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2019 PASIR GUDANG CHEMICAL INCIDENTS: THE IMPACT OF TRANSDISCIPLINARY APPROACH ON EMERGENCY MEDICAL SERVICES

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List of Abbreviations

DOE	: Department of Environment
EMS	: Emergency Medical Services
ETD	: Emergency and Trauma Department
HAZMAT	: Hazardous Material Team
MCI	: Mass Casualty Incident
MOH	: Ministry of Health
NADMA	: National Disaster Management Agency
NSC	: National Security Council
OSC	: On-Scene Commander
PAGEMA	: Pasir Gudang Emergency Mutual Aid
PHC	: Pre-Hospital Care
TDA	: Transdisciplinary Approach
VOC	: Volatile Organic Compounds

ABSTRACT

Introduction: Managing mass casualty incidents (MCI) is always challenging, requiring a well-coordinated transdisciplinary approach (TDA) due to its complexity. Between 7th and 20th March 2019, a state-level chemical incident occurred in Pasir Gudang's heavily industrialized area. Illegal dumping of tonnes of waste into Kim Kim River released a mix of

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volatile organic compounds (VOCs), including acrolein, acrylonitrile, and benzene, causing mainly respiratory and gastrointestinal symptoms. **Objective:** To coordinate an effective response to the Kim Kim chemical incident. **Methods:** Government agencies, industrial players, and NGOs collaborated under the coordination of Malaysia's National Disaster Management Agency (NADMA), following Directive No. 20 of the National Security Council. Key agencies such as the Department of Environment, Fire and Rescue Department, Ministry of Health, and Johor State Disaster Management Committee, with support from Pasir Gudang Emergency Mutual Aid (PAGEMA), led containment efforts. A patient management center was established near the site to prevent overwhelming healthcare facilities. Ambulance transportation and logistics were systematically organized. **Results:** Approximately 6,000 victims, including medical staff, received treatment over the two-week period. The coordinated effort effectively contained the incident. **Conclusions:** The incident highlights the importance of public-private partnerships and shared understanding among agencies in managing complex disasters through TDA.

Keywords: Transdisciplinary Approach; Mass Casualty Incident; Chemical Exposure

INTRODUCTION

Disaster is defined by The American College of Emergency Physicians (ACEP) as having destructive effects that the incident happens suddenly which overwhelm the ability of a given area or community to meet the demand for health care. The World Health Organization (WHO) defines it as "a sudden ecologic phenomenon of sufficient magnitude to require external assistance". In either case, disasters are defined by what they do to people (1).

Incidents such as earthquakes, floods, volcanic eruption, tsunami and hurricanes are among the natural disasters. The war, pollution, nuclear explosions, hazardous materials exposures and transportation accidents are among the man-made disasters.

Apart from the casualties, disasters will also cause property losses which cost millions to billions of dollars lost, or even more, due to the impacts and require more financial support for the post-impact processes (2). This trend of loss of human lives and property damage suggests that our communities are not resilient enough to disasters (3).

Due to the large impacts on the people and the economies, the world community currently has turned its attention to the issues related to disaster risk management since the last decade. The focus on the importance of having an integrated disaster risk management towards

strengthening the disaster resilience, at the same time to reduce the hazards and vulnerability of the population at risks, has been the main agenda in most nations, including Malaysia. The main challenge of disaster management is that a variety of actors have to deal instantly with a range of aspects, often in a chaotic environment. The actual occurrence or threat of serious damages, and the actual or possible disruption of critical societal functions and social life, create a sense of urgency. These have to be appropriately dealt with. During the response phase, there is limited time to gather relevant information and virtually no time to generate or develop new information/knowledge.

In Malaysia, flood is the most intense natural disaster experienced (4), and the average annual flood damage is as high as RM100 millions (5). On the other hand, hazardous materials exposure incidents which is an example of man-made disaster is on the rise at the moment. Hazardous chemicals are substances or preparations that are capable of causing harm either through its physical and chemical properties or its toxicity. It can be in the form of dust, gas, liquid, compound or mixtures; natural or synthetic. Chemical exposure incidents have been recorded in several occasions in Malaysia due to the increasing in numbers of chemical-related industries operating in the country. Some of them occur accidentally while few occasions were due to illegal dumping of industrial waste substances into the environment as in Pasir Gudang, Johor in March 2019.

