample. Using Slovin's sample size formula, the minimum required sample size was calculated at $n = 272$ with a confidence interval of 95%.

Statistical analysis

IBM-SPSS® version 26 was utilized for data analysis. Firstly, Cronbach's alpha coefficient for the staff survey was determined. Cronbach's alpha refers to the degree to which the survey can give the same results if repeated under the same conditions. Cronbach's alpha ≥0.6 is considered satisfactory.[20] Since the data was presented in the ordinal form (Likert scale), the Mann-Whitney U-test was conducted to assess the mean difference between the staff groups' opinions. Group 1 comprised the staff deployed in the ambulances (APs and CCPs), while Group 2 comprised the remaining staff (AA and nurses). Furthermore, the Shewhart control chart was utilized to assess the impact of the implemented intervention on the ATAT. The Shewhart control charts are widely used in quality improvement studies.[21] They helped detect the occurrence of special and normal causes within a process and monitor their behavior when implementing an intervention.

Table 1. Pre-packs at HMCAS.

Item code	Pre-pack	Item description	Average cost (QAR)
AMBULANCE PARAMEDIC PRE-PACKS (INTERMEDIATE CARE LEVEL)			
7012000121	AP ADULT ROLL	AP AIRWAY ROLL KIT - ADULT	637.50
7012000122	AP PEDIA ROLL	AP AIRWAY ROLL KIT - PAEDIATRIC	369.99
7012000081	A5	SUCTION KIT	8.78
7012000082	A6	OXYGEN KIT	3.27
7012000112	A7	OXYGEN KIT (PEDIATRIC)	4.53
7012000113	A8	NEBULIZATION KIT	4.16
7012000128	A9	CHEST SEAL KIT	79.00
7012000114	A10 TRAUMA	IV ADMINISTRATION KIT - TRAUMA (ADULT)	17.17
7012000115	A10 MEDICAL	IV ADMINISTRATION KIT - MEDICAL (ADULT)	21.34
7012000092	A11 PEDIA	I.V. ADMINISTRATION KIT (PEDIATRIC)	44.78
7012000012	A12	HYPOGLYCAEMIA KIT	3.97
7012000013	A13	I.V. FLUID NACL	3.29
7012000102	A14	WOUND/SPLINT KIT	10.20
7012000107	A15 LARGE	LARGE BURNS KIT	125.87
7012000110	A15 SMALL	SMALL BURNS KIT	58.03
7012000125	A16	DRUG ADMINISTRATION KIT	1.17
7012000105	A17	OBSTETRIC KIT	64.12
7012000106	A18	PPE DISEASE KIT	106.79
7012000063	A19	PELVIC IMMOBILIZATION KIT	74.30
7012000075	A20	MAJOR HAEMORRHAGE PACK	152.35
7012000071	A21	HYPOTHERMIA MANAGEMENT	13.07
9100001542	A22	SHAPEABLE SPLINT XL 36 INCH	20.82
7012000093	A23	TOURNIQUET KIT	41.53
CRITICAL CARE PARAMEDIC PRE-PACKS (ADVANCED CARE LEVEL)			
7012000117	C1	CCP - ADULT AIRWAY ROLL	1649.07
7012000123	C2	CCP - PEDIATRIC AIRWAY ROLL	1128.05
7012000098	C3	CCP VENTILATOR KIT - ADULT	245.14
7012000054	C4	CCP PAEDIATRIC VENTILATOR KIT	320.87
7012000126	C6	CCP DRUG ADMINISTRATION KIT	12.87
7012000072	C7A	CCP INTRA-OSSEOUS KIT (ADULT)	881.54
7012000073	C7B	CCP INTRA-OSSEOUS KIT (PEDIATRIC)	441.49
7012000108	C8	CCP INFUSION KIT	8.59
7012000031	C10	CCP NASOGASTRIC KIT	23.16
7012000119	C11	CCP ARTERIAL LINE KIT	244.00
7012000101	T1	HAMILTON T1 VENTILATOR KIT	335.74
7012000120	RSI PACK	CCP RSI SYRINGE PACK 2021	9.27
7012000116	OPA KIT	AIRWAY GUEDEL KIT	11.39

Abbreviations: AP, Ambulance Paramedic; A, Alpha; IV, Intravenous; C, Charlie; CCP, Critical Care Paramedic; QAR, Qatari Riyals; RSI, Rapid Sequence Induction.

Table 2. The survey questions used in this study.

1. Please specify your role/designation in Hamad Medical Corporation Ambulance Service (HMCAS).
2. Please specify the number of years employed at HMCAS.
3. Have you previously worked in an ambulance in HMCAS or other organizations?
4. Have you worked with pre-packed medical kits in your past employment?
5. The contents of the pre-packed kits at HMCAS are designed for the interventions performed based on patients' needs (yes/no).
6. Were you at any stage consulted to give input on the design, structure, and contents of the pre-packs at HMCAS?
7. Pre-packs reduce the inventory of items in the ambulance and response bags compared to loosely stocked medical items (yes/no).
8. Pre-packs shorten the checking times of ambulances at the start of the shift, thereby improving unit availability and turnaround time (yes/no).
9. Pre-packed medical kits help in easy access and organization of medical items indicated for a clinical intervention during the emergency (yes/no).
10. Pre-pack kits reduce the preparation time while performing clinical interventions on patients, thereby reducing the mortality of the patients (yes/no).
11. The labeling and color coding of pre-packs are well designed for memory recall during use, for example, administration of 1 gram Paracetamol infusion over 20 min, the ACS pre-pack drug doses, or to distinguish between the adult and pediatric medical pre-packs.
12. The medication pre-pack design makes easy and controlled preparation and administration of high-risk emergency medications under stressful situations (yes/no).
13. I believe that pre-pack medical kits reduce medication administration errors (yes/no).
14. Do you feel that pre-pack medical kits are beneficial in a pre-hospital emergency setting?
15. Have you encountered any missing pre-pack items while performing a clinical intervention on a patient?
16. I am confident and do not doubt that all items required for clinical intervention are always present in the pre-pack kit (yes/no).
17. The packaging quality of pre-packs is appropriate and user-friendly for prehospital use (yes/no).
18. Standardized pre-pack storage/locations inside the ambulance and in response bags is an ideal concept that promotes efficient restocking processes (yes/no).
19. The standardized pre-pack storage/location concept in ambulances and response bags makes accessing items when required (yes/no) easier.
20. The standardized pre-pack storage/location plan in the ambulance and response bags makes easy and quick restocking, thereby promoting ambulance turnaround times at the ED after a call and during shift change (yes/no).
21. The pre-pack concept and standardized storage/location plan promote accuracy and peace of mind by ensuring all items in the ambulance are present and available for the next emergency call (yes/no).
22. Based on your experience, does the pre-pack system reduce clinical risks compared to loosely stocked medical items?
23. Are you familiar with the HMCAS "unused loose medical item return process" after opening pre-packs?
24. I make it my duty to return all unused items from opened pre-packs used in my care to the supply chain through the appropriate production processes for recycling (yes/no).
25. The integrity of recycled contents in the pre-packs is satisfactory and safe for patient use (yes/no).
26. In comparison to loosely stocked medical items, pre-packs are more accessible and remove the burden of having to search through multiple items from the stores' shelves at ED during restocking (yes/no).
27. The pre-pack system shortens restocking times and improves ambulance make-ready processes to achieve better ambulance turnaround at the ED (yes/no).

