

**DRUG UTILIZATION PATTERN DURING FLOOD
SEASON IN THE STATE OF KELANTAN, MALAYSIA:
PERCEPTIONS, EXPERIENCES AND CHALLENGES
IN MILITARY FIELD HOSPITALS**

MOHAMMAD FIRDAUS BIN YAACOB

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by

MOHAMMAD FIRDAUS BIN YAACOB

**Thesis submitted in fulfilment of the requirements
for the degree of
Master of Science**

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DECLARATION OF ORIGINALITY

I hereby declare that this thesis is my own work and none of the content of this thesis contains substantial proportion of materials that has been submitted and accepted for the reward of any other degree or diploma at any tertiary educational institution or organisation. The information derived from the previously published work or written by any person has been acknowledged in the text, and a full list of references has been included in this thesis.

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LIST OF ABBREVIATIONS

AADMER	ASEAN Agreement on Disaster Management and Emergency Response
ACDM	ASEAN Committee on Disaster Management
ACE	AHA Centre Executive
AHA Centre	ASEAN Coordinating Centre for Humanitarian Assistance
AJDRP	ASEAN Joint Disaster Response Plan
ARDEX	ASEAN Regional Disaster Emergency Exercise
ATC	Anatomical Therapeutic Chemical
ATLS	Advanced Trauma Life Support
BMI	Body Mass Index
CPR	Cardio Pulmonary Resuscitation
CSH	Combat Support Hospital
DELSA	Disaster Emergency Logistics System for ASEAN
DL	Danger Level
ERAT	Emergency Response and Assessment Team
FIP	International Pharmaceutical Federation
FIT	Force Integration Training
FMT	Forward Medical Team
HADR	Humanitarian Assistance and Disaster Relief
ICD-10	International Code of Disease version 10
INN	International Non-proprietary Name
IRU	International Road Transport Union

KKH	Kuala Krai Hospital
MAF	Malaysian Armed Forces
MASH	Mobile Army Surgical Hospital
MEPS	Military and Emergency Pharmacists Section
MFH	Military Field Hospital
MOD	Ministry of Defence
MOH	Ministry of Health
NADMA	National Disaster Management Agency
OCHA	United Nations of the Coordination of Humanitarian Affairs
ORS	Oral Rehydration Salt
PDC	Pacific Disaster Centre
PTSD	Posttraumatic Stress Disorder
SABC	Self-Aid Buddy Care
SASOP	Standard Operating Procedure for Regional Standby Arrangements
SPSS	Statistical Package of Social Sciences
URTI	Upper Respiratory Tract Infection
WHO	World Health Organization

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**POLA PENGGUNAAN UBAT-UBATAN SEMASA MUSIM BANJIR DI
NEGERI KELANTAN, MALAYSIA: PERSEPSI, PENGALAMAN DAN
CABARAN DI HOSPITAL LAPANGAN TENTERA**

ABSTRAK

Setiap misi perubatan mempunyai persoalan mengenai jenis dan kuantiti dadah yang perlu dibawa secukupnya untuk menampung keperluan sepanjang misi dilaksanakan. Terdapat ketidakpastian mengenai tempoh misi, jenis ubat-ubatan yang perlu dibawa dan kesukaran dalam komunikasi serta pengangkutan darat di kawasan bencana. Ahli farmasi boleh merancang dengan lebih baik stok yang perlu dibawa sekiranya mempunyai data berkaitan pola penggunaan ubat-ubatan dalam misi yang terdahulu. Pengoperasian hospital lapangan tentera dalam memberikan sokongan kesihatan kepada bencana alam, konflik buatan manusia, misi pengaman dan medan tempur memberikan cabaran kepada petugas kesihatan. Mereka terdedah kepada persekiran dan situasi yang tidak menentu yang boleh membahayakan kesihatan dan keselamatan diri. Kajian ini terbahagi kepada dua fasa (metodologi campuran - reka bentuk penjelasan). Fasa pertama merupakan kajian kuantitatif dilaksanakan secara retrospektif dan deskriptif mengenai corak penggunaan ubat-ubatan semasa musim banjir pada tahun 2014 di hospital lapangan tentera di Manek Urai, Kelantan. Kajian ini bertujuan mengangarkan corak penggunaan dadah semasa musim banjir di hospital lapangan tentera di negeri Kelantan. Pengkaji menganalisis sebanyak 2771 preskripsi dengan purata 103 preskripsi digunakan setiap hari. Kebanyakan pesakit menunjukkan penyakit berkaitan sistem respirasi (44.9%), masalah kulit (15.1%) dan sistem digestif (11.6%). Sejumlah 8082 dadah telah dipreskripsikan sepanjang