The use of chemicals is seen in many sectors including health care. Poor management of chemicals and hazardous materials can cause safety incidents such as spills, splashes and explosions; and also lead to occupational diseases, poisoning and cancers. Despite important advances in the care of patients with inhalation injury, which continues to be largely supportive, morbidity and mortality remain high. Inhalation injury can feature supraglottic thermal injury, chemical irritation of the respiratory tract, systemic toxicity due to agents such as carbon monoxide (CO) and cyanide, or a combination of these insults.

In any incident involving the chemical exposure, lots of efforts from various agencies and stakeholders must be put together to handle the situation from getting worse. Delay in tackling the issue will impose heavy burden to the government. It can spread by various means affecting the vulnerable groups of population and livestock including the environment. Healthcare services will be overwhelmed with patients from all walks of life in different degrees of illnesses seeking for treatment.

METHODS

Transdisciplinary Approach (TDA) In Disaster Management

Due to the complexity, the management of mass casualty incident (MCI) and disaster will always be challenging to the responding agencies. Since it involves various search and rescue (SAR) agencies in the response phase, including the medical teams, it requires a well-coordinated transdisciplinary approach (TDA). As each agency has its own standard operating procedure (SOP) in dealing with the situation, it definitely requires a lot of discussions throughout the process. Identification of key agency to be in-charge of the whole scenario is very crucial. TDA serves as a platform to promote scientific knowledge-based decision making in disaster risk and reduction management (DRRM) practices. By having TDA practices, the responders of all disciplines and stakeholders of all sectors can work together to achieve the common goal forming an international network of natural, social and humanitarian aspects. Resilient society against natural hazards can be built only by scientific knowledge-based decision made under TDA (6).



Figure 1. Disaster Management Cycle
Source: Bosher et al., 2021

As shown in figure 1, the disaster management cycle has 4 phases; namely preparedness, response, recovery and mitigation. Although all the phases need to be attended to, a well-coordinated effort by all the responding agencies in the response phase will determine the outcome of the whole processes. By their nature, disasters are unique and differ with regards to a number of variables such as occurrence agent and magnitude, incident dynamic, number of societal systems affected, risk for escalation, composition of stakeholders and responding agents. The new approach for transdisciplinary disaster management framework extends the scope of existing preparedness activities such as risk assessments of systems to include

identification of potential weaknesses within, across, and between organizations, systems and borders. Dealing with these factors of complexity, uncertainty, urgency and scale of the disaster impose multiple challenges to the stakeholders and responders (7).

Francine et al (7) further elaborates about the use of a transdisciplinary instrument which will automatically lead to more awareness of individual disciplines in multifaceted cases. This will encourage over time a transdisciplinary mentality. The contribution of a transdisciplinary methodology to improve current incident management practices is visually summarized in figure 2. Well-coordinated flow of processes involving in disaster management is crucial in determining the successful outcome. Correct methodology and appropriate tools will provide proper insight and understanding in links and interactions among the agencies, especially in a chaotic situation at the incident site. The accurate and timely information will be helpful to the responders in preparing themselves for coordinated emergency planning and response. Highly respected command and control from the incident commander is required in organizing a smooth operation in dealing with the event. Strategic coordination is also required to achieve the objective.

