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TOWARDS SUSTAINABLE URBAN ENVIRONMENTS

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Strategic Domestic Solid Waste Management in Urban Areas

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Abstract

Effective domestic solid waste management in urban areas has become a key element in the pursuit of sustainability, as it encompasses a range of strategic approaches to reduce waste generation and promote recycling and recovery while minimizing environmental impact. Recognizing the importance, this discussion aims to (1) assess the current state and innovation of domestic waste management practices, (2) identify the key challenges and barriers faced in implementing strategic waste management practices, and (3) develop effective strategies and policy recommendations for improving domestic waste management in urban areas. The discussion was structured into five sections: policy, operational management, initiative and technology, public behaviour and collaboration. By adopting a holistic approach from each section to strategic domestic waste management, urban areas can reduce the amount of waste they generate, divert more waste from landfills, and create a cleaner and healthier environment for everyone.

Keywords: Household waste, circular economy, sustainable development, municipality

INTRODUCTION

Effective domestic solid waste management has become a crucial component in the pursuit of sustainable development, as it encompasses a wide range of strategic approaches aimed at minimising waste generation, promoting recycling and resource recovery, and mitigating environmental impacts (Awogbemi et al., 2022; Kurniawan et al., 2022). The world generates an estimated 2.01 billion metric tons of municipal solid waste (MSW) annually, of which 33% is not adequately managed in an environmentally safe manner. The average amount of waste generated per person daily is 0.74 kg, but this ranges widely from 0.11 to 4.54 kg. The per capita MSW generation in Southeast Asia is 1.14 kg per day, and 1.17 kg per day for Malaysia (Kaza et al., 2018). SWCorp also reported in 2020 that the Malaysian recycling rate stood at 30.67%, which is better than the average recycling rate of developing countries at 15-20% but significantly lower than that of other developed nations such as Taiwan (60%), Singapore (59%), and Korea (49%) (Rajesh, 2019; MIDA, 2021).

In Malaysia, the responsibility for solid waste management (SWM) lies with multiple entities, including the Ministry of Urban Wellbeing, Housing, and Local Government (KPKT), National Solid Waste Management Department (JPSPN), Solid Waste Management and Public Cleansing Corporation (SWCorp), local governments, and concessionaires (Razali & Wai, 2019). This collective approach demonstrates Malaysia's strong responsibility and commitment to effective SWM. The 12th Malaysia Plan 2021–2025 (RMK-12) recently focused on

several themes, including improving sustainability (Economic Planning Unit, Prime Minister's Department Malaysia, 2021). The plan introduces Game Changer VIII, embracing a circular economy emphasising the enhanced utilisation of recycled materials and effective management of production waste (Cheng et al., 2022). In addition, SWM is highly integrated into sustainable development goals (SDGs), mentioned explicitly or implicitly in 10 of the 17 SDGs set forward by the United Nations, emphasising the significance of a strategic SWM system (Hannan et al., 2020).

Residential areas are the primary generators of solid waste as this is where people reside. Food waste, plastic, paper, fabric and household items such as used oil, e-waste, and tyres are typically disposed of from residential areas. The increasing rate of household waste has become a serious concern. Malaysian landfills account for 95% of the total waste gathered, including recyclable and compostable waste, and landfills in Malaysia have surpassed capacity and may close within a few years (Kuan et al., 2022; Chen et al., 2021). The mismanagement of MSW is a pressing environmental concern exacerbated by population growth, rapid industrialisation, urbanisation, and limited public awareness of waste generation, resulting in adverse health impacts (Mohamad et al., 2022). Acknowledging the importance of strategic domestic waste management, this discussion aims to assess the current state and innovation of domestic waste management practices, identify the key challenges and barriers faced in implementing strategic waste management practices, and develop effective strategies and policy recommendations for improving domestic waste management in urban areas.

POLICY IN WASTE MANAGEMENT

Waste management should align with sustainable development principles to prevent harm to present and future generations (Khan et al., 2020). Thus, the JPSPN was established under the Solid Waste and Public Cleansing Management Act of 2007 (Act 672) and the Solid Waste and Public Cleansing Management Corporation Act of 2007 (Act 673). Both acts were gazetted in August 2007 and came into force by 2009. The JPSPN, as provided under Act 673, has the function of coordinating various agencies, including federal and state government, local authorities, private agencies, and the public, while SWCorp role is to assist in the implementation of the policy (Bukhari et al., 2020). This department is coordinated under the KPKT. The respective states are Perlis, Kedah, Pahang, Negeri Sembilan, Malacca, Johor, and the Federal Territories of Kuala Lumpur and Putrajaya.

According to Section 74, Act 672, the public must segregate solid waste and failure to do so, if convicted, can be fined a maximum of RM1000.00. Section 108 (2) (g) states that it is the individual's responsibility to separate solid waste that can be recycled while also avoiding dumping waste at disposal centres. The state government of Selangor, Perak, Penang, Kelantan, and Terengganu remained under the jurisdiction of previous acts, including the Local Government Act 1976, Town and Country Planning Act 1976, and Site, Drainage and Building Act 1974 (Khan et al., 2020).

OPERATIONAL WASTE MANAGEMENT

The main areas that require improvement in waste management operations include waste collection, transportation, and disposal. Insufficient waste containers and stations impede waste management efficiency in some places. Improving infrastructure and collection systems is essential for proper household waste collection. Problems in waste collection arise in urban areas, such as Kuala Lumpur, where the development is not planned adequately and poses issues such as the placement of waste containers and bins. In addition, domestic waste collection in traditional village settlements in urban areas can be challenging because of the limited access to narrow roads. It is necessary to prepare central collection points in these settlements, which require proper planning by local authorities.

The frequency of domestic waste collection was also highlighted in the discussion as one of the provisions of Act 672 is the standardisation of a 2 + 1 collection system involving two days of domestic waste collection and one day of recyclable or bulk waste collection. The 2 + 1 collection system is adequate for rural and suburban areas. However, it may not be feasible in urban areas with high populations and traffic, especially tourism areas, which have high levels of waste generation and require more frequent waste collection. Another example of a collection system can be seen in Selangor, which does not enforce Act 672 and enacts its own state government SWM law (mention the state law) that implemented the 3 + 1 collection system, where the concessionaire collects domestic waste three times a week. This collection frequency was deemed more suitable because Selangor has the highest population density of all Malaysian states (Baig et al., 2022).

Transportation is crucial to waste management because inefficient transportation systems can result in delays, increased costs, and negative environmental impacts. Improving waste transportation logistics by optimising routes, deploying suitable vehicles, and establishing tracking systems can increase the efficacy of waste management. SWCorp—implemented Automated Vehicle Locating System (AVLS), which uses Global Positioning System (GPS) to track the location of vehicles, that can be utilised to monitor the activities of waste collection trucks. The acquired data can be used to track the progress of the waste collection, identify issue areas, and optimise truck routes. In addition, KDEB Waste Management (KDEBWM) has taken the initiative to monitor waste collection operations by installing cameras on waste collection vehicles.

Effective waste management involves proper recycling and segregation of different types of waste. Many waste disposal systems lack efficient recycling facilities and fail to promote segregation at the source. Significant improvements in waste management are possible through the implementation of awareness programmes, the enhancement of recycling infrastructure and the provision of recycling incentives. In addition, proper treatment and disposal facilities are required to effectively manage the various types of waste including incinerators and landfills. These aspects are analysed in Environmental Impact Assessment (EIA) studies prior to any implementation of SWM. Figure 1 shows the current flow and fate of domestic solid waste.