operasi dengan purata 2.92 dadah setiap preskripsi. Sepuluh dadah yang paling kerap digunakan ialah paracetamol (15.3%), chlorpheniramine (12.3%), diphenhydramine (11.9%), mefenamic acid (4.1%), diclofenac (4.1%), methyl salicylate (3.3%), neomycin (2.9%) oral rehydration salt (2.5%), magnesium trisilicate (2.3%) dan bromhexine (2.1%). Sementara itu, fasa kedua pula merupakan kajian kualitatif di mana pengkaji melaksanakan temubual secara bersemuka dan berstruktur separa. Kajian ini bertujuan untuk mendapatkan maklumat tentang cabaran, pengalaman dan persepsi petugas kesihatan di hospital lapangan tentera dalam pelbagai operasi. Analisis tema kandungan dilaksanakan dan mendapati tiga tema utama diikuti dengan subtema. Pertama, cabaran hospital lapangan tentera Malaysia semasa operasi seperti faktor eksternal, operasi, sumber manusia dan cabaran logistik telah dikenal pasti. Kedua, pengalaman petugas kesihatan sebelum dan selepas misi. Dengan memahami pengalaman sebelum dan selepas misi akan membantu organisasi dalam persediaan dan penambahbaikan di masa akan datang. Akhir sekali, persepsi petugas kesihatan tentang operasi hospital lapangan tentera termasuklah tugas dan tanggungjawab, pengurusan sumber manusia, motivasi staf, pihak berkepentingan, maklumbalas pesakit, kewajaran pengoperasian, latihan, sokongan logistik dan rancangan di masa akan datang. Kajian ini mengutarakan beberapa usul berasaskan bukti dalam membantu pihak tentera atau mana-mana organisasi dalam menyediakan perkhidmatan perubatan di lapangan yang lebih baik di masa akan datang.

**DRUG UTILIZATION PATTERN DURING FLOOD SEASON IN THE
STATE OF KELANTAN, MALAYSIA: PERCEPTIONS, EXPERIENCES
AND CHALLENGES IN MILITARY FIELD HOSPITALS**

ABSTRACT

Every medical mission faces a dilemma on which type of drugs to be brought adequately to cover the whole operation throughout the mission. There are uncertainties about the duration of mission, type of drugs to be brought, and difficulties in communication and land transport in the disaster area. Pharmacists will be able to plan which medical stock to bring if they can acquire relevant data regarding the pattern of drug utilization from previous missions. The deployment of a military field hospital for the purpose of responding to natural disaster, man-made conflicts, and peacekeeping mission, as well as conventional battlefield, brings a number of challenges to healthcare providers. They face many uncertainties in different environments and situations, including the exposure to personal and health threats. This current research was conducted in two phases (mixed method: explanatory design). The first phase was a quantitative study, which was a retrospective and descriptive examination of the drug utilisation pattern during the flood season of 2014 at a military field hospital which was deployed at Manek Urai, Kelantan. This study aimed to estimate the drug utilisation pattern during a specific flood season at a military field hospital in the state of Kelantan. The researcher analysed 2771 prescriptions with an average of 103 prescriptions per day. Most of the patients displayed diseases related to the respiratory system (44.9%); skin problem (15.1%); and the digestive system (11.6%). The sum of 8082 drugs was prescribed in the operation, with an average drug(s)-per-

encounter of 2.92. The top ten utilised drugs were paracetamol (18.0%), chlorpheniramine (12.3%), diphenhydramine (11.9%), mefenamic acid (4.1%), diclofenac (4.1%), methyl salicylate (3.3%), neomycin (2.9%) oral rehydration salt (2.5%), magnesium trisilicate (2.3%) and bromhexine (2.1%). Meanwhile, the second phase was qualitative study, where the researcher conducted a semi-structured face to face interview. This study aimed to explore challenges, experiences, and perspectives of healthcare professionals in a military field hospital in various deployments. Thematic content analysis was done and three major themes were followed by subthemes. First, challenges in a Malaysian military field hospital during an operation, which include external factor, operational, human resource, and logistic challenges were identified. Second, the experience of healthcare professionals, before and after a mission, was recorded. Understanding their experience before and after a mission would help organisations to prepare for the future by improving readiness. Finally, the perception of a military field hospital operation among healthcare professionals include roles and responsibilities, human resource management, staff's motivation, stakeholders' view, patients' feedback, relevance of deployment, training, logistics support, and future plans. This current study was an attempt to highlight several key evidences to assist the military or any organisation in providing better medical service in the field for the future.

CHAPTER 1

INTRODUCTION

1.1 Background

A massive flood hit the district of Manek Urai in the State of Kelantan in the year 2014, which caused substantial destruction in terms of the loss of homes, supply disruption of clean water and electricity, and damages to the land transportation network, as well as to government, public, and private facilities. The Kuala Krai Hospital (KKH), the major public hospital in the area, was critically affected and had to close their operation temporarily due to the severe flooding. The Malaysian Armed Forces Health Services was given orders to set up a Level 2 Field Hospital to provide healthcare services to the flood victims and to support the KKH. Located 21.8 km from KKH, the Level 2 Field Hospital offered outpatient and inpatient services, forward mobile medical services, operation theatre, and specialist services, such as anaesthetic, surgery, orthopaedic, obstetric gynaecology, and paediatric. These medical services required their support and ancillary services, such as pharmacy to manage dispensing, counselling, supply chain, and logistics of the medicines and consumables which were handled by the medical specialists and staffs. In addition, laboratory and radiology services were also needed for diagnostic purposes.