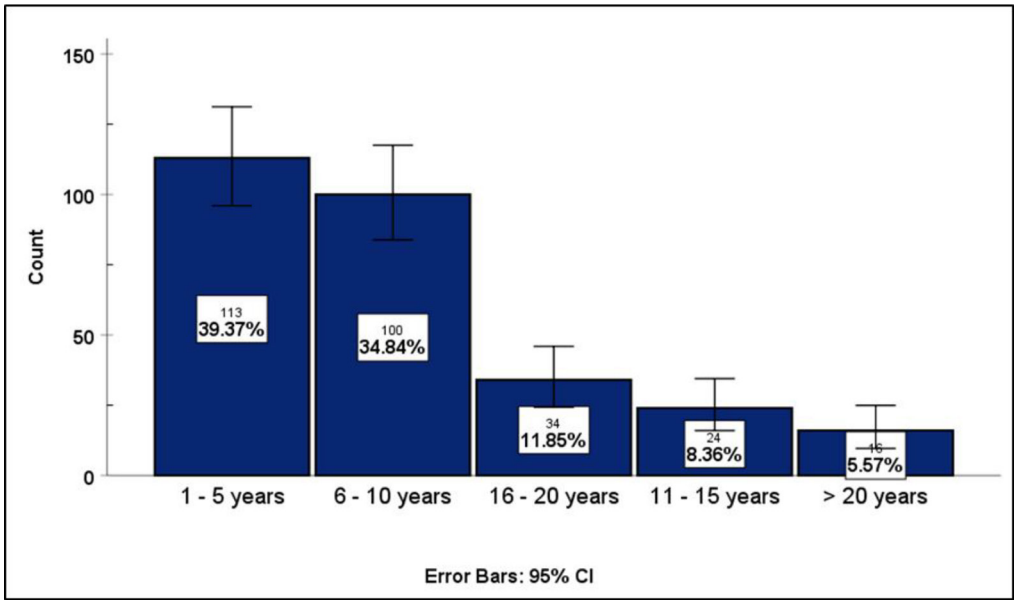

Figure 3. Classification of staff experiences of study participants.

RESULTS

A total of 287 staff at HMCAS completed the survey. Among the participants, 5.9% were AA, 78.7% were AP, 14.3% were CCP, and 1.1% were nurses. The work experience of the staff at HMCAS for most of the participants' population was between one and five years (Figure 3). The Cronbach's alpha was determined (Table 4) with an overall coefficient equal to 0.739, indicating that the survey utilized in this study had a satisfactory reliability level. Tables 2 and 3 summarize the descriptive data and results of this survey.

Almost 94% of the participating staff found that the pre-pack concept supports LEAN restocking processes and improves access and clinical applications, ambulance checks, and overall ATAT at the ED. Only 32.1% of the respondents had prior experience with a pre-pack system from other organizations before joining HMCAS, and 95.5% reportedly had the opportunity to contribute to the design, structure, and contents of the pre-packs at HMCAS. Only 1.7% of the participants highlighted that they had experienced missing items in the pre-packs.

Most staff's experience with pre-packs was generally positive. They believed that pre-packs reduce inventory items and ambulance checks and enhance patient interventions. They also understood that these packs are easily accessible in ambulances or medical response bags. More than 75% of HMCAS participants reported familiarity with pre-packs and the process of returning unused pre-pack items. The survey participants preferred restocking pre-packs in comparison to loosely stocked medical items. Overall, they were confident about all aspects of the pre-pack storage and location (Table 2). Furthermore, the Mann-Whitney U-test for each item of the surveys showed a *p*-value of more than 0.05 except for question 25 (Table 5). This indicates that both the groups (Groups 1 and 2) have similar distributions and that the mean engagement scores were not statistically significantly different. Additionally, the Shewhart control chart (Figure 3) illustrated that the implemented intervention effectively reduced the ATAT at the ED to an acceptable level. This improvement was observed between weeks 24 and 41 (Figure 4).

DISCUSSION

The medical items that are loosely stocked in ambulances create potential issues such as overstocking, increased supply inventory, expired items, disorganized and cluttered stockings, and increased clinical risks and waste. All these factors lead to significant financial costs, time loss, increased patient risks, and operational disruption, thereby impacting the ATAT at the ED. Therefore, this study aimed to determine if the innovation of modularized pre-pack adds value to the end user, evaluate the restocking processes as perceived by HMCAS staff, and measure the patient supply

Table 3. Descriptive statistics of the survey items.

		Staff categories							
		Ambulance attendant		Ambulance paramedic		Critical care paramedic		Nurse	
		Count	Column *N*	Count	Column *N*	Count	Column *N*	Count	Column *N*
Q3	No	8	47.1%	67	29.6%	4	9.8%	0	0.0%
	Not Sure	0	0.0%	1	0.4%	0	0.0%	0	0.0%
	Yes	9	52.9%	158	69.9%	37	90.2%	3	100.0%
Q4	No	9	52.9%	143	63.3%	34	82.9%	0	0.0%
	Not Sure	0	0.0%	9	4.0%	0	0.0%	0	0.0%
	Yes	8	47.1%	74	32.7%	7	17.1%	3	100.0%
Q5	Agree	17	100.0%	215	95.1%	39	95.1%	3	100.0%
	Disagree	0	0.0%	1	0.4%	2	4.9%	0	0.0%
	Not sure	0	0.0%	10	4.4%	0	0.0%	0	0.0%
Q6	No	8	47.1%	123	54.4%	28	68.3%	2	66.7%
	Not sure	2	11.8%	19	8.4%	1	2.4%	1	33.3%
	Yes	7	41.2%	84	37.2%	12	29.3%	0	0.0%
Q7	Agree	16	94.1%	200	88.5%	30	73.2%	3	100.0%
	Disagree	0	0.0%	12	5.3%	8	19.5%	0	0.0%
	Not sure	1	5.9%	14	6.2%	3	7.3%	0	0.0%
Q8	Agree	16	94.1%	221	97.8%	39	95.1%	3	100.0%
	Disagree	0	0.0%	3	1.3%	2	4.9%	0	0.0%
	Not sure	1	5.9%	2	0.9%	0	0.0%	0	0.0%
Q9	Agree	17	100.0%	221	97.8%	31	75.6%	3	100.0%
	Disagree	0	0.0%	2	0.9%	6	14.6%	0	0.0%
	Not sure	0	0.0%	3	1.3%	4	9.8%	0	0.0%
Q10	Agree	17	100.0%	217	96.0%	25	61.0%	3	100.0%
	Disagree	0	0.0%	0	0.0%	9	22.0%	0	0.0%
	Not sure	0	0.0%	9	4.0%	7	17.1%	0	0.0%
Q11	Agree	15	88.2%	205	90.7%	34	82.9%	3	100.0%
	Disagree	0	0.0%	3	1.3%	2	4.9%	0	0.0%
	Not sure	2	11.8%	18	8.0%	5	12.2%	0	0.0%
Q12	Agree	17	100.0%	216	95.6%	34	82.9%	3	100.0%
	Disagree	0	0.0%	1	0.4%	6	14.6%	0	0.0%
	Not sure	0	0.0%	9	4.0%	1	2.4%	0	0.0%
Q13	Agree	16	94.1%	202	89.4%	34	82.9%	2	66.7%
	Disagree	0	0.0%	2	0.9%	6	14.6%	0	0.0%
	Not sure	1	5.9%	22	9.7%	1	2.4%	1	33.3%
Q14	No	0	0.0%	2	0.9%	1	2.4%	0	0.0%
	Not sure	0	0.0%	5	2.2%	5	12.2%	0	0.0%
	Yes	17	100.0%	219	96.9%	35	85.4%	3	100.0%

(cont.)

Table 1. (Continued)