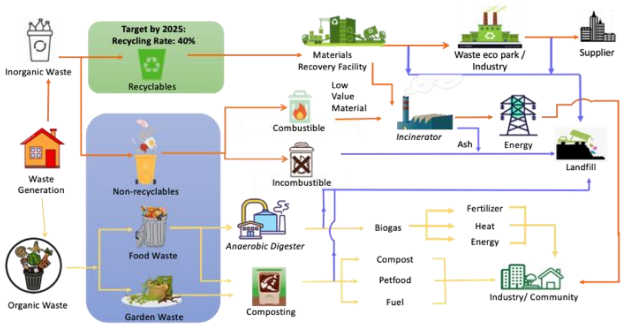

Figure 1. Current Domestic Solid Waste Flow in Malaysia

Many locations lack proper waste processing, treatment, and disposal capabilities, thereby increasing waste dumping into landfills. Investing in advanced treatment technologies and waste-to-energy facilities can improve waste disposal systems including waste mining. A few projects, such as the Selangor Green Energy Eco Park by KDEBWM, which is expected to process 2,400 tons of waste daily to produce approximately 50 megawatts of energy, have been introduced as initiatives to improve the efficiency of waste management and lessen the dependency on landfills.

INITIATIVE AND TECHNOLOGY IN WASTE MANAGEMENT

As Malaysia adapts to urbanisation, the application of technologies has aided in many fields, including waste management. The technology used in waste management has increased the efficiency of this field through monitoring, waste collection, and recycling processes. The energy, time and human resources can be reduced by utilising technology as it can handle the growing amount of waste more effectively.

Monitoring system applications have made a significant impact on waste management. The increasing development of the Internet of Things (IoT) and upgraded surveillance system helps the authorities manage their operation well and make amendments to the area that needs improvement. Agencies involved in waste management in Malaysia, such as SWCorp, KDEBWM, and the local authorities, including Kuala Lumpur City Hall (DBKL), have implemented their way of tech into their daily operation. For example, SWCorp has enforced a system to comprehensively monitor their waste operation called the C4i system (Command, Control, Communication, Computer, and Intelligence). Implementing advanced technology to the system enables them to perform on-site monitoring of concessionaires efficiently. Besides that, KDEBWM and DBKL have sensor-based waste bins, which can send real-time data on the level of waste filled into those bins. It helps them optimise the waste collection routes, reduce unnecessary pickups and ensure timely collection, saving fuel and decreasing traffic congestion.

Malaysia still has a long way to go regarding the circular economy. The concept of circular economy is based on which the design of the products has been versatilely manufactured with different uses and is guaranteed to be reused multiple times (Arruda et al., 2021). The authorities have studied and tried various efforts to extend the life cycle of waste generated in the country, such as recycling, composting, and waste-to-energy facilities. SWCorp has deployed the Waste Executive Geographic Information System (WEGIS) internet application in an effort to assist the circular economy. This application was created in 2019 to boost the agency's efficiency by managing and monitoring concession activities in seven states using high-level data access. Here, the public can access nearby recycling and recovery facilities to send their household waste without sending it straight to the bins. Furthermore, KDEBWM plan to build a Waste-to-Energy (WTE) power plant technology to move towards a resource-efficient, low-carbon, and circular economy without adverse environmental impacts and does not require a big land. It reduces the volume of waste going into landfills while generating renewable energy.

Another option to promote a circular economy is by composting organic waste. There are a lot of composting methods that can be used. One reliable approach is using Black Soldier Fly (BSF) larvae composting. This method utilises the larvae of BSF to break down organic waste, including food waste, into nutrient-rich compost. Since food waste is the highest waste generated in Malaysia, it is crucial to use these composting approaches to minimise the transport of organic waste to landfills as it can generate hazardous gasses if released into the open air. DBKL has successfully implemented BSF farming through the project of bioconversion of organic waste generated by KL Wholesale Market, and they managed to reduce about 10 tonnes of waste per month, according to DBKL.

UiTM also made the same approach to counter the food waste problem at the university. They extensively researched BSF farming and invented a new BSF Intellicycle Composting Rack (BSF-ICCR). This innovative system allows communities, local authorities, and industries to manage food waste sustainably and effectively. The BSF-ICCR adapted IoT by introducing an automated temperature and humidity control system that can easily be managed using a smartphone. This innovation makes BSF farming accessible in many areas with minimal care. Embracing IoT in BSF composting moves waste management towards a more data-driven, intelligent and eco-friendly future (Mohd Rasdi et al, 2022).

All of these innovative technologies can be leveraged more to enhance the waste management system in Malaysia. The authorities have made many efforts to counter the waste problem by promoting and adopting these technologies and ensuring equitable access to the public. By providing continuous awareness campaigns, workshops, and programs, the public can make full use of these technologies to manage domestic waste, thus reducing the amount of waste sent to landfills.

PUBLIC BEHAVIOUR REGARDING WASTE MANAGEMENT

Law and regulations play a pivotal role in ensuring sustainable development. Each country has their regulations, which state that it is necessary to follow the rules and acts created and endorsed. According to Khan et al. (2019), in their research article entitled "A Survey on Perceptions of Legal and Non-Legal Factors Affecting Sustainable Solid Waste Management in Malaysia", the majority of the respondent do agree that legal factor is crucial in waste management. Also, in the same article, most respondents agree that a satisfactory policy facilitates sustainable SWM. That means the public does realise the importance of act and policy on this aspect. However, on the contrary, during the discussion with the focus group discussion panelists, stated that based on their work experience, that there is still a lack of enforcement by the authorities. This caused the public not to follow the act or rules imposed. Moreover, this public behaviour is driven by the lack of enforcement towards waste management.

Secondly, it involves facilities factors that are present to promote and make recycling accessible to the public. Discussions with the local authorities agreed that recycling facilities also play an important role in why domestic waste management in Malaysia is one of the current national issues. There is a lack of recycling centres and limitedly in Malaysia. If it is present, the location is quite further apart. Therefore, the public has problems accessing and using it easily. This makes the recycling process troublesome for the public and indirectly causes a lack of participation among the public to engage actively and involve in the recycling process.

According to SWCorp, regular monitoring is required by the right authorities. This means inconsistent participation of the public has become one of the challenges of waste management in Malaysia. It was also added that a lack of staff to monitor regularly towards the community contributes to inconsistent participation among the public in waste management. The public has to be regularly reminded of the importance of waste management, which makes the authorities' job a huge challenge. It can be assumed that people do have knowledge of

waste management, but the issue is from the public whether they always stick to what they have been taught or not.

Another issue discussed during the forum was the lack of awareness and implementation of waste management in the household. Waste management education was taught in childhood, but the behaviour was not carried out when the student was at home. This is because the children will follow their parent's footsteps whether to practice the correct waste management at home itself. This behaviour requires constant reminders so that the next generation will have a high awareness to practice good waste management, even at home. Education in school only is not enough to instil a correct mindset on waste management in the young generation, as environmental or social factors also play a huge role in breeding a correct and good mindset everywhere that particular person is.

Public participation is very important in the execution of waste management initiatives. For instance, waste segregation is a fundamental and critical aspect of any effective waste management system, including the integration of advanced technologies. Without waste segregation, the potential benefit of the technologies would be limited and lower the quality of recycled materials. Thus, public participation is instrumental in ensuring the public segregates waste effectively.