Rescue workers faced grave challenges during the post-flood period due to limited land mobility, either to rescue victims or deliver medical services and supplies to the front lines. Without clean water, electricity, and proper shelter, the flood victims were exposed to many health-related risks, especially among the elderly, chronic patients, pregnant women, and children. They really needed immediate and sustainable medical attention/services on site. Electrical power blackout had shut down the communication towers, resulting in both mobile and landline communication failures. Meanwhile, flood victims and rescue workers were exposed to various infections/diseases, such as skin and wound infection, acute respiratory infection, and diarrhoea. Among the top priorities for disaster relief healthcare workers during the Kelantan post-flood and the reconstructive phase were the management of mosquito-borne infections (malaria and dengue) and water-borne infections (leptospirosis, polio, and typhoid), which had caused great harm.

1.2 Translating Military Pharmacy Practice into Pharmacy Research

The researcher, who has been serving as a military pharmacist for more than 10 years, is well-experienced with the deployment of military field hospital. Accordingly, in the Malaysian context, the country is seriously lacking the data set regarding drug utilization during military field hospital deployment in responding to natural disasters. Studies from other countries are available, but they are different in terms of socio-demographics, health care coverage, and nature of the disasters. Therefore, there is a pressing need to conduct research for the purpose of sharing this beneficial information for future pharmacists to use as guideline when responding to disasters, either from an organizational or individual standpoint. A pharmacist is in charge of drug preparation before deployment, resupply activities and drug administration during an operation, thus to optimise drug utilization, a pharmacist must maximally make use of limited resource to prevent wastage.

Upon having obtained the data set regarding drug utilization, the question arises regarding issues during military hospital deployment for other types of crises such as battlefields, humanitarian assistance and peacekeeping mission. In this case, qualitative study can explore the challenges, experiences and perceptions of healthcare professionals in the deployment of military field hospital (Sofaer, 1999). Therefore, phase two of the qualitative study has been conducted to explore the challenges, experiences and perceptions of healthcare professionals from various disciplines such as mission commanders, emergency physicians, anaesthetists, surgeons, paediatricians, medical doctors, medical assistants, nurses, hygiene officers and medical support service staff like radiographers, laboratory technicians and pharmacists. Perhaps, the inputs from all spectra of healthcare professionals may provide holistic and more specific information that can assist in improvement of military field hospital deployment in the future.

1.3 Study Objectives

This study is divided into two phases, namely the quantitative phase, followed by the qualitative phase.

1.3.1 The quantitative phase

The quantitative objectives of the study are as follows:

1. To determine the pattern of medication prescribing according to the total amount prescribed;
2. To determine the prevalence of physical injury of the patient due to the flood disaster;
3. To estimate the direct cost for drug usage per mission in the affected area of Kuala Krai.

1.3.2 The qualitative phase

The qualitative objectives of the study are as follows:

1. To explore the challenges in a Malaysian military field hospital during an operation;
2. To determine the experience of healthcare professionals, before and after a mission;
3. To investigate the perception of military field hospital operation among healthcare professionals.

1.4 Significance of the Study

Medical deployment for the battlefield is the core responsibility of military pharmacy. In peace time, military pharmacy shall keep practising and improving preparedness. This study will assist policy makers to plan for the future deployment of a military field hospital in Malaysia, should the need arise.

Besides that, a tropical country like Malaysia receives a lot of rain annually, allowing a higher chance for potential disasters, such as flood. Providing a national dataset will serve as valuable resources for policy makers and pharmacy preparedness.

Responding to emergencies and disasters is a niche area of pharmaceutical practices. Data on drug utilisation in real deployment have been very limited. This study will enhance the military pharmacy's practices by understanding the scenario of natural disasters, especially flood.

Pharmacy is a part of healthcare service provider, both in civilian or military contexts. Pharmacists need to deal with matters of medical logistics in medical deployment. Thus, this study will help pharmacists to understand the needs of a military field hospital.

1.5 Outline of the Thesis

This thesis is organised into the following sequences to address the study's objectives:

In Chapter 2, the literature review presents a comprehensive background of military field hospitals and natural disasters. The review focuses on the role of medical services for humanitarian assistance and disaster relief (HADR). This chapter also reviews evidence on the challenges in military field hospital deployment around the world.

Chapter 3 addresses the methodology undertaken to achieve the quantitative objectives of the study. The descriptive results and outputs are presented in figures and tables. The interpretation of the results, discussion, limitations, and conclusions are also presented accordingly.