		Staff categories							
		Ambulance attendant		Ambulance paramedic		Critical care paramedic		Nurse	
		Count	Column *N*	Count	Column *N*	Count	Column *N*	Count	Column *N*
Q15	No	11	64.7%	111	49.1%	15	36.6%	2	66.7%
	Not sure	2	11.8%	32	14.2%	6	14.6%	1	33.3%
	Yes	4	23.5%	83	36.7%	20	48.8%	0	0.0%
Q16	Agree	16	94.1%	178	78.8%	23	56.1%	3	100.0%
	Disagree	1	5.9%	14	6.2%	13	31.7%	0	0.0%
	Not sure	0	0.0%	34	15.0%	5	12.2%	0	0.0%
Q17	Agree	16	94.1%	204	90.3%	32	78.0%	3	100.0%
	Disagree	0	0.0%	7	3.1%	8	19.5%	0	0.0%
	Not sure	1	5.9%	15	6.6%	1	2.4%	0	0.0%
Q18	Agree	17	100.0%	216	95.6%	38	92.7%	3	100.0%
	Disagree	0	0.0%	3	1.3%	1	2.4%	0	0.0%
	Not sure	0	0.0%	7	3.1%	2	4.9%	0	0.0%
Q19	Agree	17	100.0%	220	97.3%	39	95.1%	3	100.0%
	Disagree	0	0.0%	1	0.4%	2	4.9%	0	0.0%
	Not sure	0	0.0%	5	2.2%	0	0.0%	0	0.0%
Q20	Agree	17	100.0%	223	98.7%	38	92.7%	3	100.0%
	Disagree	0	0.0%	1	0.4%	0	0.0%	0	0.0%
	Not sure	0	0.0%	2	0.9%	3	7.3%	0	0.0%
Q21	Agree	16	94.1%	215	95.1%	35	85.4%	3	100.0%
	Disagree	0	0.0%	2	0.9%	2	4.9%	0	0.0%
	Not sure	1	5.9%	9	4.0%	4	9.8%	0	0.0%
Q22	No	0	0.0%	4	1.8%	8	19.5%	0	0.0%
	Not sure	1	5.9%	16	7.1%	5	12.2%	1	33.3%
	Yes	16	94.1%	206	91.2%	28	68.3%	2	66.7%
Q23	No	1	5.9%	20	8.8%	4	9.8%	0	0.0%
	Not sure	1	5.9%	26	11.5%	2	4.9%	0	0.0%
	Yes	15	88.2%	180	79.6%	35	85.4%	3	100.0%
Q24	Agree	17	100.0%	210	92.9%	33	80.5%	3	100.0%
	Disagree	0	0.0%	5	2.2%	5	12.2%	0	0.0%
	Not sure	0	0.0%	11	4.9%	3	7.3%	0	0.0%
Q25	Agree	14	82.4%	204	90.3%	31	75.6%	3	100.0%
	Disagree	0	0.0%	2	0.9%	0	0.0%	0	0.0%
	Not sure	3	17.6%	20	8.8%	10	24.4%	0	0.0%
Q26	Agree	15	88.2%	213	94.2%	35	85.4%	3	100.0%
	Disagree	0	0.0%	4	1.8%	5	12.2%	0	0.0%
	Not sure	2	11.8%	6	2.7%	1	2.4%	0	0.0%
	Agree	17	100.0%	223	98.7%	36	87.8%	3	100.0%
Q27	Disagree	0	0.0%	1	0.4%	2	4.9%	0	0.0%
	Not sure	0	0.0%	2	0.9%	3	7.3%	0	0.0%

Table 4. Reliability analysis of the survey items.

1. Reliability statistics				
Cronbach's alpha		Cronbach's alpha based on standardized items		N of items
.739		.868		25
2. Item-total statistics				
	Scale mean if the Item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's alpha if the item deleted
Q3	65.91	23.158	−.091	.777
Q4	66.69	22.632	−.036	.773
Q5	65.41	22.010	.424	.728
Q6	66.56	20.169	.252	.741
Q7	65.56	20.467	.483	.716
Q8	65.40	21.838	.476	.726
Q9	65.44	21.434	.478	.723
Q10	65.48	21.035	.521	.718
Q11	65.48	21.466	.444	.724
Q12	65.44	20.954	.640	.715
Q13	65.50	20.986	.515	.718
Q14	65.41	21.558	.606	.722
Q15	66.46	23.154	−.094	.779
Q16	65.69	21.027	.289	.731
Q17	65.52	20.738	.486	.718
Q18	65.42	21.940	.420	.728
Q19	65.39	22.120	.436	.729
Q20	65.38	22.484	.391	.733
Q21	65.43	21.617	.494	.724
Q22	65.52	20.632	.539	.715
Q23	65.63	22.049	.129	.743
Q24	65.48	21.289	.440	.723
Q25	65.49	21.940	.329	.730
Q26	65.45	21.245	.497	.721
Q27	65.39	21.688	.631	.723

chain performance and ATAT at the ED. Quality assurance of pre-packs is a fundamental aspect as discrepancies could be detrimental to patient outcomes. There are defined SC production processes to address discrepancies, thereby mitigating such potential occurrences. Historically, there have been no reported cases of significant harm to patients or interventions caused by missing items in pre-packs at HMCAS.

The pre-pack system or concept was considered not only an important element within the ambulance operations as it impacts both the ambulance restocking and ATATs at the ED, but also it simplifies the task for new or temporary staff who need to gather required items to treat patients during the mass gathering event like FIFA World Cup 2022 in Qatar. Pre-packs were also designed according to patients' specific needs and paramedics' skills. The pre-pack system within the prehospital setting is relatively new and was first used in the HMCAS in 2013.[5] The pre-packs have subsequently undergone various phases of improvement to make them lean. However, the pre-pack principle has been utilized in other industries to enhance customers' experience. The concept of pre-packaged kits has been used for several decades within the hospital theatre, airline, food

Table 5. Mann-Whitney U-test results of survey items.

	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
Mann-Whitney U	7492.5	8044	7561	8056.5	8169	7959	7419	8067
Wilcoxon W	10732.5	29572	29089	29584.5	11409	29487	28947	29595
Z	−1.499	−1.039	−1.294	−0.602	−0.617	−1.32	−2.794	−0.637
Asymp. Sig. (2-tailed)	0.134	0.299	0.196	0.547	0.537	0.187	0.005	0.524
	Q12	**Q13**	**Q14**	**Q15**	**Q16**	**Q17**	**Q18**	**Q19**
Mann-Whitney U	8020	8232	8044	7434	7873	8104	8197.5	8032
Wilcoxon W	29548	29760	29572	10674	29401	29632	29725.5	11272
Z	−1.008	−0.138	−1.039	−1.471	−0.874	−0.511	−0.363	−1.38
Asymp. Sig. (2-tailed)	0.313	0.891	0.299	0.141	0.382	0.609	0.716	0.168
	Q20	**Q21**	**Q22**	**Q23**	**Q24**	**Q25**	**Q26**	**Q27**
Mann-Whitney U	8040	8135	7722.5	7931	7747.5	7467.5	7808	8244
Wilcoxon W	29568	29663	29250.5	29459	29275.5	28995.5	28923	29772
Z	−1.536	−0.547	−1.557	−0.813	−1.76	−2.273	−1.106	-0.2
Asymp. Sig. (2-tailed)	0.124	0.584	0.119	0.416	0.078	0.023	0.269	0.841

a. Grouping Variable: Staff Classification (1: APs and CCPs; 2: Attendant and nurses)

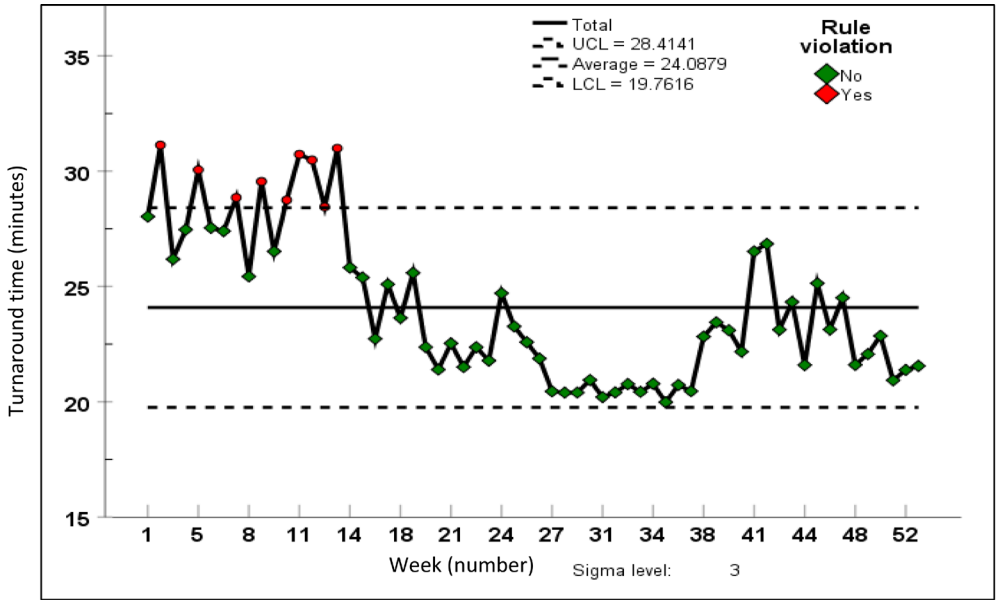

Figure 4. Shewhart chart of the average Turnaround time (minutes) of ambulances at the emergency department.

industries, factories, and the military.[22] For instance, in the airline industry, passengers are served pre-packaged meals according to their airline ticket status and dietary requirements.[23]

Pre-packs have significantly reduced the inventory of items in ambulances and medical response bags and further streamlined the patient supply chain.[22] The lean pre-packs facilitated ease of

Table 6. The most commonly used pre-packs (2022).