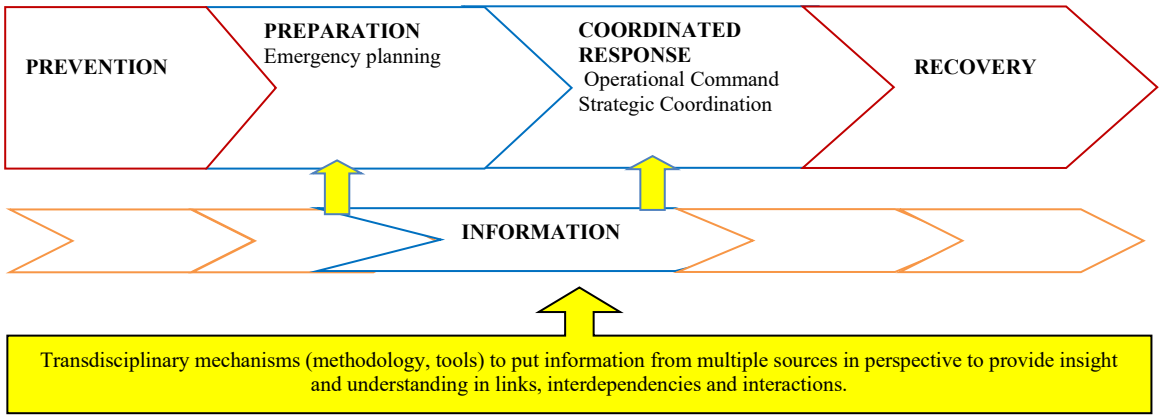


Figure 2. Contribution of Transdisciplinary Mechanisms to Improve Current Incident Management Practices
Source: Takeuchi., 2019; Franciane., 2017

This paper is focusing on the TDA among all the responders in a state-level disaster management in Malaysia in March 2019. The incidence had affected thousands of victims, mainly students, as a result of chemical exposure from illegal dumping of toxic industrial waste in the southern state of Malaysia.

Milestones Of Disaster Management In Malaysia

Following the tragedy of the collapse of Highland Towers Condominium on 11th December 1993, the Malaysian Cabinet made a decision to form a mechanism for the management of on-scene incident in major disaster on land. The needs for various factors relating to disaster management were taken into consideration, such as:

1. The need to formulate a policy and mechanism of Disaster Management in an integrated, coordinated and systematic manner to manage and handle disasters on land;
2. The need to have an integrated disaster management system to deal with any kind of disaster;
3. The need to have a sound system of coordination among agencies in search and rescue (SAR) operations as well as relief and rehabilitation; and
4. The need to have a specialized and highly skilled SAR team.

Thus, Directive No. 20 of National Security Council (NSC) on 'Policy and Mechanism on National Disaster and Relief Management' was developed few years later in 1997. It was revised in 2012 in accordance to the changes in complexity of disaster management. Handling of disasters involving maritime, air (aviation), CBRN (chemical, biological, radiological and nuclear) including the outbreak of diseases and pandemic situation were added in the revised version (8). It serves as a guide to all the efforts carried out by the relevant SAR agencies. It mentions about three levels of disaster management in the country – level I, level II and level III referring to district, state and federal levels respectively. The policy outlines the management mechanism with the purpose of determining the roles and responsibilities of the various agencies involved in handling disaster. It is also aiming at:

1. Reducing the casualties and minimizing the damage to properties;
2. Preventing the spreads of disasters;
3. Coordinating the relief works and providing rehabilitation to the victims; and
4. Bringing immediately the situation back to normal.

Therefore, the Council facilitates activities that are implemented by the Disaster Management and Relief Committee. This committee is given the task of coordinating disaster relief operations at national, state and district level with the combined aims of reducing damages and reducing loss of human life.

In 2014, following an extraordinary big flood in the country affecting mainly the east coast states, National Disaster Management Agency (NADMA), under the Prime Minister's Department, was established. NADMA plays an important role as the lead agency in dealing with disaster in Malaysia (9). It is assisted by the Malaysian Civil Defence Force (MCDF) as the secretariat. By having a common guideline as a policy, the main agencies like Royal Malaysian Police (RMP), Malaysia Fire and Rescue Department (MFRD), Malaysia Ministry of Health (MOH) and MCDF are responsible in dealing with such incidents. Other relevant agencies will be involved depending upon the situation. Smooth and systematic management of disaster in the country has been achieved so far following the establishment of such policy and mechanism.