Thus, these are the few challenges that are faced by the authorities in implementing good practices on the public aspect of strategic domestic waste management. It can be concluded that the roles and the factors of effectiveness of waste management do not just fall on the authority but also on the public. Incineration with air pollution issues and the lack of landfills are serious challenges. This multifactorial aspect needs to be focused more, and strategies to reduce or minimise the challenges faced can be well-executed.

COLLABORATIVE EFFORT FOR A STRATEGIC WASTE MANAGEMENT

The fundamental goal of current waste management practices is to reduce waste production and extend the lifespan of landfill sites. Therefore, the goal must be the main focus of cooperation between the government, private organisations, research institutions, and the public. Collaboration allows for sharing resources, knowledge, and expertise from different stakeholders. Government agencies, private sector entities, research institutions, and the public each bring unique perspectives, experiences, and capabilities that can be leveraged to address complex waste management challenges effectively.

The government should support the circular economy goals by providing the facilities such as innovation centres, or research and development hubs that collaborate with industries to foster the creation of new, innovative products with circular design principles. The government can incentivize companies to invest in developing eco-friendly products through grants, funding, or tax reduction. Embracing circular economy principles can reduce carbon emissions by promoting the use of recycled materials and decreasing the use of raw materials in manufacturing. This would benefit the government in line with their National Low Carbon Cities Masterplan directions, highlighting the need to provide funding and financing to facilitate low-carbon development and increase community participation in low-carbon development (Rahman, 2020).

Government agencies provide policies such as implementing a circular economy and various programs such as recycling, waste to energy, and waste to wealth. The government is only able to implement some programs that have been designed; this opportunity needs to be taken by the private sector because managing waste provides a good return. Research institutions can contribute valuable insights into and advancements in waste management technologies, processes, and best practices. Government agencies should encourage private parties and research institutions to implement policies and programs produced through incentives, such as tax exemptions or research grants.

CONCLUSION

Strategic domestic waste management in urban areas is complex and multifaceted. It requires a holistic approach that includes policy, operational management, initiative and technology, public behaviour, and agency collaboration. As policymakers, the government must regulate the waste management industry to ensure that waste is managed environmentally sound and sustainably. Next, issues in the operational management of waste management, such as infrastructure, waste collection frequency, and transportation and disposal systems, should be addressed to develop innovative solutions. In addition, initiatives, and technologies such as advanced monitoring systems, promoting the circular economy through website applications, recycling, composting, and waste-to-energy facilities play a crucial role in improving waste management to reduce the amount of waste that goes to landfills. It is also vital for the public to be aware of the importance of strategic domestic waste management and to be willing to participate in waste management programs and initiatives.

Collaboration among government agencies, private sector entities, and research institutions facilitates the development and implementation of well-informed waste management policies. The government should provide incentives and facilities for companies adopting the circular economy principles. Research institutions can provide evidence-based insights, while private sector entities can offer practical perspectives and market expertise. Together, they can develop practical and feasible policies. By adopting a holistic approach to strategic domestic waste management, urban areas can reduce the amount of waste they generate, divert more waste from landfills, and create a cleaner and healthier environment for everyone.

CONTRIBUTION STATEMENT

The MAEH Urban Health Forum was held at the National Institute of Health (NIH), Setia Alam, from 19-20 June 2023. AAZ, NHY, NAA, ANJS and FAS conceived the forum, applied for and obtained funding from the Malaysian Association of Environmental Health and Universiti Teknologi MARA, and also drafted the first version of the manuscript. SRMI, MIMY, NAFA, MRS, ARI, SR and RM analysed the issue. All participants at the forum contributed to the focus group discussion that produced the article and approved the final version.

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TOWARDS SUSTAINABLE URBAN ENVIRONMENTS

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Urban Flood Challenges and Opportunities for Mitigation

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Abstract

Urban flood is one of the disasters that can happen at any time, which is quite concerning these days. Focus Group Discussion (FGD) was conducted qualitatively by a discussion from different organisations and backgrounds to identify the challenges and opportunities for mitigation in urban floods. Two main objectives discussed in this article are to assess the implication of climate change and future flood risks for health impacts, adaptation process, and emergency response; and to analyse the mitigation strategies for the flood related to the community's environment, health, and safety. This program was conducted to raise awareness and knowledge regarding urban floods and look for more profound views and perspectives of different organisations. FGD was held at the National Institute of Health (NIH), Setia Alam, Selangor. Six panellists were invited to participate, and all opinions from the panellists were recorded and taken during the FGD event and presented in the manuscript.

***Keywords*:** extreme weather, climate change, infectious disease

Introduction

The world has faced significant climate change over the past few decades, which causes some natural hazards and extreme weather in the environment, including floods. Monsoons and flash floods are the two varieties of flooding that typically affect specific regions. Asia and Southeast Asia have experienced a rise in hydro-meteorological disasters in the last two decades (Yusmah et al., 2020). Notably, the climatic conditions in Peninsular *Malaysia* exhibit significant differences from those in East *Malaysia.* According to Vincent & Yusoff (2022), Malaysia has two types of monsoons that affect the weather: the Southwest Monsoon, which runs from late May to September, and the Northeast Monsoon, which runs from November to March. In Malaysia, the monsoon's annual flooding frequently causes significant losses. Floods are a major disaster in every nation, and these disasters have disrupted

daily community activities, caused financial losses, damaged infrastructure, such as railway tracks, bridges, roads, vehicles, and properties, and even claimed lives (Muzamil et al., 2022; Safiah Yusmah et al., 2020). Usually, flash floods occur in urban areas due to infrastructural and drainage problems. Urban flooding is defined as flooding in a densely populated area (Association of State Floodplain Managers, 2020). Urban flooding is known to cause damage to infrastructure and loss of life. Urban flooding inundates land or property in the built environment, particularly in densely populated areas (Yusmah et al., 2020). Extreme flood events are associated with the climate change caused by urbanisation, which resulted from a lack of effective flood risk management plans, especially in low and middle-income areas (Koje et al., 2022; Najibi & Devineni, 2018; Penning-Rowsell, 2014). One of the extreme flood events that had a detrimental impact on Malaysians was the flood that happened at Taman Sri Muda Shah Alam in 2021. When the rainfall exceeds 50mm, knee-deep floods will happen due to the low-lying Taman Sri Muda (Idris, 2022)**.**

Flood risk, exposure, and damage potential increase, causing destitution and vulnerability to rise, which traumatised the communities, and the yearly flood hazard has compelled residents to plan to return to their everyday lives more quickly (Safiah Yusmah et al., 2020). Annual flooding is a predictable phenomenon, and the victim's experiences with this kind of emergency have led them to prepare in advance. Safiah Yusmah et al. (2020) indicate that the results suggest that the occurrence of the flood was due to several factors, including the demographic characteristics of the affected area, the positioning of the houses, inadequate and imprecise information and evacuation strategies, suboptimal management of the transit centre, and insufficient preparedness on the part of the community.

Urban flooding involves drowning land or property within a constructed setting, mainly in regions with high population densities. The impact of high population density, expanding infrastructure, and economic growth on the sustainability of urban areas is a subject of concern among researchers (Safiah Yusmah et al., 2020). Over time, it has presented an increasingly complex task for governmental bodies and developers to formulate a development strategy that effectively reconciles the need for urbanisation with the imperative to conserve natural resources.