Ranked pre-pack	Pre-pack	Item description
1	A10 MEDICAL	I.V. ADMINISTRATION KIT - MEDICAL (ADULT)
2	A13	I.V. FLUID NACL
3	A14	WOUND/SPLINT KIT
4	A16	DRUG ADMINISTRATION KIT
5	A10	I.V. ADMINISTRATION - TRAUMA (ADULT)
6	A6	OXYGEN KIT
7	A11	I.V. ADMINISTRATION KIT (PEDIATRIC)
8	A8	NEBULIZATION KIT
9	C6	CCP DRUG ADMIN KIT
10	A21	HYPOTHERMIA MANAGEMENT

Abbreviations: A, Alpha; IV, Intravenous; C, Charlie; CCP, Critical Care Paramedic.

restocking by the locum staff of FIFA World Cup 2022 in Qatar. The pre-packs are prepared by a specialized support services team at HMCAS based on the agreed contents, as they are not commercially available. Hence, various loose items are sourced from various service providers and pre-packed by a team at HMCAS. This procedure follows rigorous practice to reduce the risk of missing items (Figure 2).

Due to the reduced inventory and standardized storage locations of medical items in ambulances, the restocking processes have been efficient. This improvement led to a reduction in the recovery time of ambulances at the ED. This has been validated by the findings of the study. Most or nearly all staff perceive the pre-pack concept and the strategic placements of items in ambulances and medical response bags in comparison to an individual or loose medical items. As a result, there was a positive impact on improving the restocking methods, accessibility, and ambulance checks. This further ease the staff's burden, replenishing, and checking ambulances simple and effective. The performance of the pre-pack approach in ambulances has significantly minimized the overall handling of individual medical items. The most commonly utilized pre-packs at HMCAS are presented in Table 6.

An impact on ATAT (Figure 4) at the Hamad General Hospital (HGH) ED, the largest tertiary care hospital in Qatar, depends entirely on the process flows of how ambulances are made available from the ED after transferring the patients to the ED staff. The innovative concept of the pre-pack system improves the operational handling of individual items. Subsequently, this concept positively impacts the operation of AS, such as restocking, checking, and accessing items in ambulances and medical response bags; further, this enhances the clinical benefits for patients.

The stepwise approach from the inception of the pre-pack system is evident that these approaches have considerably impacted ATAT at the HGH ED. This is measured against international norms where the average ATAT at EDs was between 30 and 35 min,[24] while the average ATAT in our study was between 20 and 25 min.

LIMITATIONS

1. The study relied on a convenience sample of participants who volunteered to answer the survey. This could introduce some positive or negative selection bias of people who specifically wanted to voice their opinion concerning the pre-pack approach.
2. The questionnaire may have not fully evaluated the staff's perceptions of the pre-pack system since it was limited to essential important closed-ended questions.
3. Although English is the primary mode of communication within HMCAS, the employees within the organization are from various countries; hence, the interpretation of the survey questions may have differed based on their level of English proficiency.
4. The quantitative method utilized in this study was appropriate; however, further studies should explore the qualitative approach using interviews or focus group discussions. In so doing, non-verbal cues could be observed, and further probing of questions could be conducted.

5. Although there were 1400 clinical staff in HMCAS at the time of the study, the sample population was limited to those directly involved with the pre-packs and support staff. This established a sample population of 850 staff from which the required sample size of a minimum of 272 participants was calculated.
6. The findings of this study are limited to HMCAS and may not be generalizable to other international settings. Resource availability may hamper an effective inquiry.
7. Ambulance offload delays (AODs) were excluded from the ATAT data as the focus was on the recovery times of ambulances at the ED. Potential AODs are identified by the National Command Center at HMCAS which diverts ambulances to other receiving facilities to mitigate delays.
8. Pre-pack contents may vary based on the supplier.

CONCLUSION

This study contributes to the theoretical framework for understanding the patient supply chain and innovative concepts that could improve the performance or operational processes within the prehospital setting. The results presented in this study show that the pre-pack innovative concept positively impacts various aspects of ambulance service operations including processes, clinical applications, and outcomes. It is applicable in all AS. The outcomes of this study are true reflection of the initial hypothesis that "the modular make-ready lean pre-pack system and innovation improve ATAT at HGH ED". Such innovative practice was especially important for Qatar preparation to host the FIFA 2022 World Cup, during which the volume of that event has created a significant increase in the emergency calls as expected. This has also involved the recruitment of a very large number of new locum staff temporarily hired to provide pre-hospital medical coverage for that mega sporting event.

Conflict of Interest

The authors have no conflict of interest to declare.

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APPENDIX 1
HMCAS Pre-pack contents:

A5.3 - SUCTION KIT			A5
Sl No	**Item description**	**UOM**	**Qty**
1	CATH YANKEUR 72"X7/32" POOLE	EAC	1
2	CATH SUCTION 06 FG W/CON VALVE	EAC	1
3	CATH SUCTION 10 FG W/CON VALVE	EAC	1
4	CATH SUCTION 18 FG W/CON VALVE	EAC	1

A6 - OXYGEN KIT (ADULT)			A6
Sl No	**Item description**	**UOM**	**Qty**
1	OXYGEN CANNULA NASAL GREEN TRANSPARENT 200cm LONG TUBE ADULT SIZE	EAC	1
2	MASK OXYGEN NON-REBREATHING ADULT SIZE, W/VENT, BAG, EXT.TUBE, STERILE	EAC	1

A7 - OXYGEN KIT (PEDIATRIC)			A7 Pedia
Sl No	**Item description**	**UOM**	**Qty**
1	OXYGEN MASK PEDIATRIC SIZE, NON-REBREATHING WITH RESERVE BAG AND 7 FEET TUBING	EAC	1
2	CANNULA NASAL OXYGEN W/TBG, PEDIATRIC, DISPOSABLE..	EAC	1

A8 - NEBULIZATION KIT			A8
Sl No	**Item description**	**UOM**	**Qty**
1	NEBULIZER SET W/O T-PIECE WITH MASK & 7FT SUPPLY TUBE, ADULT SIZE	EAC	1
2	NEBULIZER SET W/MASK & 7FT SUPPLY TUBE, PAED. SIZE	EAC	1

A9 - CHEST SEAL KIT			A9
Sl No	**Item description**	**UOM**	**Qty**
1	HYFIN VENT CHEST SEAL TWIN PACK, 6 X 6 INCHES	EAC	1

A10 - IV ADMINISTRATION TRAUMA (ADULT)			A10 Trauma
Sl No	**Item description**	**UOM**	**Qty**
1	I.V. ADMINISTRATION SET 15/20 DROPS, TUBE LENGTH APPROX.:185CM, STERILE	EAC	1
2	VENFLON PRO SAFETY IV CATHETER, SIZE 16Gx45MM, GREY COLOR, STERILE	EAC	2
3	SWAB IMPREGNATED IN 70% ISOPROPYL ALCOHOL, SIZE: 4X4CM, STERILE	EAC	2
4	DRESSING STRIP ADHESIVE, SIZE 1"X3" WATERPROOF, STERILE	EAC	2
5	TOURNIQUET DISPOSABLE FOR DRAWING BLOOD, LATEX 1"X18"X0.025" PERFORATED ROLL, BLUE COLOR	EAC	1
6	DRESSING SEMI-PERMEABLE SIZE: 7 CM X 8 CM, WITH LABEL, ADHESIVE, THIN FILM	EAC	1
7	STOPCOCK 3-WAY LUER LOCK #394600	EAC	1