Pasir Gudang and Pagema

Pasir Gudang, with more than 500,000 populations is located in Johor Bahru District, Johor, Malaysia. It is administered by Pasir Gudang City Council (PGCC) after being upgraded from Pasir Gudang Municipal Council (PGMC) on 22 November 2020 (10). For more than three decades, Pasir Gudang has been the town to many heavy and petrochemical industries. The industrial operations are supported by the presence of 2 major ports i.e. Johor Port and Tanjung Langsat Port (TLP). It has almost 2,005 industrial factories, of which nearly 250 were chemical-based factories (11). The main industries are shipbuilding, petrochemicals and other heavy industries, transportation and logistics, and oil palm storage and distribution. It is the site of the Sultan Iskandar Power Station, one of two major power stations in Johor.

The close proximity of housing areas, public institutions and facilities, which include schools, to the industrial area is one of the main contributory factors that led to the Sungai Kim Kim and Taman Mawar toxic gas poisoning incidents in 2019 (11).

Pasir Gudang Emergency Mutual Aid (PAGEMA) was established in 1988 and it was chaired by Johor Port Sdn. Bhd. before handed over to Pasir Gudang Municipal Council (PGMC) in 1998. It provides a good platform of emergency management coordination between various government agencies and highrisk petrochemicals and heavy industries in Pasir Gudang industrial area (12). PAGEMA membership consists of both the governmental agencies and public sectors that work hand in hand with the industries operating in Pasir Gudang. The industries will pay annual fees to PAGEMA as part of their responsibility to ensure the disaster resilience is maintained while their welfare is being taken care by the local authority.

Led by the PGMC chairman, PAGEMA has 2 main committees i.e. the Incident Command System Committee (ICSC) and Mock Drill and Exercise Committee that are responsible for all the activities of PAGEMA. Working on voluntary basis to safeguard the Pasir Gudang area and its community from the natural and man-made hazards and disasters, PAGEMA has shown a tremendous progress since its establishment to safe life and property.

PAGEMA conducts its annual emergency drill involving the agencies and industries to test their preparedness as well as to familiarize the personnel with the MCI response using the prepared ICS and Directive No. 20 of NSC. Various achievements and improvements have been made following the exercises since then. All these tirelessly efforts have improved the cooperation and teamwork among the responders - both from the public as well as the private - to act efficiently in any event, within Pasir Gudang specifically and Johor generally. The transdisciplinary approach (TDA) has been practiced in combating disasters and major incidents since then, thus making Pasir Gudang a safe place for everyone. Figure 3 shows various activities and drills to achieve this objective.



Figure 3. Example of Activities Carried Out Annually by PAGEMA i.e. Disaster Drill
Source: Rahmat., 2025

2019 Kim Kim River Chemical Incident, Pasir Gudang

On 7th March 2019, the country was shocked by an early morning chemical inhalation incident. The community of Taman Pasir Putih started complaining of 'abnormal' smell as early as 4.30 am. They summoned the MFRD of Pasir Gudang to have a look, but the team couldn't find anything related to it. None of the residents complaining of any symptom initially. It was only at around 9.00 am when a few students of Taman Pasir Putih (TPP) Primary and Secondary Schools in Pasir Gudang, Johor started to develop dizziness, headache, nausea, vomiting and watery eyes. Hundreds of students and staff were affected later on. Some of the victims were even fainted causing panic and chaotic situations. Parents started to storm the schools once the news broke out - mostly through social media - to find out on their children. Both the schools were immediately evacuated and the unaffected students were sent home. Local leaders and the residents were giving their assistance to ensure the safety of the students and nearby community.

Upon receiving the distress call from the authority, MFRD with the HAZMAT teams were deployed within minutes. MOH facilities; Pasir Gudang Health Clinic, Hospital Sultan Ismail Johor Bahru (HSIJB) and Hospital Sultanah Aminah Johor Bahru (HSAJB) were alerted. Emergency medical services (EMS) with the pre-hospital care (PHC) teams were deployed to the incident site. PHC team from HSIJB was supported with MCI team led by an Emergency Physician. Together with other teams, they worked effortlessly to their best in order to manage the situation. Immediate medical treatment were given at the medical base station within the yellow zone of the incident site, which was set up outside the schools' compound, as shown in figure 3. Those who required further treatment were sent to HSIJB and the health clinic. PAGEMA was activated and fleets of ambulances were provided by the industries to assist in sending the victims to the hospitals and clinics. The incident saw a total of 36 victims were sent to HSIJB for further treatment. Out of this, 34 victims were admitted including 4 that were intubated and ventilated in ICU.