Health impacts of increased waterborne and vector-borne diseases with poor healthcare access amidst urban floods

i. Increased waterborne diseases

Pathogens can quickly spread in floodwaters, making them a breeding ground for cholera, Hepatitis A, and diarrhoea. It can become established in floodwaters, increasing the likelihood of waterborne infections. During floods, bacteria, viruses, and parasites can spread in the water supply, making drinking unsafe. Sewage overflows, broken sanitation systems, and flooding combined with agricultural or industrial waste are all potential entry points for these bacteria. For example, diarrhoea during floods can spread *rotaviruses, noroviruses*, *E. coli, Salmonella,* and *Campylobacter*. Pathogens in contaminated water or food can cause gastrointestinal disorders. *Vibrio cholerae* causes acute diarrhoea and is spread by faeces-contaminated water or food in places with poor sanitation and insufficient water**.** It also contributes to hepatitis, which can spread *Hepatitis* A and E viruses mainly through feces, indirectly increasing hepatitis risk because of floods.

ii. Vector-borne diseases

During the focus group discussion, Mr Mohd Hairal Zainal mentioned that post-flood is one of the vital phases as the vector-borne disease is more prone to spread than during the flood. The vector-borne disease is easily spread as floods create unsanitary conditions that exacerbate the potential for malaria, instead of dengue fever, to spread more quickly in flooded areas because of the increase in mosquito populations. The unsanitary conditions happen due to the affected sanitation systems because the sewage and stagnant water that arise from the flood cause the mosquitoes breeding rates to increase (Kaur et al., 2020; Chan, 2017; Kouadio et al., 2012; Watson et al., 2007). Malaria spreads when the agent (*Anopheles* mosquito) infected by *Plasmodium* parasites bites the host (human) (Kaur et al., 2020).

iii. Healthcare access amidst urban floods while overcoming disruptions in service systems

Flood occurrence in urban and rural areas also disrupts healthcare services. Mr Mohd Hairal Zainal said that the vehicle can only access limited areas when floods happen for up to two days. Hence, distributing medical aid becomes a significant problem for flood victims at flood evacuation centres. Floods also

have a massive impact on healthcare services. People become very vulnerable to floods because there is little clean water and food; hence, when people stay at flood evacuation centres for more than two days, they have problems with cleanliness and healthcare services. Due to limited clean water, some infectious diseases that might occur during floods and at evacuation centres are leptospirosis and diarrhoea. There is also good evidence of outbreaks of leptospirosis but relatively weak evidence that flooding leads to an outbreak of other infectious diseases (e.g., *cholera, hepatitis*, vector-borne disease) (Few et al., 2004). Hence, disruption of healthcare services during floods could significantly impact the community's health. Medication and medical aid are crucial sources for the well-being of a community during a disaster. Dr Norfazillah Ab Manan highlighted that flood disrupts people's ability to get to the clinic for medical care, mainly when a flood takes a long time to subside, like the recent flood in Klang Valley.

Safeguarding lives through early warning systems, enhanced disaster preparedness, and effective coordination and communication in urban flood

i. Timely early warning system

One thing that needs to be emphasised when dealing with disasters is the effectiveness of early warning systems. The early warning system is crucial as it assures the affected communities receive information on potential hazards, such as floods (Global Disaster Preparedness Centre, 2023). It does not only help the communities but also helps the organisation or individual prepare and act appropriately when facing floods. However, the information must be disseminated promptly so communities, organisations, and individuals can prepare themselves, including taking precautionary measures like switching off the main power supply of the house or building to avoid any property damage. The effectiveness of early warning systems is determined by ensuring that the community receives the alerts, understands the signal or warning given, and acts toward it (International Labour Organization, 2022). Mr Herman Tawil said there is a public *Infobanjir* official website to be referred to, but more people need to know about this website. Dr Norfazillah Ab Manan mentioned that the warning does not alert the communities, and it is unclear to the community to prepare themselves during the flood, and Mr Mohd Firdaus Zainal concurred.

ii. Enhanced disaster preparedness

Mr Herman Tawil said there is a new National Flood Forecasting and Warning Center (PRABN) where the information received from meteorology map during rain will be simulated at an interval of time, and it will link to the system that can predict the situation in three days and seven days of preparation. Nevertheless, this prediction process is quite challenging because the climate is different nowadays, and it is hard to predict precisely, but it is still precautionary to proceed with the results.

Dr Ernieza Suhana Mokhtar agrees that a flood information system is an excellent way to inform people regarding flood occurrence. However, most people need assistance understanding the water level information, although adding a visual perspective for flood distribution is an innovative idea. She added that visual mapping is a better way to deliver understanding for communities, for example, a red alert on an affected area or location. In addition, the crowd-sourcing approach is an effective way of informing the flood status during real-time events on social media because, with the advanced technologies, people focus more on viral/current live events but be mindful of the validity of the information. Validity of information is essential even though the technology is vastly used, but still, meteorology maps and precise information is the essential.

It is challenging to implement to the people or engage with the community, as it all depends on the people themselves because they will only react according to the guideline if they regularly face the most extreme situation. The warning system should be like fire drills and more specific time instructions to face the disaster.

iii. Coordination and communication

Coordination and communication are crucial to an emergency response plan when a disaster happens. Lack of communication and loopholes in coordination could have a significant impact on emergency preparedness. Effective coordination and communication are essential in managing crises, public safety, and organisation relief support. The role of National Disaster Management Agency (NADMA) at local, state and federal levels needs to be reevaluated and reorganized. Mr Mohd Firdaus Zainal said that during the latest flood in Segamat, there was considerable support for food, clothes, and necessities in certain areas from any organisation, relief support, or NGO causing excessive aid support from agencies to distribute the aid. Segamat Municipal Council has developed comprehensive guidelines called Command Centre (CC) to guide the coordination of support relief. Establishing a clear

command structure and a chain of command could facilitate effective decision-making and coordination among agencies and response teams. Communication among communities is also essential to continually raise awareness to prepare for floods. Effective communication in delivering information is crucial to create early awareness among people about flood hazards.

The environmental impacts caused by urban floods

Major causes of urban flooding are rapid development, urbanisation, heavy rainfall, and drainage system problems. The drainage system will be challenged as the development happened rapidly, and the drainage system cannot withstand water overflow during heavy rains. Urban flooding also had detrimental effects on environmental pollution. Urban heat islands have also been identified as a cause for enhancing convective rainfall in and around cities and inducing flooding (Gupta, 2020). Post flood waste management remains an issue. Water supply and transportation are badly disrupted.

The detrimental effect on the environment due to flooding can be seen through changes in the topography of an area, land use changes, and climate change. Due to climate change, the factors exceeded 30% more than the estimated and overwhelmed the monsoon drainage. Based on flood occurrence records, the estimation of floods is crucial to providing broad information on the extent (the boundary or flood inundation region) of flood-prone locations. Numerous tasks were necessary for river basin planning and management, ranging from timely flood alarms to identifying areas in danger of flooding, stimulating, and occasionally even enforcing the necessity for such a modelling system (Adnan et al., 2014).

Low-lying areas and regions with steep slopes can be prone to flooding as, naturally, water will flow downhill, which has sometimes caused this area to become more sloping. Human activities due to urbanisation and rapid development have modified the landscapes, which can disrupt the drainage system (Cilia et al., 2021). According to the previous study by Mokhtar et al. (2020), the lowest elevation and near the riverbank has the highest percentage of flood inundation and supported by Wu et al. (2014) that said the downstream area was affected the most during flooding compared to the upstream area due to the speed of water for the high level to the lower elevation. Post flood waste management is critical for returning to normalcy. Environmental Impact Assessment (EIA) studies should address such issues in the planning stages. All five panellists agreed that increasing or more uncontrolled development is one of the main reasons for the urban flood.