Chapter 4 provides the qualitative methodological approaches and sampling techniques applied in phase two. It covers the recruitment process, interview process, emerged themes from analysed interviews, and the conclusions. Discussion and analysis throughout the research have been assured to adhere to the study's objectives.

Chapter 5 represents the overall conclusions of both phases (Chapters 3 and 4). Finally, recommendations for future study are derived.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview

This chapter aims to provide holistic background information to guide the research objectives as shown in Chapter 1. Meanwhile, the outcomes of the study will be further discussed in Chapters 3, 4, and 5.

This chapter will begin with a review of the military field hospital's structure from the aspects of roles and capabilities. Information regarding natural disasters, especially floods, and HADR activities will also be discussed further from the global, extra-regional, intra-regional, and domestic perspectives.

Drug utilisation study, epidemiology, and prevalence of diseases during natural disasters and the direct cost outcomes will be discussed as well.

Finally, this chapter reviews relevant articles to the challenges faced by healthcare professionals during field hospital deployments.

2.2 Structure of Military Field Hospital

A Military Field Hospital (MFH) is defined as a small mobile medical unit, or mini hospital, that temporarily takes care of injured soldiers and any casualty on site before they can be safely transported to more permanent hospital facilities (Greenwood, 2008). In other words, it is also referred to as the Mobile Army Surgical Hospital (MASH), which was designed to keep pace with combat units during wartime, by providing immediate lifesaving care to casualties (King and Jatoi, 2005).

According to the United Nations Department of Peacekeeping Operation (1999), medical supports are structured into basic first aid and four successive levels, which are different from each other in the aspects of treatment capacity, staffing, equipment, and infrastructure.

2.2.1 Basic level

Basic level focuses on providing prompt first aid and essential life support to the casualties or injured personnel by the nearest person, using basic medical equipment and supplies until medical help is accessible. It is also known as Self-Aid Buddy Care (SABC) (Jin et al., 2015). The fundamental knowledge of first aid, such as cardiopulmonary resuscitation, bleeding control, immobilisation of fractured limb, and casualty evacuation, is crucial, especially for military personnel who are deployed to work together in a small group under an operation.

2.2.2 Level 1 Medical Support

Level 1 medical support provides first line primary healthcare and emergency treatment, which include triage, resuscitation, and stabilisation of casualties before evacuation to the next level of medical care. Level 1 can be deployed within a peace-keeping mission area. This level is supported by a medical team which consists of 8 to 12 healthcare professionals, including at least 2 doctors who must be available on site. It has the operational ability to provide at least 2 Forward Medical Teams (FMT) in two locations simultaneously, each with 1 doctor and 2 to 3 paramedics. Its capacity should be maintained to support up to 700 troops and handle 20 ambulatory patients per day. It also has the capability to ward up to 5 patients for about 2 days each, to monitor and provide inpatient treatments, and has inventories to sustain up to 60 days. Level 1 unit is usually established in tents or containers; however, if existing buildings are available, it can be deployed in these.

2.2.3. Level 2 Medical Support

Level 2 medical support is superior than Level 1 due to its capability of performing surgical resuscitation. Level 2 has surgical expertise and facilities supported by the ancillary laboratory, radiology facilities, a dental unit, and hospital support elements. It provides second line healthcare, emergency resuscitation, stabilisation, limb and life-saving surgical interventions, basic dental care, and casualty evacuation to the next echelon. It consists of about 35 medical and support personnel. The healthcare personnel should include general and orthopaedic surgeons, an anaesthe-

tist, an internist, a general physician, a dentist, a hygiene officer, a pharmacist, and intensive care and operating room personnel. It can support up to 1000 strength of troops and handle 40 ambulatory patients per day. It can deploy at least 2 FMTs similar to Level 1. Level 2 should have the capacity to conduct 3 to 4 major surgeries, 5 to 10 dental treatments, 10 x-ray examinations, and 20 laboratory tests per day. It also has the capability to hospitalise up to 20 patients for up to 7 days each and has inventories to sustain up to 60 days. An example of a recent deployment of such a facility in Malaysia was during Operation Murni for disaster relief of a flood which had occurred in December 2014 (Ho, 2013; Yaacob and Basari, 2015).

2.2.4. Level 3 Medical Support

Level 3 is the highest level of medical care provided by a deployed UN medical unit. It provides surgery, extensive diagnostic services, specialised inpatient treatment, and specialist medical consultation services, such as internal medicine, infectious diseases, tropical medicine, dermatology, psychiatry, and gynaecology. Level 3 is composed of the combined capabilities of Level 1 and Level 2 units, with high standards of laboratory, radiology, and pharmaceutical services. It is usually deployed in a circumstance when there is no hospital close to or within the mission area. Thus, Level 3 medical support can be considered as a multidisciplinary field hospital, which is estimated to have 90 medical and support staff. It can deploy at least 2 FMTs, run a vaccination programme, and other preventive medicine. It can support up to 5000 strength of troops and handle 60 ambulatory patients per day, 10 to 20 dental cases, perform about 10 major general and orthopaedic surgical procedures, 20 X-ray examinations, and 40 laboratory tests per day. Level 3 also has the capability of hospitalising up to 50 patients for up to 30 days and has inventories to sustain up to 60 days. It has limited capability of resupplying Level 1 and Level 2, if required. An example of a recent deployment of a Malaysian Field Hospital was during Operation Starlight at the Kutupalong Rohingya refugee camp in Cox's Bazar, Bangladesh (Malay Mail, 2018).