Immediate action by the DOE and other relevant agencies to curb the situation were carried out. Intensive investigation was carried out to look for source. DOE, HAZMAT, Royal Malaysian Police (RMP) and other relevant agencies worked hand-in-hand to find the answer. It was only in the afternoon they found the source for the unexpected incident. It was noted that the pungent smell came from the nearby river, about 300 m away from the affected schools. The Kim Kim River, hence the name of the operation - Ops Kim Kim, was said to be polluted

with illegal dumping of tonnes of unknown substances a day prior to that. Further actions by the authorities were carried out to look for the perpetrators, while the rescuers continued dealing with the victims tirelessly.

In the afternoon, after no more victims at the incident site, the on-scene commander (OSC) declared stand down at the incident site at about 1.30 pm. Initial information stating that methane was the involved agent, was denied by the HAZMAT and DOE later on.

Unfortunately, the incident recurred on 11th March 2019 following the opening of the schools. More students were affected as compared to the earlier incident. Reactivation of the response was declared. Again, cooperation from the industry players in providing manpower, ambulances and logistic items to help the government agencies were observed. Stand down was declared later that evening.

The condition became worse on 12th and 13th March 2019. More schools were involved and many students and staff fall sick after inhaling the chemical VOC. On the 13th March, schools as far as 10 to 12 km from the dumping site were affected. More ambulances and logistic vehicles were required to bring the victims to the casualty collecting point (CPP) set up in Community Hall, Taman Pasir Putih. Later on, the CPP or field medical base was translocated to Indoor Stadium of Pasir Gudang (on 14th March 2019) after getting the advice from the State Disaster Management Committee. It was opened till the announcement of stand down on 20th March 2019.

Transdisciplinary Approach in Kim Kim Chemical Incident

Throughout the distress period (7th to 20th March 2019), total of 5,848 victims was treated at the medical base station. Out of this, 951 victims were admitted to HSIJB and HSAJB for further treatment, with 25 were admitted to the intensive care unit (ICU). Various agencies and industries, including the non-governmental organizations (NGOs) took part in managing the incident. More than 30 government agencies and nearly 120 companies and private sectors were involved in the overall process of the incident. NADMA was coordinating the process with State Disaster Management Committee leading the whole effort, assisted by all the concerned agencies and authorities.

Individual contributions were also pouring in to help the victims and assisting the responders. Logistic items and preparations were made available round the clock. This process was coordinated and monitored by the Social and Welfare Department personnel. Proper and systematic distributions of important items were made to the victims and responders.

Without a good coordination and understanding between the responding parties, the situation might be getting worse. For example, with hundreds to thousands of victims required transportation to the health facilities, assistance given to the MOH facilities by the NGOs and the companies, along with their ERT personnel, made the transfer possible within the given time. Without this cooperation, many victims will be stranded at the medical base station (MBS). Their condition might be deteriorated giving rise to poor outcome. Fortunately, there was no fatality among the victims, despite 13 patients that were intubated and ventilated in ICU HSIJB for several days.

The incident site was managed according to the Directive No. 20 of NSC guideline. It was divided into 3 zones, namely Red Zone (high risk zone - the incident site), Yellow Zone (tactical zone for Command Center) and Green Zone (strategy zone). According to the MFRD, particularly the hazardous material team (HAZMAT) standard operating procedures (SOP) in dealing with chemical incidents, the red zone was further divided into hot, warm and cold zones. The decontamination process was performed in the warm zone before the victim or patient was handed over to the medical teams for further treatment at the medical base station (MBS). Since it was a chemical exposure event, Department of Environment (DoE) under the Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC) was among the lead agencies. As shown in figure 4, the zoning concept clearly dictates the roles and responsibilities of each responding agency and their whereabouts at the incident site (8). Malaysia Civil Defense Force (MCDF) acted as the secretariat for the response activities.