Addressing challenges in promoting community engagement, mitigating climate change, and enhancing land use planning in urban flood

i. Community engagement

Segamat's experience sees the management of disaster allocation needs to be better prepared, which helps to avoid any uncontrollable crisis. The victims' essential equipment and necessities are always available. However, there are no specific guidelines to distribute emergency aid accordingly, and there should be a decision-maker to centralise the situation. That makes collaboration between organisations important when facing a disaster. Head of the community plays a significant role in coordinating the people because the safety officer can only proceed with the guideline if only there is an engagement with the community.

Knowledge and awareness among people on handling solutions during floods are necessary to avoid consequences such as loss of life, property loss and others. However, people living in flood-prone locations must be informed and prepared early. Their mentality needs to be better prepared because flooding in an urban area only occurs occasionally, like on the east coast. For example, Taman Sri Muda flooding occurs unexpectedly, which makes the people unprepared for the situation, making the event more chaotic.

ii. Climate change

In the last few decades, Malaysia has increasingly experienced extreme weather events characterised by days of hot temperatures, high rainfall, dry spells, thunderstorms, and strong winds (Rosedi & Ishak, 2023). Moreover, the inter-monsoon seasons occur in March-April and September-October, which brings intense convective rainfall. It has also been said that during inter-monsoon, the rainfall is exceptionally intense, occurring at 3% more of the frequency of seasonal rainfall. Moreover, Peninsular Malaysia has an annual rainfall range of 1450 mm to 2575 mm. Thus, the amount of rainfall and its yearly variability and seasonal distribution have been drastically impacted due to climate change, where increasing monsoon rainfall intensities are a source of large

or flash floods. Besides, floods are also affected by various climatic system characteristics, most notably precipitation (intensity, duration, amount, timing, phase - rain or snow) and temperature patterns (Kundzewicz et al., 2014). Hence, the flash flood in Taman Sri Muda gradually increased the high intensities of rainfall by 1000 mm in a few hours for more than two days. Floods also can happen due to concurrent extreme tide events and storm surges.

iii. Land use planning

Adapting to future flood risks requires comprehensive land-use planning measures that steer development away from high-risk flood areas and protect natural floodplains. In the FGD session, flood mapping hazards from the Flood Management Division, Department of Irrigation and Drainage (DID) where the prediction of flood will take place in the future whole of Malaysia using the model of hydrodynamic on the land. This flood hazards mapping would predict the location in Malaysia prone to flood disasters, and the implication will be quite challenging since it involves the economy. The understanding and acceptance of the people on this issue is the most challenging aspect in accepting the bitter truth about the urban flood in the home area, and all five panelists agree upon this statement during FGD session.

Seizing opportunities for mitigation in integrated water, flood plain management and developing community response teams, and ensuring health and safety during urban floods

i. Integrated water and flood plan management

Mr Herman Tawil again highlighted that flood mapping hazards could be used as a tool in helping the government in preparing for mitigation action where the preparedness process can be prepared in advance for the flood-prone location. The concept from DID, “Living with the flood,” because nothing can be done can be hard to accept because the development process cannot be pushed away. Dry ponds and wet ponds system should be enhanced. He also emphasised said the development should also have a resilient structure and waterproofing properties with a new guideline.

Dr Ernieza Suhana Mokhtar sees the plantation owners facing the consequences due to the lower land and highly exposed to flooded events. The uncontrolled water will release and affect their plantation. However, compensation for the loss should be taken seriously by the government after the flood event to recover the damaged crops during the flood. Flood Mitigation Project (*Projek Mitigasi Banjir*) would include planning that refers flood mapping hazards and the risky location should be avoided for development and minimising the damages due to urban floods is necessary.

ii. Develop community response teams

Mr Mohd Zainoor Annuar Mohd Zain said the community could develop a CERT (community emergency response team) where the people can prepare themselves, and this shows a reasonable effort by the community to respond to a disaster before any help/aid comes to save the situation. Local authorities should always lead the way. Hence, improving the local community engagement to respond quickly to crises and react fast to save other people before too late. These efforts need collaboration between village heads and villagers in rural areas to respond to emergencies. Effective team organisation could effortlessly help other victims to evacuate to safe places and distribute any aid efficiently. Effective communication between CERT and external emergency responders would help deliver information through radios, phone systems, or messaging apps. Reliable resource management is also crucial in allocating resources during crises and emergencies, developing a sense of community among people around the affected area.

iii. Health and safety measures during urban floods

In terms of health and safety, comprehensive flood management strategies should be implemented. First, the responsible parties must establish protocols to address immediate health and safety risks during floods, including emergency medical services and evacuation procedures. Next, providing access to safe shelters and sanitation facilities for displaced individuals. Finally, promoting public health measures, such as disease surveillance, vector control, and access to clean water, to prevent post-flood health hazards. All points suggested were discussed and agreed upon by the panellists, and the most important factor in overcoming the situation is communication in all directions.

Conclusion

Urban flood challenges and opportunities for mitigation during FGD sessions from all five panellists have agreed on one statement: collaboration between departments and organisations during mitigation is essential during mitigation or flood disaster. Mentality, attitude, self-awareness, early education and knowledge, budget allocation, and human resources are vital in

preparing the organisation (NGOs), departments (local, state and federal), and every community during pre, during, and post-flood disaster response.

Contribution Statement

The MAEH Urban Health Forum was held at the National Institute of Health Setia Alam from 19-20 June 2023. NAH, NAFM, SFAR, ZA and FAS conceived the forum, applied for and obtained funding from the Malaysian Association of Environmental Health and Universiti Teknologi MARA, and drafted the article's first version. ESM, HT, MFZ, and MZAMZ analysed the issue. All participants at the forum contributed to the focus group discussion that produced the article, and all approved the final version.

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TOWARDS SUSTAINABLE URBAN ENVIRONMENTS

MAEH URBAN HEALTH FORUM 2023

Strategy for Dengue Prevention and Control at Construction Sites

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Abstract

Urbanization globally has led to increased construction sites, which often cause environmental disturbances and attract mosquitoes, leading to dengue outbreaks. Dengue fever cases in Selangor, Malaysia, have shown a worrying increase which statistics showing increasing cases from year to year. Construction sites are a key factor in the escalating number of dengue cases. This Focus Group Discussion will further discuss strategies for preventing and controlling dengue at construction sites. This discussion aims to assess challenges in construction site dengue prevention and identify innovative approaches, enhance coordination and collaboration among stakeholders for effective dengue prevention, and develop strategies to reduce construction site dengue risk using technology and data-driven solution. The discussion was structured into five main key points, which are 1) Identifying gaps and challenges, 2) Innovative Approaches and Best Practices, 3) Collaborative strategies and stakeholder engagement, 4) Policy and regulatory considerations, and 5) Implementation and Recommendation. By having a discussion with all the panellists, ideas on strategies for dengue prevention and control at construction sites can be implemented.