2.2.5. Level 4 Medical Support

Level 4 provides the definitive medical care and specialist medical treatment, but it is impractical or not cost effective to be deployed within a mission area because this level of support is generally obtained from existing civilian or military hospitals within the mission area or a neighbouring country. It offers specialist surgical and medical procedures, reconstruction, rehabilitation, and convalescence, which are highly specialised, costly, and required for longer duration. However, the UN can arrange the transfer of a patient or casualty to such a facility and continue monitoring the patient's progress.

2.3. Deployment of Military Field Hospital

The main difference between field hospitals and ordinary hospitals is that the former is more provisional, mobile, and portable (Blue Med, 2019). Compared to most organisations, the military has more capability and experience to operate in difficult and extreme situations. Therefore, with the exception of giving support and providing care to injured soldiers, military field hospitals are also able to participate in actions that civilian hospitals cannot partake in, for instance, natural disasters, humanitarian aid, and peacekeeping.

2.3.1. Battlefield and Conventional Warfare

Over the centuries, soldiers have lost precious lives in wars. Historical studies showed that approximately 20% of all wounded soldiers died on the battlefield, and 90% of those died before they were treated in a medical facility (Knight, 2002). Without treatment, an additional 15% would die within 30 minutes from injuries of the head, neck, chest, or abdominal area (Knight, 2002). Therefore, it is crucial to have a military field hospital to make battlefields less deadly than they once were. An example of a military field hospital is the United States Army's 28th Combat Support Hospital (CSH), which was established to provide specialised medical care for burn patients during the military operation which had overthrown Saddam Hussein's regime (Stout et al., 2007). A fully deployed CSH will have eight operating room tables and wards for intensive, intermediate, and minimal nursing care, with

beds for up to 296 inpatients. During the deployment from April 11, 2003, until August 21, 2003, the 28th CSH experienced a lot of problems in the aspect of personnel, supplies and equipment, and clinical care. For example, it did not manage to perform culture and sensitivity testing until it was provided with a microbiology laboratory. A total of 7920 patients were treated by the CSH during its 4-month deployment (Stout et al., 2007).

2.3.2. Natural Disaster

In the new millennium, most modern armies have made disaster relief an important part of their programmes, providing quick response, and performing medical aids, logistical support, air traffic response, aid distribution, protection, and recovery in natural disasters on a global scale (Army Technology, 2011). Common natural disasters that happen around the world include earthquakes, floods, tsunamis, hurricanes, typhoons, and tornadoes. In Asia, the military force of The People's Republic of China (PRC) sent medical teams for medical rescue during the Wenchuan earthquake in 2008, which resulted in approximately 90,000 people reported as dead, missing, and/or presumed dead (Rafferty and Pletcher, 2009). In Malaysia, the Malaysian Armed Forces Health Services established a Level 2 field hospital for a high-mud-content flood disaster relief in 2014, in which 237,000 victims had been displaced and 21 people had died (Yaacob and Basari, 2015; MalaysiaKini, 2014). During the relief operation, outpatient and inpatient services, forward mobile medical services, operation theatre, and specialist services, such as anaesthetics, internal medicine, surgery, orthopaedics, gynaecology, obstetrics, and paediatrics were provided to the victims. In addition, pharmaceutical care, laboratory, and X-ray examinations for diagnostic purposes were also offered (Yaacob and Basari, 2015).

2.3.3. Humanitarian Assistance for man-made conflict

Military field hospitals have a pivotal role to play in providing humanitarian assistance other than natural disaster relief due to its unique capability of transporting thousands of supplies and necessary equipment. In 2017, due to the destruction of local hospitals and outpatient clinics in Aleppo, Syria, caused by militants, there was a shortage of medicines and doctors. Russian doctors, thus, used mobile field hospi-

tals to offer medical care services and consultations to more than 200 residents daily (TASS, 2017). To illustrate clearer, a Malaysian field hospital was also established in Cox's Bazar, Bangladesh to lighten and alleviate the stress caused by the influx of Rohingya refugees from Myanmar since late November 2017 due to violence and oppression from the Burmese government. The majority of the Rohingya refugees are women and children, at least 40 per cent of them are under the age of twelve (UNHCR, 2018). Field hospitals were set up to offer healthcare services, such as paediatrics, geriatrics, and gynaecology care services, as well as basic life and sanitation support. Moreover, in December 2004, several field hospitals were also set up by Malaysia, with cooperation from 8 other countries, such as Australia, Germany, Belgium, Russia, Portugal, Pakistan, China, and Singapore, to provide humanitarian aid to tsunami victims in Aceh, Indonesia, (OCHA Relief Web, 2005).