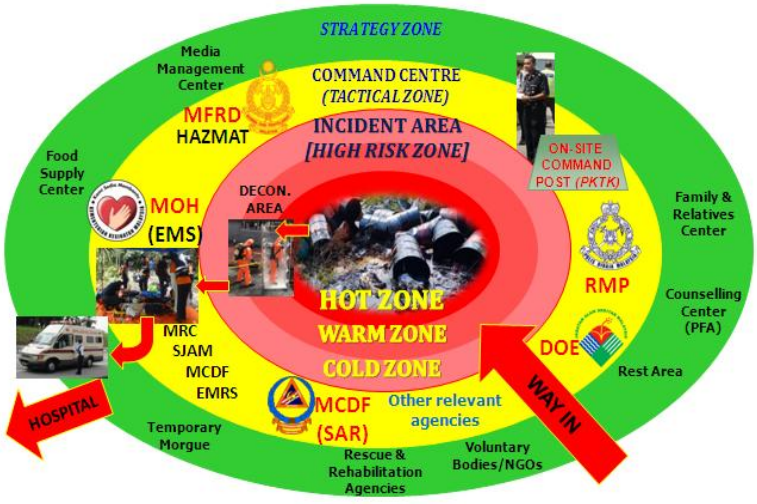


Figure 4. Zoning Concept at the Incident Site
Source: Prime Minister's Department., 2012; Rahmat., 2025

While figure 4 mentions about the zoning concept at the incident site, figure 5 tell about the chain of command right from the Emergency Operating Center (EOC) down to the field commanders. As stated in Directive No. 20 of NSC, the on-scene commander was the police officer, while the operation commander was the officer from the fire and rescue department.