A10 - IV ADMINISTRATION MEDICAL (ADULT)			A10 Medical
Sl No	**Item description**	**UOM**	**Qty**
1	I.V. ADMINISTRATION SET 15/20 DROPS, TUBE LENGTH APPROX.:185CM, STERILE	EAC	1
2	IV CANNULA SAFETY WITH INJECTION PORT, GREEN COLOR, SIZE G18 X 32MM, LATEX FREE, STERILE	EAC	1
3	IV CANNULA SAFETY WITH INJECTION VALVE, PINK COLOR, SIZE:20G X 32MM, LATEX FREE, STERILE	EAC	2
4	SWAB IMPREGNATED IN 70% ISOPROPYL ALCOHOL, SIZE: 4X4CM, STERILE	EAC	2
5	TOURNIQUET DISPOSABLE FOR DRAWING BLOOD, LATEX 1"X18"X0.025" PERFORATED ROLL, BLUE COLOR	EAC	1
6	DRESSING SEMI-PERMEABLE SIZE: 7 CM X 8 CM, WITH LABEL, ADHESIVE, THIN FILM DESIGNED FOR I.V. CATHETER SITES AND TO SECURE OR COVER INTRAVASCULAR DEVICES, STERILE	EAC	1
7	DRESSING STRIP ADHESIVE, SIZE 1"X3" WATERPROOF, STERILE	EAC	2
8	STOPCOCK 3-WAY LUER LOCK	EAC	1

A11 - IV ADMINISTRATION KIT (PEDIATRIC)			A11
Sl No	**Item description**	**UOM**	**Qty**
1	I.V. ADMINISTRATION SET 15/20 DROPS, TUBE LENGTH APPROX.:185CM, STERILE	EAC	1
2	VENFLON PRO SAFETY 22G BLUE	EAC	2
3	INSYTE AUTOGUARD BC WINGED 24 GA 0.7 IN 0.7x9MM, REF# 382912 (FOR AMBULANCE SERV)	EAC	2
4	SWAB IMPREGNATED IN 70% ISOPROPYL ALCOHOL, SIZE: 4X4CM, STERILE	EAC	4
5	TOURNIQUET DISPOSABLE FOR DRAWING BLOOD, LATEX 1"X18"X0.025" PERFORATED ROLL, BLUE COLOR	EAC	1
6	DRESSING I.V.TRANSPARENT FILM, ADHESIVE, WITH BORDER, SIZE 5CMSX5.7CMS, DESIGNED TO SECURE THE CATHETER FOR CHILDREN, STERILE	EAC	2
7	I.V. ARM BOARD PAED., CUSHION PADDED, WITH PLASTIC COVER, WASHABLE, DISPOSABLE, SIZE : 3 x 9 INCH	EAC	1
8	BANDAGE CREPE 2"	ROL	1

	A12 - HYPOGLYCEMIA KIT		A12
Sl No	**Item description**	**UOM**	**Qty**
1	DEXTROSE 10%,500ML	BAG	1

	A13 - I.V.FLUID		A13
Sl No	**Item description**	**UOM**	**Qty**
1	SODIUM CHLORIDE 0.9%, 500ML	BAG	1

	A14 - WOUND/SPLINT KIT		A14
Sl No	**Item description**	**UOM**	**Qty**
1	TAPE CLOTH WHITE ADHESIVE SIZE:1 INCH x 10 YARDS	ROL	1
2	BANDAGE CREPE 4”	ROL	1
3	GAUZE SWAB (100% COTTON) 12 PLY, PLAIN, WHITE, FOLDED EDGES, 15 THREADS/CM2, STERILE, SIZE:10x10CM, PKT/5	PKT	1
4	BANDAGE TRIA.136X96X96 COTTON	EAC	1
5	WOUND DRESSING SIZE 12CMX12CM MD1894 - MEDIUM	EAC	1
6	WOUND DRESSING SIZE 18CMX18CM MD1895 - LARGE	EAC	2

	A15 - LARGE BURNS KIT		A15 Large
Sl No	**Item description**	**UOM**	**Qty**
1	DRESSING BURN HYDROGEL 500G/17.5OZ SIZE:24X16INCH, STERILE	EAC	1
2	FACIAL BURN DRESSING MASK 30CMx40CM	EAC	1

	A15 - SMALL BURNS KIT		A15 Small
Sl No	**Item description**	**UOM**	**Qty**
1	DRESSING BURN HYDROGEL 40G/1.4OZ SIZE:4X4INCH, STERILE	EAC	2
2	DRESSING BURN HYDROGEL 120G/4.2OZ SIZE:8X8INCH, STERILE	EAC	2
3	PLASTIC CLING WRAP, SIZE: 4 INCHES (WIDTH), 50 METERS LONG. (PER ROLL)	EAC	1

	A16 - DRUG ADMINISTRATION KIT		A16
Sl No	**Item description**	**UOM**	**Qty**
1	SOD. CHLORIDE 0.9% FOR INJECTION, 10 ML	AMP	1
2	SYRINGE TUBERCULIN 1CC WITH NEEDLE, 25G/26GX5/8”, STERILE	EAC	1
3	SYRINGE WITH NEEDLE 03CC 21GX1.5 - LUER LOCK, STERILE	EAC	1
4	SYRINGE WITH NEEDLE LUER SLIP 5CC 23GX1.25”, STERILE	EAC	1
5	SYRINGE WITH NEEDLE 10CC 21GX1.5 - LUER LOCK, STERILE	EAC	1
6	NEEDLE 22G 1.5”	EAC	1
7	NEEDLE 25G 5/8” LUER LOCK, STERILE	EAC	1
8	SWAB IMPREGNATED IN 70% ISOPROPYL ALCOHOL, SIZE: 4X4CM, STERILE	PKT	6

	A17 - OBSTETRIC KIT		A17
Sl No	**Item description**	**UOM**	**Qty**
1	DRESSING MULTI-TRAUMA 10” X 30”, ABSORBENT, STERILE,	EAC	1
2	BLADE SURGICAL W/SCALPEL SZ.10	EAC	1
3	SYRINGE BULB FOR ASPIRATION AND IRRIGATION (EAR AND ULCER) SIZE: 02 OUNCES, LATEX FREE, STERILE	EAC	1

4	UMBILICAL CORD CLAMP STERILE, DISPOSABLE	EAC	3
5	GAUZE SWAB (100% COTTON) 12 PLY, PLAIN, WHITE, FOLDED EDGES, 15 THREADS/CM2, STERILE, SIZE:10x10CM, PKT/5	PKT	1
6	PLASBAG YELLOW MED.WASTE B.HAZ.SIZE 25"X17"	EAC	1
7	BLANKET BABY WRAP, SIZE: 80 CMX80 CM, ABSORBENT THERMAL, WIND, AND WATERPROOF	EAC	1
8	TOWEL HAND, COTTON, BLUE, STERILE, DISPOSABLE, (1 PACK)	EAC	2
9	BABY CAP STRIPED PINK & BLUE	EAC	1
10	MATERNITY/SANITARY PAD N/STERILE SIZE: X-LARGE WITH ADHESIVE TAPE, HIGHLY ABSORBENT	EAC	2
11	TEMPA DOT THERMOMETER FOR PEDIATRIC	EAC	2

A18 - PPE DISEASE KIT			**A18**
Sl No	**Item description**	**UOM**	**Qty**
1	GLOVES EXAMINATION NITRILE SIZE LARGE WITH ALOE VERA, POWDER-FREE, GREEN COLOR, EXTRA SENSITIVE NITRILE, NON-STERILE	EAC	4
2	GLOVES EXAMINATION NITRILE WITH ALOE VERA, POWDER-FREE, GREEN COLOR, EXTRA SENSITIVE NITRILE, NON-STERILE, SIZE: X- LARGE	EAC	4
3	OVER SHOE COVER, NON-WOVEN, 40x15cm, BLUE, FITS ALL SIZES, DISPOSABLE	EAC	4
4	SURGICAL MASK N95 REGULAR SIZE 3 LAYER, LATEX FREE, FLUID SHIELD N95 PARTICULAR FILTER RESPIRATOR SURGICAL MASK.	EAC	2
5	FACE MASK SURGICAL, DISPOSABLE WITH BACTERIAL FILTER, MULTIPLE PLEATS, HYPOALLERGENIC, NON-WOVEN INNER FACING, SOFT ALUMINUM NOSE PIECE, AND RESILIENT COTTON TIES (X50)	EAC	1
6	TYVEK SUIT MEDIUM	EAC	2
7	TYVEK SUIT XL	EAC	2