2.3.4. International Peacekeeping Operation

Since 1960, Malaysia has participated in over 30 peacekeeping operations. The Royal Medicine and Dental Corps (RMDC) has participated in numerous notable peacekeeping missions in Namibia (1989), Cambodia (1991), Somalia (1993), war zone Bosnia and Herzegovina (1993), and in the Timor Leste (1999) (Mat Jusoh, 2017). Until recently, the RMDC has also assisted in several more United Nations' (UN), as well as North Atlantic Treaty Organisation's (NATO) missions, which required different approaches in lending its support (Mat Jusoh, 2017). For instance, the UN has requested the Malaysian medical element to be involved in the Western Sahara (2006) mission. In all of these missions, the medical deployments offered more robust capabilities, such as orthopaedics and general surgical specialties (Mat Jusoh, 2017). Furthermore, the RMDC was able to provide full medical support and assistance per the requirements of the affected nations, aid in nation building capacity, and ensure that the affected populace would be able to take care of themselves following the cessation of the mission time (Mat Jusoh, 2017). According to data from United Nations (UN) Peacekeeping, Malaysia is ranked the eight highest troop contributors to the UN in Asia, contributing 847 troops to UN Peacekeeping Operations as of 28 February 2019 (UN Peacekeeping, 2019).

2.4. The Change of Paradigm from War to Natural Disaster

Disasters today often involve economic dislocation, collapse of political structures, violence ranging from banditry to civil conflict to all-out international war, famine, mass population displacements, and weapons of mass destruction, including biological, chemical, and nuclear warfare (Gaudette et al., 2002). Weapons of mass destruction create a new and significant challenge for the disaster medical response system (Gaudette et al., 2002).

Since war and conflict no longer become the primary threat to modern human living, extreme weather and climate variability (natural disasters) have been taking place (Thomas, 2013). Natural disasters have claimed approximately 3 million lives worldwide since the past 20 years, and have adversely affected the lives of at least 800 million more people and caused more than \$50 billion in property damages (Gaudette et al., 2002). Therefore, the concept of MFH inherited from the battlefield is now applied in cases of disasters or major accidents (Greenwood, 2008). For example, a small military hospital in Forward Kahuta, Pakistan (during the 2005 Kashmir Earthquake), remained functional and was inundated with severely injured patients for over 72 hours (Mulvey et al., 2008).

2.5. Natural Disaster – Flood

Natural disaster is defined as a natural event such as a flood, earthquake, or tsunami that kills or injures a lot of people (Cambridge, 2020a). Meanwhile, flood is defined as a large amount of water covering an area that is usually dry (Cambridge, 2020b). Flood usually occurs due to heavy rains, overflowing rivers, broken dams, urban drainage basins, storms surges and tsunamis, channels with steep sides, lacks of vegetation, or melting snow and ice. According to a study done by Ismail and Haghroosta (2018), first, the flood which occurred in Kelantan in December 2014 was due to heavy rainfall of 850 mm for 10 days, more than the normal rate of 100mm. Flood of this nature could only occur once in a blue moon, which could possibly return in a period of 1000 years. Second, the flood occurred due to deforestation factor in the catchment area or waterway from excessive logging activities.

		Measurement	
		Tangible	Intangible
Forms of flood losses	Direct	Damage to private buildings and contents; Destruction of infrastructure, such as roads and railroads; Erosion of agricultural soil, destruction of harvest; Damage to livestock; Evacuation and rescue measures; Business interruption inside the flooded area; Clean-up costs.	Loss of life, injuries, loss of memorabilia; Psychological distress, damage to cultural heritage; Negative effects on habitats or ecosystems.
	Indirect	Disruption of public services outside the flooded area; Induced production losses to companies outside the flooded area, including suppliers of companies affected by flood; Cost of traffic disruption; Loss of tax revenue due to migration of companies in the aftermath of flood.	Inconvenience of post-flood recovery; Trauma; Loss of trust in authorities.