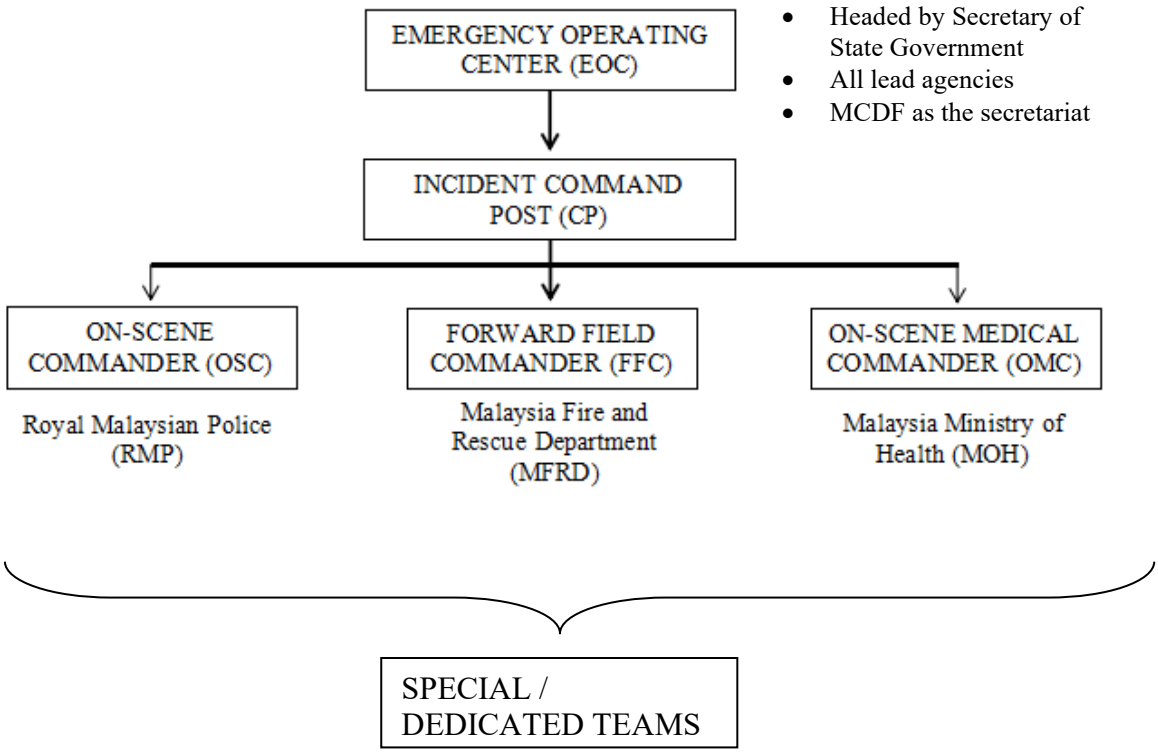


Figure 5. Incident Site Management: Chain of Commands
Source: Rahmat., 2025

Regular meetings and discussions on the progress of the incident throughout the response phase were held in PGMC attended by the representatives from the government agencies and the industries (mainly the safety officers). Various inputs were obtained from the members. Secretary of Johor State Government led the efforts. Officers from NADMA acted as the coordinator and supervising the process. Directive no. 20 NSC is used as a guide and followed by the participating parties, along with PAGEMA incident command system (ICS) manual which specifically focus on the emergency occurring in Pasir Gudang. Emergency operating center (EOC) was set up in the PGMC building. All the relevant agencies were involved. Emergency response teams (ERT) responded to the emergency with the help of the concern authorities. Medical base was set up in the yellow zone area, along with the command post and fire department's post.

With regards to the healthcare services, the Director of Johor State Department of Health acted as the State Medical Commander throughout the entire phases of the incidence. He was assisted by the Deputy of Medical and Public Health Divisions of the Health Department. Both the deputies were then coordinating the efforts from the hospitals and health clinics respectively. The Public Health Division was also responsible in compiling the data of the patients. The data was updated daily and was submitted to the state Crisis Preparedness and Response Center (CPRC) after verification. It was then shared with National CPRC at the Ministry of Health's (MoH) level. The Minister of Health was kept updated with this systematic flow of communication and well-coordinated process from the state. Other divisions' deputies were helping based upon their capacities following the orders from the State Medical Commander.

The Emergency Medical Services (EMS) were activated since day 1 of the incident. Emergency medical teams (EMT) from the hospitals and health clinics worked together hand-in-hand under the Pre-Hospital Care and Ambulance Service (PHCAS). The continuous movement of ambulances along with the tirelessly trained staff, was tremendously coordinated and monitored by the Medical Emergency Coordinating Center (MECC) in HSAJB. The human resources for the PHCAS were mainly from the Emergency and Trauma Department (ETD). They had been continuously providing high-skilled pre-hospital emergency care to the patients at the incident site. They also play a major role in managing the patients at the collecting points in Taman Pasir Putih Community Hall and Indoor Stadium of Pasir Gudang. All patients were given utmost medical care to prevent further deterioration from the effects of the chemical exposure. Those who required further treatment were transported via ambulances to HSIJB or HSAJB.

Apart from the EMT, the emergency response teams (ERT) from the non-governmental organizations (NGO) and the private sectors, especially the industrial players under PAGEMA were giving their assistance. The efficient and timely contributions by the ERT had given a big impact as part of TDA during this unfortunate Ops Kim Kim. Without their presence, EMS could not be provided effectively and efficiently to thousands of victims requiring medical attention. The health conditions of the victims, especially the school children might get worsened if they were not provided timely medical treatment.

Many more health staff were stationed at the hospital to manage the patients. Disaster management plan was activated immediately seeing the Hospital Director automatically acted

as the Hospital Medical Commander (HMC). All disciplines were involved during the stressful 2 weeks period. Things however were under control where all the patients were given the best medical care and services. Fortunately, there was no mortality at all despite of 13 critical patients that were intubated and ventilated in intensive care unit (ICU) for several days.