***Keywords*:** industrialization, housekeeping, outbreaks

INTRODUCTION

Dengue, also known as dengue fever, is a viral infection caused by the dengue virus. It is transmitted to humans through the bites of infected female mosquitoes, primarily the Aedes aegypti mosquito. Dengue is a significant global health concern yearly (Basar et al., 2018). In Malaysia, the cumulative number of dengue cases reported until April 2023 shows a 195.3% increase for the same period in 2022 (WHO Western Pacific Region, 2023). Basar et al. (2018) state that the unexpected rise in dengue incidence in Malaysia may not be solely attributable to climate change. Complex factors such as environmental changes, weather patterns, the degree of urbanization, and the effectiveness of vector control services in urban areas may impact the rise of dengue incidence in tropical and subtropical countries.

The state of Selangor recorded 1,185 cases of dengue fever during EW20/2023, a 10.2% increase over the previous week's count of 1,075 cases (Jabatan Kesihatan Negeri Selangor, 2023). This highlights the increasing prevalence of dengue fever in Selangor and emphasizes the need for improved surveillance and intervention techniques to reduce its impact on public health. 21,926 cases were reported in 2023, a 100.7% increase from the same period in 2022 (Jabatan Kesihatan Negeri Selangor, 2023). The number of deaths from dengue fever in Selangor increased slightly in 2023, with four reported in 2023 compared to three in 2022. The Petaling district had the most dengue cases with 149 cases, Klang with 146 cases, Damansara with 113 cases, Sg. Buloh with 98 cases, Batu with 85 cases, and Sepang with 44 cases. **Table 1** shows Malaysia's current daily dengue outbreaks, highlighting Selangor as the highest case compared to other states.

As can be seen, urbanization is increasing globally, and the presence of construction sites is highly correlated with it (Likos et al., 2016). A construction site is a specially designated spot where work is done on various projects, including infrastructure, buildings, bridges, and other structures. The development of construction sites frequently causes environmental disturbances due to changes in land use, increased human presence, and increased trash, which negatively impacts flora and wildlife habitats (Knop, 2016). Dengue outbreaks in nearby communities are frequently attributed to construction projects. An excellent setting for the spread of vector-borne diseases like dengue exists on building sites. The case burden has increased in places with many of these locations. The quick and widespread migration of people and urbanization are likely to blame for the rise in dengue epidemic incidences. One study suggests that the construction developer was given instructions to work with a private pest control company to carry out fogging, larvicide, and "search and destroy" operations to destroy possible breeding containers to limit the number of mosquitoes (Shafie et al., 2021). Both the disease-causing virus and its vector, the Aedes aegypti mosquito, were already common in these regions.

Therefore, the primary objective of this article is to identify Dengue Prevention and Control at Construction Sites. Additionally, the article seeks to accomplish several specific objectives, including:

- Assessing challenges in construction site dengue prevention and identifying innovative approaches.
- To enhance coordination and collaboration among stakeholders for effective dengue prevention.
- To develop strategies to reduce construction site dengue risk using technology and data-driven solution

Table 1: Total Daily Cases from National Crisis Preparedness and Response Centre (CPRC), Ministry of Health Malaysia (MOH, 2023)

State	Daily Cases On 02 Jul 2023	Total Cumulative Cases From 29 Dec 2019 Until 02 Jul 2023
JOHOR	30	4,639
KEDAH	17	2,857
KELANTAN	10	945
MELAKA	2	500
NEGERI SEMBILAN	7	1,838
PAHANG	2	618
PERAK	7	1,741
PERLIS	2	445
PULAU PINANG	14	5,039
SABAH	13	4,327
SARAWAK	1	357
SELANGOR	108	29,485
TERENGGANU	1	126
WP KUALA LUMPUR	46	6,079
WP LABUAN	0	52
WP PUTRAJAYA	4	269
MALAYSIA	**264**	**59,317**

IDENTIFYING GAPS AND CHALLENGES IN CONSTRUCTION SITES MANAGEMENT

Construction sites are frequently blamed for dengue epidemics in adjacent communities. The atmosphere is conducive to the development of young mosquitoes in the absence of predators and the convenience of female mosquitoes feeding on exposed construction workers (Abdul Rahim et al., 2022). Because of that, there will be challenges and gaps in preventing and controlling dengue epidemics caused by construction. The term "key gaps and challenges in dengue prevention" refers to the important areas of deficiency and obstacles that must be overcome to successfully control and eliminate the spread of dengue fever, a mosquito-borne viral disease. M. A. Zaki, (personal communication, June 19, 2023), lecturer from UiTM Puncak Alam, stated that vector resilience is one of the key gaps and challenges. Vector resilience is the ability of the Aedes aegypti mosquito to withstand environmental changes, adapt to new conditions, and maintain its population despite the control of its action. Alterations in temperature, humidity, rainfall patterns, urbanization, and land use are examples of environmental changes. These modifications may affect the behaviour, reproductive habits, and geographic distribution of Aedes

aegypti mosquitoes, which may alter dengue transmission dynamics. They can locate adequate breeding sites, endure in various climates, and persist in various geographical areas because of their ability to adapt to changing environmental conditions. Their capacity for adaptation strengthens their resistance to dengue as a vector.

S.M. Lau, (personal communication, June 19, 2023), a medical entomologist at Selangor State Health Department, stated that vector resistance is another challenge in reducing dengue outbreaks at construction sites. The widespread use of insecticides has caused the vector to become resistant, which makes vector control operations more difficult. Repeated exposure to pesticides over time may cause mosquito populations to develop resistance, making the insecticides less effective at controlling mosquito populations and preventing the spread of disease. Genetic alterations in the mosquito population that give pesticide resistance may cause this resistance. There was one study supporting this issue, and suggestion has been given. Insecticide resistance is now a major problem on a global scale, and there are few effective methods to stop it from spreading. Insecticides from unrelated classes with various modes of action should be used in a rotation at 6 month or a year basic. In areas where Aedes aegypti is allegedly highly resistant to pyrethroids but still vulnerable to organophosphate, rotational planning of insecticides applications by substituting pyrethroids with organophosphates is strongly advised (Rasli et al., 2021).

Multicultural society exists in Malaysia. Malaysians tend to be quiet, restrained, and discreet. They frequently exhibit modesty in their appearance and body language and approach daily life with a lot of tolerance. Besides, Malaysia is a country that accepts foreigners to work in our industry, especially construction sites. Two panellists from our discussion, M.H. Ab Rahman and Hafiz and S. Idris (personal communication, June 19, 2023), talked about how reducing dengue cases at construction sites was difficult due to the varied cultural behaviours of foreign workers. Foreign workers at construction sites may come from various cultural backgrounds and have different degrees of knowledge and behaviour regarding illnesses spread by mosquitoes, like dengue. They did not know how dangerous dengue cases were and how to prevent them from arising at their workplace. Foreign employees may come from nations where dengue is rare or where different precautions are taken. They need to be made aware of the dangers of dengue and how to stop mosquito reproduction. Some employees may have difficulties to accept new procedures or preventive measures. The employer needs to educate and give proper training and communicate well with them to ensure they understand the risk of dengue cases at their workplace.

Lack of effective communication among stakeholders is another gap and challenge in preventing dengue at construction sites. Effective communication between stakeholders is essential to undertake preventative measures, maintain a coordinated effort, and reduce the risk of dengue transmission at construction sites. Based on the discussion, V. Supramaniam, (personal communication, June 19, 2023), stated that good communication among market players is important because the implementation of the appropriate preventive measure may be affected if stakeholders, such as construction workers, contractors, project managers, and health authorities, are not sufficiently informed about the hazards connected with dengue and the necessary preventive measures. This statement was supported by one study that showed that the absence of sufficient involvement of the community, health sector, and local government officials made the dengue vector control program ineffective. Their issues originate from the local people's committee's attitude of dependence on the health sector's activity, lack of excitement from mass organizations and community leaders, heavy workloads, and poor communication skills from the health sector (Nguyen-Tien et al., 2019). Other than that, during a discussion, the panelist highlighted the issue of the language barrier among foreign workers, especially with the employer, which became one of the challenges in preventing dengue cases at construction sites. Workers from various areas or nations are frequently present at construction sites. It might be challenging to achieve uniform use of dengue prevention techniques across the site due to language and cultural differences that can disrupt good communication and understanding.