A19 - PELVIC IMMOBILIZATION KIT			**A19**
Sl No	**Item description**	**UOM**	**Qty**
1	PELVIC SLING	EAC	1

A20 - MAJOR HAEMORRHAGE KIT			**A20**
Sl No	**Item description**	**UOM**	**Qty**
1	BLAST BANDAGE	EAC	1
2	CHITO GAUZE	EAC	1

A21 - HYPOTHERMIA MANAGEMENT			**A21**
Sl No	**Item description**	**UOM**	**Qty**
1	WARMING BLANKETS, DOUBLE-SIDED FLEECE,180G/M2, NAVY BLUE, SIZE 102 CMX214 CM	EAC	1

A23 - TOURNIQUET KIT			**A23**
Sl No	**Item description**	**UOM**	**Qty**
1	SOF TACTICAL TOURNIQUET	EAC	1

	OPA - AIRWAY GUEDEL KIT		OPA
Sl No	**Item description**	**UOM**	**Qty**
1	AIRWAY GUEDEL SIZE: 0, SIZE EMBOSSED, WITH COLOR-CODED BITE BLOCKS, ANATOMICALLY SHAPED, STERILE	EAC	2
2	AIRWAY GUEDEL SIZE: 1, SIZE EMBOSSED, WITH COLOR-CODED BITE BLOCKS, ANATOMICALLY SHAPED, STERILE	EAC	2
3	AIRWAY GUEDEL SIZE: 2, SIZE EMBOSSED, WITH COLOR-CODED BITE BLOCKS, ANATOMICALLY SHAPED, STERILE	EAC	2
4	AIRWAY GUEDEL SIZE: 3, SIZE EMBOSSED, WITH COLOR-CODED BITE BLOCKS, ANATOMICALLY SHAPED, STERILE	EAC	2
5	AIRWAY GUEDEL SIZE: 4, SIZE EMBOSSED, WITH COLOR-CODED BITE BLOCKS, ANATOMICALLY SHAPED, STERILE	EAC	2

	AP AIRWAY ROLL KIT		AP
Sl No	**Item description**	**UOM**	**Qty**
1	LARYNGEAL TUBE SET SIZE 1 WITH DRAIN TUBE 10FR, ET TUBE WITH STABILIZER & COLOR-CODED SYRINGE 20ML	EAC	1
2	LARYNGEAL TUBE SET SIZE 2 WITH DRAIN TUBE 14FR, ET TUBE WITH STABILIZER & COLOR-CODED SYRINGE 60ML	EAC	1
3	LARYNGEAL TUBE INTUBATION SET (FOR PATIENT 125-155CM) SIZE 2.5/3, WITH LT TUBES, ET TUBE WITH STABILIZER ID 5.5MM, COLOR CODED SYRINGE 60ML, STERILE	EAC	1
4	LARYNGEAL TUBE INTUBATION SET (FOR PATIENT >155CM) SIZE 4/5, WITH LT TUBES, ET TUBE WITH STABILIZER ID 7.5MM, COLOR CODED SYRINGE 100ML, STERILE	EAC	1
5	LUBRICATING JELLY 5GM SINGLE-USE SACHETS, STERILE	SAC	3
6	HOLDER ENDOTRACHEAL TUBE ADULT-600-10000(EMS)	EAC	1
7	HOLDER ENDOTRACHEAL TUBE PEDIATRIC (FOR AMBULANCE SERVICE)	EAC	1
8	FILTER LINE SET ADULT/PED WITH AIRWAY ADAPTER.	EAC	2
9	BAG RESUSCITATOR MANUAL DISPOSABLE ADULT, WITH CLOSED RESERVOIR BAG AND PRESSURE LIMITING VALVE, CHECK VALVE, DISPOSABLE FACE MASK (MEDIUM).	EAC	1
10	AMBU DISPOSABLE FACE MASK WITH CHECK VALVE SIZE ADULT LARGE REF #000252956	EAC	1
11	AMBU DISPOSABLE FACE MASK WITH CHECK VALVE SIZE ADULT SMALL REF #000252954	EAC	1
12	AIRWAY GUEDEL SIZE: 0, SIZE EMBOSSED, WITH COLOR-CODED BITE BLOCKS, ANATOMICALLY SHAPED, STERILE	EAC	1
13	AIRWAY GUEDEL SIZE: 1, SIZE EMBOSSED, WITH COLOR-CODED BITE BLOCKS, ANATOMICALLY SHAPED, STERILE	EAC	1
14	AIRWAY GUEDEL SIZE: 2, SIZE EMBOSSED, WITH COLOR-CODED BITE BLOCKS, ANATOMICALLY SHAPED, STERILE	EAC	2
15	AIRWAY GUEDEL SIZE:3, SIZE EMBOSSED, WITH COLOR-CODED BITE BLOCKS, ANATOMICALLY SHAPED, STERILE	EAC	1
16	AIRWAY GUEDEL SIZE:4, SIZE EMBOSSED, WITH COLOR-CODED BITE BLOCKS, ANATOMICALLY SHAPED, STERILE	EAC	1
17	BAG VALVE MASK AMBU SPUR II PAEDIATRIC, WITH BAG RESERVOIR AND MASKS 000252953 + 000252952 (FOR EMS)	EAC	1
18	MASK FACE DISPOSABLE WITH CHECK VALVE, SZ: NEONATE, (AMBU) #000-252-951	EAC	1

19	MASK FACE DISPOSABLE WITH CHECK VALVE, SZ: TODDLER, (AMBU) #000-252-953	EAC	1
20	FILTER HME TWINSTAR 65A ADULT SIZE (FOR AMBULANCE SERVICE)	EAC	1
21	AP ADULT AIRWAY ROLL (BLUE COLOR)	EAC	1

CRITICAL CARE PARAMEDIC KITS (ADVANCED CARE)

C3.3 -3:17 CCP ADULT VENTILATOR KIT			C3
Sl No	**Item description**	**UOM**	**Qty**
1	SUCTION SYSTEM CLOSED FOR ENDOTRACHEAL TUBES WITH DOUBLE SWIVEL ELBOW 72HRS, 14FR 54CMS	SET	1
2	BREATHING CIRCUIT FOR OXYLOG 3000 PLUS 150CM	EAC	1
3	FILTER HME TWINSTAR 65A ADULT SIZE	EAC	1

C4 - CCP Pediatric Ventilator Kit 2017			C4
Sl No	**Item description**	**UOM**	**Qty**
1	OXYLOG 3000 PLUS DISPOSABLE HOSE (PED) 190CM	EAC	1
2	SUCTION CLOSED SYSTEM 72 HRS, SIZE 06FR 2.0MM, 30.5CM LENGTH, Y ADAPTER, STERILE (2.5, 3.0, 3.5mm)	SET	1
3	FILTER HME TWINSTAR 10A (PEDIA/NEONATAL) REF # MP01825	EAC	1

C6 - CCP DRUG ADMIN KIT			C6
Sl No	**Item description**	**UOM**	**Qty**
1	SOD.CHLORIDE 0.9% FOR INJECTION, 10ML	AMP	1
2	SYRINGE WITH NEEDLE 03CC 21GX1.5 - LUER LOCK,STERILE	EAC	1
3	SYRINGE WITH NEEDLE LUER SLIP 5CC 23GX1.25", STERILE	EAC	1
4	SYRINGE WITH NEEDLE 10CC 21GX1.5 - LUER LOCK, STERILE	EAC	1
5	SYRINGE WITH NEEDLE 20CC 21GX1.5" - LUER LOCK, STERILE	EAC	1
6	SYRINGE TUBERCULIN 1CC WITH NEEDLE, 25G/26GX5/8", STERILE	EAC	1
7	SWAB IMPREGNATED IN 70% ISOPROPYL ALCOHOL, SIZE: 4X4CM, STERILE	PKT	4
8	NEEDLE 18G 1.5" FOR LUER LOCK SYRINGES STERILE	EAC	1
9	NEEDLE 22G 1.5"	EAC	1
10	MUCOSAL ATOMIZATION DEVICE	EAC	1