Table 2.1 Tangible and intangible damage by flood

Flood causes deleterious damages on victims, such as direct impact on their health and properties, public and private infrastructure, ecological systems, cultural heritage, and economic activities. Moreover, the consequences of flooding for people are more complex. Direct losses are due to the physical contact of the floodwater with humans, property, or infrastructure, and the location of the flood will indirectly affect all networks and social activities, causing indirect losses, including disruptions of traffic, trade, and public services. Meanwhile, intangible impacts are more difficult to assess, for example, the psychological effects of loss of life, displacement, and property damage. In fact, some damages can be long-lasting or even permanent (Nicholls et al., 2015; Van Ootegem and Verhofstadt, 2016). Disaster gives a tremendous impact on the physical, psychological, social, and economic aspects of the victims. Those involved with high impact incidents or experiencing traumatic events are at greater risk of developing post-traumatic stress disorder (PTSD) (Othman et al., 2016). Damages of the flood are summarised in Table 2.1

Flood damage has steadily increased, despite local and federal mitigation efforts in the United States. There is no standard guideline for estimating flood losses, and no central clearing house exists for data on flood damage. Flood was estimated to have caused \$2.4 billion in damage in the United States in 2003, and more than \$16 billion in 1993, which was the worst yearly record. The magnitude of damage depends on several factors, such as population in flood-prone areas, climate change, development patterns, and local flood policies. Flood damage hazard has mostly affected streams, rivers, deltas, and coastlines (Glass, 2013)

2.5.1 Scenario in Kuala Krai

Torrential rain began on 17th December 2014, which led to flash flooding and forced 3390 people in Kuala Krai, Kelantan, to flee their homes. Later, 3 days of continuous heavy rain fell from 21st to 23rd December 2014, in Gua Musang. This was a record-setting rainfall of 1295 mm, equivalent to the amount of rain usually seen in a span of 64 days. As a result, the water levels of 3 major rivers (Sungai Galas in Dabong, Sungai Lebir in Tualang, and Sungai Kelantan), rose drastically above the water levels considered dangerous (Baharuddin et al., 2015).

According to Baharuddin et al. (2015), the main rivers in Kelantan exceeded the danger level (DL), as follows:

- Sungai Galas in Dabong, Gua Musang, was 46.47 metres (DL: 38 metres)
- Sungai Lebir in Tualang, Kuala Krai, was 42.17 metres (DL: 35 metres)
- Sungai Kelantan in Tangga Krai, Kuala Krai, was 34.17 metres (DL: 25 metres)
- Guillemard Bridge in Tanah Merah, was 22.74 metres (DL: 16 metres)
- Sungai Golok in Rantau Panjang, was 10.84 metres (DL: 9 metres)

According to Tuan and Hamidi (2013), the flood plain of the Kelantan River Basin encompasses several districts, including Kota Bharu, Pasir Mas, Tumpat, Tanah Merah, Machang, Kuala Krai, Jeli and Gua Musang. Their study reported that floods which had occurred from 1966 until 2005 exceeded the dangerous level (DL) of main rivers, including Sungai Kelantan (23 times), Galas (16 times), Lebir (10 times), and Pergau (7 times). Meanwhile, the period of these floods varied, ranging from 3 days to 21 days. These floods had affected the population of 553,099 in prone areas, approximately one-third of Kelantan's overall population of 1.3 million. The worst flood occurred in 1967, with an estimated damage cost of RM 30 million, and affected about 320,000 victims, resulting in 38 casualties.

2.5.2 Deployment in Kuala Krai

The Kuala Krai Hospital (KKH), which is the major public hospital in the Kuala Krai District had to close their operation temporarily due to being hit by severe flooding (as shown in Figures 2.5 and 2.6). Therefore, the Malaysian Armed Forces Health Services was given orders to set up a Level 2 military field hospital to provide healthcare services to the flood victims and to support the KKH. Located 21.8km from the KKH, the MFH offered outpatient and inpatient services, forward mobile medical services, operation theatre, and specialist services, such as anaesthetics, surgery, orthopaedics, obstetric gynaecology, and paediatrics. These medical services required its support and ancillary services, such as pharmacy. In addition, laboratory and radiological services were also needed for diagnostic purposes.

Known as Ops Murni, the researcher had been deployed as a pharmacist in the military field hospital and was in charge of the pharmacy department. Assisted by

2 staff, the pharmacy department operated 24 hours throughout the whole operation. Dispensing, supplying drugs to FMT, planning, and replenishing stock when necessary, were the major activities for the pharmacy department in the military field hospital. Figure 2.7 illustrates the actual deployment of a level 2 military field hospital in Manek Urai post-flood.



Figure 2.1 Destruction to public infrastructure – a railway bridge



Figure 2.2 Long timbers driven by the flood, which swept a house



Figure 2.3 The view of the Sungai Lebir river-bank after the flood



Figure 2.4 Destruction to private property - a flood victim's house



Figure 2.5 Kuala Krai Hospital's medical store, affected by the flood



Figure 2.6 Kuala Krai Hospital temporarily closed-down after the flood



Figure 2.7 Deployment of the level 2 military field hospital in Manek Urai



Figure 2.8 Medication counselling at the pharmacy department



Figure 2.9 Dispensing activity at the pharmacy department



Figure 2.10 Medicines stored under the pharmacy's tent



Figure 2.11 The medical team who served in the Manek Urai military field hospital



Figure 2.12 A visit by the Senior Director of Pharmaceutical Services, Dato' Eishah and her team

2.6 HADR Activities

Humanitarian activity is defined as an activity involved in or connected with improving people's lives and reducing suffering (Cambridge, 2020c). Several organisations in different levels, such as global, extra-regional, regional, or national, are established with the same objective, which is to save lives and to alleviate people's suffering around the world as the consequence of natural disasters or man-made conflicts.