INNOVATIVE APPROACHES AND BEST PRACTICES TO PREVENT DENGUE OUTBREAKS AT CONSTRUCTION SITES

"Prevention is better than cure" is the main key of the Focus Group Discussion (FGD) in finding a strategy for dengue prevention and control at the construction site. This is because all the panellists believe it is better to stop something bad before than to deal with it after it has happened. Often, fines will be given by authorities such as the Department of Safety and Health, the Construction Industry Development Board (CIDB), and the Ministry of Health (MOH) in the event of an outbreak of dengue in a construction site or nearby residential area. Therefore, we are looking for some initiatives to reduce punishment and increase education and rewards for companies and employees who take initiatives to reduce dengue epidemics in their respective areas.

“The common breeding site in construction areas, particularly due to shared houses inhabited by foreign workers. The location was identified as a common breeding site including bathing areas, open burning, and leaking plumbing areas” - M.R. Abdul Jalil (personal communication, June 19, 2023)

Implementation of continuous training and programs is vital to address this issue by implementing a comprehensive syllabus in dengue management for foreign workers and employers along with specific Standard Operation Procedures (SOPs) to ensure the matter can take as their priority. Furthermore, these SOPs should outline the responsibilities of employers and workers in preventing mosquito breeding and responding to dengue outbreaks. All the panellists suggest a comprehensive training program that is proposed as per **Table 2**. These training programs should provide workers with a comprehensive understanding of dengue, mosquito biology, and breeding, identification of breeding sites, preventive measures, workplace hygiene and maintenance, reporting and response protocols, employers’ responsibilities, ongoing awareness campaigns, and evaluation and feedback mechanism

Table 2: Propose A Comprehensive Training Modules, and Programs for construction workers to prevent dengue outbreaks.

Introduction to Dengue
• Overview of dengue fever such as causes, symptoms and potential complications
Mosquito Biology and Breeding
• Education on life cycle of mosquito and thier bereeding habitat.
Identification of breeding sites
• Focus on training workers to identify breeding sites within construction site. Encouraging workers to conduct regular inspections and report potential breeding sites.
Preventive Measures
• Equipped with knowledge and personal protective measures tominimize mosquito bites. • Emphazing the importance of mosquito repellents, waering protective clothing and utilizing bed nets. • Physical control e.g. using netting and mosquito nets
Workplace Hygience and Maintenance
• Ensure regular cleaning and disinfection practices and trageting areas of mosquito breeding sites
Employer Responsibilities
• Encouraging the establishmenyt of specific SOPs, for dengue management , conducting regular site inspection and providing mosquito control measures such as fogging, larvae treatment. • Legal compliance unde DDBIA 1975, PDCIA 1988, LGA 1976

The Construction Industry Development Board (CIDB) has suggested that a points system or rating and rewards system be created for companies that take good care of construction areas and are free from dengue outbreaks. This would be a valuable tool in preventing dengue outbreaks in construction areas by incentivizing companies to implement preventive measures, maintaining a safe and healthy workplace, and protecting workers from the disease. The points system could be based on various factors, such as the number of mosquito breeding sites on the construction site, the number of dengue cases reported, and the frequency of preventive measures implemented. Companies that score well in these areas could be awarded points, which could then be redeemed for rewards, such as discounts on insurance premiums or training courses. The rewards and rating system would also help create healthy competition between companies, leading to a more concerted effort to prevent dengue outbreaks. In addition, the system would help to maintain the company's image, as it would be seen as being proactive in preventing dengue. Appointed contractors should also be credited by the CIDB, MOH, and Local Authorities if they regularly implement preventive measures. This would help ensure that contractors take the necessary steps to protect workers from dengue and encourage other contractors to follow suit.

> "Proper chemical usage is a key strategy to contain and control dengue in construction areas" - M. A. Zaki, (personal communication, June 19, 2023)

He specifically noted that changing the frequency of an insecticide spray can help prevent the development of resistance in mosquito populations. Furthermore, mosquitoes can develop resistance to insecticides over time if they are exposed to the same insecticide repeatedly. The mosquito will likely survive and reproduce, passing its resistance genes to its offspring. In addition, it is also important to use different insecticides in combination to make it more difficult for mosquitoes to develop resistance to any one insecticide.

Self-monitoring and compliance are innovative approaches that can be improved to curb dengue in the construction site area. These two concepts are often used together in the context of regulatory compliance. In the joint discussion, the panelists opined that training should be conducted for the authorities regarding dengue management in the construction area along with the rewards and rating system. Self-monitoring will be one of the cultures to reduce the dependence of the construction company on the authorities by taking the initiative in reviewing the activities carried out and ensuring that they comply with the applicable guideline in preventing dengue in the construction area.

The panellists are in agreement on the setting up of a joint system by the Construction Industry Development Board (CIDB) and the Ministry of Health (MOH) addresses the challenges of obtaining information from government agencies regarding dengue outbreaks in construction areas. It acknowledges the existence of grey areas in standard operating procedures (SOPs), guidelines, and jurisdiction for containing dengue outbreaks in construction sites. The proposed joint system would share construction site inspection data from CIDB and dengue inspection data from MOH. Combining these datasets aims to identify construction sites that may be contributing to dengue spread in hotspot localities. This collaborative approach would facilitate information integration and enable the implementation of more effective and efficient control measures. The lack of accessible and comprehensive data and the limited availability to the public pose challenges in developing effective control measures for dengue outbreaks. Therefore, the panel believes that developing this system in collaboration with government agencies like CIDB, MOH, universities, and other relevant entities would enhance the integrity of information and enable more comprehensive control measures. Making this system open to all would ensure transparency and allow various stakeholders to access and utilize the data for research, analysis, and developing strategies to combat dengue. Multiple agencies' involvement and comprehensive data availability would enable a more coordinated and efficient response to dengue outbreaks in construction areas.

COLLABORATIVE STRATEGIES AND STAKEHOLDER ENGAGEMENT IN PREVENTING DENGUE OUTBREAKS AT CONSTRUCTION SITES

Malaysia's biggest health issue is dengue. The failure to act to combat dengue is one of its primary causes. Stakeholder involvement is considered the best strategy to increase participation and is the most productive way to establish good governance. Collaboration between different stakeholders can greatly impact preventing dengue cases at construction sites (Arham et al., 2021). Preventing dengue at construction sites requires a collaborative approach and active stakeholder engagement. Stakeholder involvement is crucial to preventing dengue outbreaks on construction sites since the strategies, plans, methods, and procedures used by stakeholders significantly impact how well the sustainable building is implemented in averting such cases (Adhi & Muslim, 2023). CIDB panellists highlighted this issue, and their suggestion for getting support from other agencies and stakeholder participation is to have a specific requirement for renewing CIDB's contractor license. According to the conversation, one

of the criteria for the contractor to maintain their CIDB license is to perform well and have no dengue outbreaks at their location. They must make sure they are eligible to renew their licenses. This may include having a valid and active contractor's license, complying with CIDB rules, and fulfilling any specifications or restrictions, including having no dengue cases and adhering to dengue training at construction sites. Besides, suggestions to renew the license include implementing mosquito control measures at their company, providing worker education on dengue prevention, and demonstrating compliance with waste management protocols. It contributes to a decrease in dengue cases at construction sites by improving the process for contractors to renew their licenses.