C7 (A) - CCP INTROSSEOUS KIT (ADULT)			C7 Adult
Sl No	**Item description**	**UOM**	**Qty**
1	EZ-IO NEEDLE ADULT	EAC	1
2	EZ-IO NEEDLE OBESE	EAC	1
3	SWAB IMPREGNATED IN 70% ISOPROPYL ALCOHOL, SIZE: 4X4CM, STERILE	PKT	2
4	SYRINGE 10CC LUER LOCK TIP W/OUT NEEDLE, STERILE	EAC	1

C7 (P) - CCP INTROSSEOUS KIT (PEDIATRIC)			C8 PEDIA
Sl No	**Item description**	**UOM**	**Qty**
1	EZ-IO NEEDLE PEDIATRIC	EAC	1
2	SWAB IMPREGNATED IN 70% ISOPROPYL ALCOHOL, SIZE: 4X4CM, STERILE	PKT	1
3	SYRINGE 10CC LUER LOCK TIP W/OUT NEEDLE, STERILE	EAC	1

	C8 - CCP INFUSION KIT		C8
Sl No	**Item description**	**UOM**	**Qty**
1	SYRINGE 60CC LUER LOCK TIP WITHOUT NEEDLE, STERILE	EAC	1
2	EXTENSION SET 200CM, TO USE WITH IVAC SYRINGE/IVAC INFUSION PUMPS, STERILE	EAC	1
3	NEEDLE 18G 1.5" FOR LUER LOCK SYRINGES STERILE	EAC	1

	C10 - CCP NASOGASTRIC KIT		C10
Sl No	**Item description**	**UOM**	**Qty**
1	TUBE FEEDING 10FR, RADIO-OPAQUE,30-50CM LONG, STERILE	EAC	1
2	TUBE SALEM 108CMS, X-RAY DETECTABLE 16FR, STERILE	EAC	1
3	URINARY DRAINAGE BAG 2000ML (GRADUATED), WITH APPROX. ONE-METER-LONG TUBE, CLEAR & FIXED NUMERICAL GRADUATION SAMPLE PORT ROLLER DRAINAGE VALVE, STERILE	EAC	1
4	SYRINGE CATHETER TIP 60CC WITHOUT NEEDLE, STERILE	EAC	1
5	TAPE CLOTH WHITE ADHESIVE SIZE:1 INCH x 10 YARDS	ROL	1
6	LUBRICATING JELLY 5GM SINGLE-USE SACHETS, STERILE	SAC	2

	C11- CCP ARTERIAL LINE KIT		C11
Sl No	**Item description**	**UOM**	**Qty**
1	REGISTER PRESSURE INFUSION AID	EAC	1
2	DTX PLUS GABARITH TRANSDUCER SET	EAC	1
3	I.V. ADMINISTRATION SET 15/20 DROPS, TUBE LENGTH APPROX.:185CM, STERILE	EAC	1
4	STOPCOCK 3-WAY LUER LOCK #394600	EAC	1
5	TAPE CLOTH WHITE ADHESIVE SIZE:1 INCH x 10 YARDS	ROL	1

	RSI - CCP RSI SYRINGE PACK		RSI
Sl No	**Item description**	**UOM**	**Qty**
1	5ML 3 PART SYRINGE LUER LOCK, WITH YELLOW COLOR PLUNGER, WITHOUT NEEDLE,WITH KETamine MEDICINE LABEL	EAC	1
2	10 ML 3 PART SYRINGE LUER LOCK, WITH BLUE COLOR PLUNGER, WITHOUT NEEDLE,WITH FENTanyl MEDICINE LABEL	EAC	1
3	20ML 3PART SYRINGE LUER LOCK, WITH RED COLOR PLUNGER, WITHOUT NEEDLE,WITH ROCuronium MEDICINE LABEL	EAC	1
4	20ML 3PART SYRINGE LUER LOCK, WITH YELLOW COLOR PLUNGER, WITHOUT NEEDLE ,WITH KETamine MEDICINE LABEL	EAC	1
5	20ML 3PART SYRINGE LUER LOCK, WITH BLUE COLOR PLUNGER, WITHOUT NEEDLE,WITH FENTanyl MEDICINE LABEL	EAC	1
6	NEEDLE 18G 1.5" FOR LUER LOCK SYRINGES STERILE	EAC	6

	T1 - HAMILTON T1 VENTILATOR KIT		T1
Sl No	**Item description**	**UOM**	**Qty**
1	BREATHING CIRCUIT 180CM, SPU, ADULT/PED. INCLUDING FLOW SENSORS SINGLE USE FOR HAMILTON T1 VENTILATOR	EAC	1
2	EXPIRATORY VALVE SINGLE USE.FOR HAMILTON T1 VENTILATOR	EAC	1
3	FILTER BREATHING BACTERIAL/VIRAL W/LL PORT ADULT	EAC	1

4	HEAT & MOISTURE EXCHANGING FILTER 22F/15M - 22M/15F BREATHING FILTER, ADULT SIZE, STERILE	EAC	1
5	CATHETER MOUNT CONNECTOR, ELASTOMERIC CAP ELBOW, 15MM TUBE WITH 22F & 15F/22MM.	EAC	1
6	FILTER LINE SET ADULT/PED WITH AIRWAY ADAPTER.	EAC	1

	CCP ADULT AIRWAY ROLL		ADULT
Sl No	**Item description**	**UOM**	**Qty**
1	ADULT AIRWAY ROLL	PCS	1
2	LARYNGOSCOPE HANDLES REGULAR	EAC	1
3	LARYNGOSCOPE HANDLES STUBBY	EAC	1
4	BLADE F/LARYNGOSCOPES, SZ: 3, MACKINTOSH, STAINLESS STEEL, CALLISTO, DISPOSABLE, #DS.3940.150.20	EAC	1
5	BLADE F/LARYNGOSCOPES, SZ: 4, MACKINTOSH, STAINLESS STEEL, CALLISTO, DISPOSABLE, #DS.3940.150.25	EAC	1
6	AIRWAY NASOPHARYNGEAL SZ 7MM	EAC	1
7	AIRWAY NASOPHARYNGEAL SZ 8MM, # 100/210/080	EAC	1
8	TRACHEAL TUBE TAPER GUARD 6.0 MM, #18860	EAC	1
9	TAPERGUARD EVAC ORAL TRACHEAL TUBE. SIZE 7.0 MM, STERILE	EAC	2
10	TRACHEAL TUBE ORAL WITH SEAL GUARD CUFF AND EVAC PORT, SIZE 8.0MM, STERILE (TAPER GUARD)	EAC	2
11	TAPERGUARD EVAC ORAL TRACHEAL TUBE. SIZE 9.0 MM, STERILE	EAC	1
12	HOLDER ENDOTRACHEAL TUBE ADULT-600-10000	EAC	1
13	CATHETER MOUNT CONNECTOR, ELASTOMERIC CAP ELBOW, 15MM TUBE WITH 22F & 15F/22MM.	EAC	1
14	FILTER LINE SET ADULT/PED WITH AIRWAY ADAPTER	EAC	1
15	SYRINGE 10CC LUER LOCK TIP W/OUT NEEDLE, STERILE	EAC	3
16	LUBRICATING JELLY 5GM SINGLE USE SACHETS, STERILE	SAC	4
17	BAG RESUSCITATOR MANUAL DISPOSABLE ADULT, WITH CLOSED RESERVOIR BAG AND PRESSURE LIMITING VALVE, CHECK VALVE, DISPOSABLE FACE MASK (MEDIUM).- FLEXICARE	EAC	1
18	AMBU DISPOSABLE FACE MASK WITH CHECK VALVE SIZE ADULT LARGE REF #000252956	EAC	1
19	AMBU DISPOSABLE FACE MASK WITH CHECK VALVE SIZE ADULT SMALL REF # 000252954	EAC	1
20	AIRWAY GUEDEL SIZE: 2, SIZE EMBOSSED, WITH COLOR CODED BITE BLOCKS, ANATOMICALLY SHAPED, STERILE	EAC	1
21	AIRWAY GUEDEL SIZE:3, SIZE EMBOSSED, WITH COLOR CODED BITE BLOCKS, ANATOMICALLY SHAPED, STERILE	EAC	1
22	AIRWAY GUEDEL SIZE:4, SIZE EMBOSSED, WITH COLOR CODED BITE BLOCKS, ANATOMICALLY SHAPED, STERILE	EAC	1
23	MAGILS FORCEPS ADULT	EAC	1
24	ARS DECOMPRESSION NEEDLE, 10Gx3.25, PRODUCT CODE: ZZ-0298	EAC	2
25	SWAB IMPREGNATED IN 70% ISOPROPYL ALCOHOL, SIZE: 4X4CM, STERILE	PKT	4
26	LARYNGEAL TUBE INTUBATION SET (FOR PATIENT 125-155CM) SIZE 2.5/3, WITH LT TUBES, STERILE	EAC	1
27	LARYNGEAL TUBE INTUBATION SET (FOR PATIENT >155CM) SIZE 4/5, WITH LT TUBES, COLOR CODED SYRINGE 100ML, STERILE	EAC	1