All together, we managed a total of 5,848 patients during the hard 2-week period of Ops Kim Kim. Out of this, 1,165 patients were treated in HSIJB with nearly 40 percent of them were admitted to the ward to receive further treatment.

RESULTS

Government Strategies During the Recovery Phase

After nearly 6,000 people were affected during the unprecedented incident of Kim Kim, with the closure of all 111 schools in Pasir Gudang district for a period of one week, firm and comprehensive efforts must be taken by the government to restore the situation back to as normal as possible. Various strategies were done to achieve this objective in order to gain the people's confidence. The authorities were focusing in bouncing back to the condition prior to the event. This is in accordance with Priority 4 of Sendai Framework on Disaster Risk Reduction (SFDRR 2015-2030) which is 'enhancing disaster preparedness for effective response, and to build back better in recovery, rehabilitation and reconstruction' (13). Some of the strategies are elaborated as follows:

1. Economic recovery support:
    a. Applying and integrating plans to most effectively leverage Federal resources and available programs to meet local community recovery needs while aggressively integrating with the private sector to facilitate early and productive engagement.
    b. Incorporating mitigation measures into redevelopment following the event to build the community back stronger to minimize future risk.
    c. Building upon the relationships developed during pre-disaster planning and works closely with local community leaders
2. Immediate post-disaster action:
    a. Counselling provided by a team of counselors from the psychiatric institute (Hospital Permai, Johor) and Department of Social Welfare (DSW) to the:
        1) Victims of the incident, and
        2) Responders involved in managing the incident

b. After action review (AAR) by the authorities and departments looking into the strengths and weaknesses during the response phase
c. Developing a new policy or guidelines in dealing with chemical exposure at all levels of agencies or revising the existing policy to strengthen the response in the future with regards to CBRNe event

DISCUSSION

Working on the common platform guided by Directive No. 20 of NSC, responders of all disciplines and stakeholders of all sectors managed to cooperate and working together. It was further strengthened with PAGEMA in place. The established networking among the agencies and companies enhancing the decision making in disaster management practices under a transdisciplinary approach (TDA). They are aiming for the common goal to be achieved which is to restore the situation back to normal as fast as possible, ensuring the safety of the residents and responders and minimizing the impact of the whole situation, in terms of morbidity and mortality. The containment activity where the detection of chemical compound and decontamination process were done by the HAZMAT team, whereas the medical team will give the appropriate treatment after that (14).

It can be stated that the successful management of disasters depends on the strong will of the government and the private sectors, along with the community of the concerned area to work together in all aspects of the disaster cycles and not selective to certain parts of the cycles only. The participation, co-operation and teamwork that are demonstrated by all the stakeholders in the activities organized will strengthen the disaster resilience of Pasir Gudang which can be used as a model to other municipal councils throughout the nation.

LIMITATION

This study is descriptive and based on operational data from one incident. Lack of patient-level clinical data limits detailed health impact analysis. Findings may not be generalizable beyond industrial disaster contexts

CONCLUSION

The involvement of various governmental agencies in dealing with the incident in Ops Kim Kim, Pasir Gudang is an example of an integrated disaster management concept. It was

strengthened with the active participation of private companies and industries to support the activities. It is crucial to ensure that the disaster risk reduction and management (DRRM) activities are a national and a local priority with a strong institutional basis for implementation (15).

It has given big impacts towards maintaining the safety and security of the community and the environment of Pasir Gudang. The contribution of societal policy and decision-making process in disaster management plays an important role in transdisciplinary approach (TDA) in this unfortunate incident. The agencies and stakeholders of all the sectors work together to achieve a common objective. The commitment and integration have made them to go beyond their limit of knowledge and capacity that each agency and sector can reach. By having a common ground using the TDA, the incidence of morbidity has been minimized whilst no mortality among the victims was observed. TDA has also strengthen the cooperation among all the stakeholders to face future threat, if any.

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CONFLICTS OF INTEREST

The author declares no conflict of interest.

ETHICAL APPROVAL

This article is a retrospective descriptive analysis of a disaster response. No direct patient data were used. Ethical approval was waived by the institution.

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