2.6.1 Global Perspective

Under United Nations Secretariat, the United Nations of the Coordination of Humanitarian Affairs (OCHA) is responsible for bringing together humanitarian actors to ensure coherent responses to emergencies. The combination frameworks of actors contribute to the overall response and cumulative efforts. The OCHA plays the role in coordinating effective and principled humanitarian action in partnership with national and international actors in order to alleviate human suffering in emergencies. Besides that, the OCHA coordinates global humanitarian funding appeals and manages global and country-specific humanitarian response funds to facilitate sustainable solutions. The OCHA speaks on behalf of the people affected by disaster to advocate their rights. The OCHA also collects, analyses, and shares critical humanitarian data and information, and sets an evidence-based and forward-looking humanitarian policy agenda (OCHA, 2020).

The International Pharmaceutical Federation (FIP) is the professional body representing over 4 million pharmacists and pharmaceutical science around the world. The Military and Emergency Pharmacy Section (MEPS) is one of the FIP's smallest and most specialised sections, which was officially created in 1953. The MEPS' main objective is to establish close cooperation between pharmacists in the military and NGOs to respond in times of emergency resulting from either a natural disaster or a man-made incident. This body establishes a network of dedicated pharmacists who collaborate together on same field in the pharmacy practices within a unique environment (International Pharmaceutical Federation, 2020).

Military and emergency pharmacists practise in more demanding conditions and challenging environments compared to their civilian colleagues, when they are in the field. Military medical services collaborate with international and local organisations in humanitarian assistance and disaster relief (HADR) situations. Updated March 2019, the MEPS have 127 members representing 47 countries. MEPS members share their knowledge and experience in their mission regarding issues, challenges, and opportunities relating to this field. Focusing on the supply chain and workforce aspects in the international perspective are the key to provide sustainable solutions (International Pharmaceutical Federation, 2020).

2.6.2 Extra Regional Perspective

The Pacific Disaster Centre (PDC) plays the role in delivering comprehensive information, assessment, tools, and services to minimise disaster risks. PDC improves disaster mitigation and risk assessment by using early warning and multi-hazard monitoring tools. The PDC prepares risk intelligence and decision support tools with up to date information, science, and technology necessary to support evidence-based decision making. The PDC provides national disaster preparedness baseline assessment to support disaster management community with high-quality information from trusted sources. PDC partnerships involve multiple agencies by closing the gaps between civilian-military, academic-operational, public-private, and US-foreign stakeholders, institutions, and communities with common interests. The PDC provides special training and exercises for actors' enhancement services in emergencies. The PDC's headquarters is located on Maui Island in the state of Hawaii, USA. Meanwhile, the personnel supporting key clients and stakeholders are located in Honolulu Island, in the USA mainland and in the Southeast Asia (Pacific Disaster Centre, 2020)

2.6.3 Regional Perspective

The ASEAN Coordinating Centre for Humanitarian Assistance on disaster management (AHA Centre) is an inter-governmental organisation, which aims to facilitate cooperation and coordination among ASEAN Member States with the United Nations and international organisation for disaster management and emergency response in the ASEAN region. This organisation was established by ten ASEAN Member States, which include Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam on 17th November 2011. ASEAN Foreign Ministers and Head of States or Government of ASEAN Member States signed the Agreement on the Establishment of the ASEAN Coordinating Centre, governed by the members of ASEAN Committee on Disaster Management (ACDM). As part of its preparedness and response efforts, the AHA Centre develops various tools and guidance to accelerate the mobilisation of resources between ASEAN Member States and partners in times of disasters. Some of the available resources include stockpiled relief items, and standard operating procedures (AHA Centre, 2020).

First, the ASEAN Standby Arrangements consist of earmark assets and capacities that are voluntarily made available by the ASEAN Member States for disaster relief and emergency response. Second, the Standard Operating Procedure for Regional Standby Arrangements and Coordination of Joint Disaster Relief and Emergency Response Operations (SASOP) is the guidance and procedures for joint disaster relief and emergency response operations, as well as for the facilitation and utilisation of military-civilian assets and capacities. Additionally, the Disaster Emergency Logistics System for ASEAN (DELSA) is a key mechanism to allow for swift provision of relief items to ASEAN countries facing post-disaster emergency situations. During disaster response, AHA Centre ERO will serve a strategic role in terms of command and control in ensuring that the AHA Centre can fulfil its mandate of coordinating collective responses from all the ASEAN member states, including its own field personnel. AHA Centre ERO will primarily focus on collecting, gathering, and analysing data, making strategic decisions, maintaining continuity of operations of the organisation, and disseminating information and data to ASEAN Member States, concerned individuals, and external stakeholders. Next, the ASEAN Joint