28	MCGRATH MAC BLADE S3 (MEDIUM SIZE BLADE)	EAC	1
29	MCGRATH MAC BLADE S4 (LARGE SIZE BLADE)	EAC	1
30	MCGRATH MAC X BLADE SIZE 3 (EXTRA LARGE SIZE BLADE)	EAC	1
31	FILTER HME TWINSTAR 65A ADULT SIZE	EAC	1
32	NEBULIZER SET ADULT WITH T-ADAPTOR MOUTH PIECE, 7FT(2.1M) TUBING & CORRUGATED TUBE	EAC	1

	CCP PEDIATRIC AIRWAY ROLL KIT		**PEDIA**
Sl No	**Item description**	**UOM**	**Qty**
1	PEDIATRIC AIRWAY ROLL	PCS	1
2	LARYNGOSCOPE HANDLES PEDIATRIC SLIM	EAC	1
3	LARYNGOSCOPE HANDLES STUBBY	EAC	1
4	LARYNGOSCOPE BLADES - FIBER OPTIC MILLER SIZE 1	EAC	1
5	LARYNGOSCOPE BLADES - FIBER OPTIC MAC SIZE 1	EAC	1
6	LARYNGOSCOPE BLADES - FIBER OPTIC MAC SIZE 2	EAC	1
7	TUBE ENDOTRACHEAL ORAL/NASAL SIZE: 5.0MM #100/111/050	EAC	1
8	TUBE ENDOTRACHEAL 5.5MM 100/111/055	EAC	1
9	HOLDER ENDOTRACHEAL TUBE PEDIATRIC	EAC	1
10	CATHETER MOUNT CONNECTOR, ELASTOMERIC CAP ELBOW, 15MM TUBE WITH 22F & 15F/22MM.	EAC	1
11	FILTER LINE SET ADULT/PED WITH AIRWAY ADAPTER.	EAC	1
12	SYRINGE 10CC LUER LOCK TIP W/OUT NEEDLE, STERILE	EAC	3
13	MAGILS FORCEPS PEDIATRIC	EAC	1
14	LARYNGEAL TUBE SIZE:0, TRANSPARENT COLOR, PATIENT WEIGHT <5KG, STERILE	EAC	1
15	LARYNGEAL TUBE SET SIZE 1 WITH DRAIN TUBE 10FR, ET TUBE WITH STABILIZER & COLOR-CODED SYRINGE 20ML	EAC	1
16	LARYNGEAL TUBE SET SIZE 2 WITH DRAIN TUBE 14FR, ET TUBE WITH STABILIZER & COLOR-CODED SYRINGE 60ML	EAC	1
17	LUBRICATING JELLY 5GM SINGLE USE SACHETS, STERILE	SAC	3
18	BAG VALVE MASK AMBU SPUR II PAEDIATRIC, WITH BAG RESERVOIR AND MASKS 000252953 + 000252952	EAC	1
19	MASK FACE DISPOSABLE WITH CHECK VALVE, SZ: NEONATE, (AMBU) #000-252-951	EAC	1
20	MASK FACE DISPOSABLE WITH CHECK VALVE, SZ: TODDLER, (AMBU) #000-252-953	EAC	1
21	AIRWAY GUEDEL SIZE: 0, SIZE EMBOSSED, WITH COLOR CODED BITE BLOCKS, ANATOMICALLY SHAPED, STERILE	EAC	1
22	AIRWAY GUEDEL SIZE: 1, SIZE EMBOSSED, WITH COLOR CODED BITE BLOCKS, ANATOMICALLY SHAPED, STERILE	EAC	1
23	AIRWAY GUEDEL SIZE: 2, SIZE EMBOSSED, WITH COLOR CODED BITE BLOCKS, ANATOMICALLY SHAPED, STERILE	EAC	1
24	TRACHEAL TUBE TAPER GUARD 6.0 MM, #18860	EAC	1
25	ARS DECOMPRESSION NEEDLE, 10Gx3.25, PRODUCT CODE: ZZ-0298	EAC	2
26	SWAB IMPREGNATED IN 70% ISOPROPYL ALCOHOL, SIZE: 4X4CM, STERILE	PKT	4
27	MCGRATH MAC BLADE S1 (INFANT & NEONATAL BLADE)	EAC	1
28	MCGRATH MAC BLADE S2 (PEDIATRIC SIZE BLADE)	EAC	1
29	TAPERGUARD EVAC ORAL TRACHEAL TUBE. SIZE 7.0 MM, STERILE	EAC	1
30	FILTER HME TWINSTAR 10A (PEDIA/NEONATAL) REF # MP01825	EAC	1

MEDICATION INFUSION KITS

NORADRENALINE INFUSION PRE-PACK

Sl No	Item description	UOM	Qty
1	NORADRENALINE	4mg/4ml	2
2	SODIUM CHLORIDE 0.9%	100ml/bag	1
3	DRUG INFUSION STICKER	EAC	1
4	NEEDLE + 10ML SYRINGE	EAC	1
5	DRUG DOSING CARD	EAC	1

TRANEXAMIC ACID INFUSION PRE-PACK

Sl No	Item description	UOM	Qty
1	TRANEXAMIC ACID	0.5mg/5ml	2
2	SODIUM CHLORIDE 0.9%	100ml/bag	1
3	DRUG INFUSION STICKER	EAC	1
4	NEEDLE + 10ML SYRINGE	EAC	1
5	DRUG DOSING CARD	EAC	1

PHENYLEPHRINE INFUSION PRE-PACK

Sl No	Item description	UOM	Qty
1	PHENYLEPHRINE	10mg/1ml	1
2	SODIUM CHLORIDE 0.9%	100ml/bag	1
3	DRUG INFUSION STICKER	EAC	1
4	NEEDLE + 10ML SYRINGE	EAC	1
5	DRUG DOSING CARD	EAC	1

AMIODARONE HYDROCHLORIDE INFUSION PRE-PACK

Sl No	Item description	UOM	Qty
1	AMIODARONE HCL	150mg/3ml	3
2	DEXTROSE 5% WATER (D5W)	100ml/bag	1
3	DRUG INFUSION STICKER	EAC	1
4	NEEDLE + 20ML SYRINGE	EAC	1
5	DRUG DOSING CARD	EAC	1

GYLCERIN TRINITRATE INFUSION PRE-PACK

Sl No	Item description	UOM	Qty
1	GLYCERIN TRINITRATE	50mg/10ml	2
2	SODIUM CHLORIDE 0.9%	100ml/bag	1
3	DRUG INFUSION STICKER	EAC	1
4	NEEDLE + 10ML SYRINGE	EAC	1
5	DRUG DOSING CARD	EAC	1

ACUTE CORONARY SYNDROME (ACS) PRE-PACK

Sl No	Item description	UOM	Qty
1	ASPIRIN	300mg/tab	1
2	CLOPIDOGREL	300mg/tab	2
3	NITROGLYCERINE SPRAY	400mcg/dose	1

ABBREVIATIONS

SI No	Stock Inventory Number	IV	Intravenous Cannulation
UMO	Unit of Measure	PPE	Personal Protective Equipment
QTY	Quantity	OPA	Oropharyngeal Airway
EAC	Each	mg	milligrams
SAC	Sachet	mcg	micrograms
PKT	Packet	ml	milliliters
RSI	Rapid Sequence Induction	tab	tablet