Another collaborative strategy and stakeholder engagement that can be implemented is by having Safety Health Officer (SHO) curriculum in Environmental Health practice. Mr. Redwan from the DSH Institute of Technology suggested that SHO competency must be implemented among environmental health practitioners. For improving workplace safety and health standards, environmental health practitioners may benefit from implementing Safety Health Officer (SHO) expertise. SHOs, experts in occupational safety and health management, create and uphold secure working conditions. Environmental health professionals can manage workplace dangers and ensure workers' well-being by including SHO competence in their job duties. Environmental health practitioners typically focus on the broader aspects of public health, including environmental factors that can impact public well-being. By incorporating SHO competency, they can expand their scope to include occupational health and safety, ensuring workplace safety. Panellist agree that at the university level, courses on environmental health and safety should be hand-in hand so that students have better knowledge and understanding of both safety and environmental aspect. This collaboration can lead to better coordination in addressing workplace hazards and promoting a safe and healthy work environment once they graduate and work, especially at construction sites. Besides, the proper instruction and training in occupational safety and health concepts, hazard identification and control, risk assessment, regulatory compliance, and emergency response are essential for implementing SHO competency among environmental health practitioners. Continual professional development and interaction with occupational safety and health experts can improve their proficiency in this field.

Based on the discussion among panellists, collaborative strategies and stakeholder engagement must have clear boundaries of responsibility with specific actions and measures, including policies and guidelines. Making wise decisions and managing problems to stop dengue outbreaks at construction sites is crucial. Each stakeholder's specific roles and responsibilities in the collaborative process must be defined. This makes it easier to avoid misunderstandings and guarantees everyone is aware of their contributions and duties. Besides, they should clearly state the goals and expected results of the cooperative endeavour. This helps stakeholders to have a common understanding, which in turn helps direct their actions and decisions. One of the ways to have a clear boundary of responsibility is by creating efficient communication routes to encourage continual discussion and information sharing among stakeholders. Regular gatherings, seminars, online forums, and other types of communication are means these approaches can be implemented.

POLICY AND REGULATORY CONSIDERATIONS USED TO PREVENT DENGUE OUTBREAKS AT CONSTRUCTION SITES

The panellists' suggestions for policy and regulatory considerations to reduce the risk of dengue transmission in construction sites are:

Introduce dengue risk assessment (DRA). This would involve developing a standardized DRA process that all contractors must follow. The DRA would identify the risk of Aedes mosquito breeding in the construction site area and the control measures that need to be taken to prevent and control transmission. The DRA process could be based on the Hazard Identification, Risk Assessment, and Risk Control (HIRARC) process, the main reference for Safety and Health practitioners in the work area.

Encourage stakeholder and policymaker involvement. This would involve ensuring that various stakeholders, such as vector control agencies, healthcare providers, and public health officials, are involved in developing and implementing policies to reduce the risk of dengue transmission. Policies should cover a range of factors, such as vector control, healthcare infrastructure, surveillance systems, public awareness campaigns, and research activities. These two initiatives would help to ensure that dengue risk is effectively managed in construction sites. The DRA process would provide a systematic way to identify and control the risk of Aedes mosquito breeding, while stakeholder and policymaker involvement would ensure that a comprehensive approach to reducing the risk of dengue transmission is taken.

IMPLEMENTATION AND RECOMMENDATION IN PREVENTING DENGUE OUTBREAKS AT CONSTRUCTION SITES

Liu et al. (2020) concluded that cutting off the transmission routes and properly controlling vectors in communities should be recommended as primary measures for dengue prevention and control at construction sites. But having a safety culture and awareness in the workplace makes this challenging to implement, especially for foreign workers, since they need to understand why they must follow existing dengue prevention activities. V. Supramaniam, (personal communication, June 19, 2023) proposes an alternative approach, advocating for a greater emphasis on health promotion, community engagement, education, and training rather than resorting to penalties. M.S. Abd Samad (personal communication, June 19, 2023) echoes this sentiment, stressing the significance of raising awareness among contractors and foreign workers. M.R. Jaffar (personal communication June 19, 2023) highlights the language barrier as a major hurdle, hindering effective communication between those in charge and the contractors on construction sites.

To overcome these challenges, M.H. Ab Rahman (personal communication June 19, 2023) emphasizes the importance of stakeholder cooperation. He suggests implementing new guidelines and policies specific to the tasks at hand, accompanied by an increased frequency of audits and inspections. These solutions aim to raise awareness among all employees, from top management to the workforce, regarding dengue prevention and control at construction sites. Expanding on these ideas, S.M. Lau, (personal communication, June 19, 2023), proposes an integrated and

systematic monitoring approach, ensuring a comprehensive solution. As the discussion continues, M.S. Awang (personal communication, June 19, 2023) suggests conducting a pilot project in a selected district, with a local authority taking the lead. This project would involve creating an integrated information system and a contractor rating system.

CONCLUSION

Dengue outbreaks in Malaysia are difficult to control from year to year. The case of dengue keeps arising even though there was much awareness given. Rapid urbanization is a good thing for developing Malaysia's economy, but at the same time, it has a inferior impact on the environment and health, whereby dengue cases arise due to the construction works. Therefore, it is important for all parties, including the government, contractors, and workers, to participate in preventing and controlling dengue outbreaks, especially from construction sites.

CONTRIBUTION STATEMENT

The MAEH Urban Health Forum was held at the National Institute of Health Setia Alam from 19-20 June 2023. NNA, MAA, MHM, MLH and FAS conceived the forum, applied for and obtained funding from the Malaysian Association of Environmental Health and Universiti Teknologi MARA, and drafted the first version of the article. The issue was analyzed by MAZ, MRAJ, MSAS, MSA, SI, MHAR, LSM, VS, and MRJ. All participants at the forum contributed to the focus group discussion that produced the article, and all approved the final version.

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TOWARDS SUSTAINABLE URBAN ENVIRONMENTS

MAEH URBAN HEALTH FORUM 2023

The Importance of Urban Parks for Community Health and Its Challenges

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ABSTRACT

Urban parks play a critical role in promoting community health and well-being while facing various challenges. This Focus Group Discussion (FGD) provides a comprehensive review of the importance of urban parks and the obstacles encountered in ensuring their successful implementation. The discussion highlights the positive impacts of urban parks on physical and mental health, as well as their cultural, aesthetic, and social value. Additionally, it examines how urban parks help to mitigate urban heat impact and reduce carbon emissions. The discussion also highlights the challenges that are encountered, including those related to space limitations, maintenance issues, disease vectors, design flaws, technological shortcomings, safety concerns, societal issues, and environmental pollution. These emphasize the need for public involvement, awareness, education, and proper enforcement to overcome these challenges. Furthermore, it also explores opportunities related to economic benefits, technological advancements, innovative design and structures, safety features, and collaboration among authorities and agencies. By addressing these challenges and capitalizing on the opportunities, urban parks can serve as therapeutic spaces, foster community engagements, provide green land in cities, and contribute to a healthier and more sustainable urban environment. This discussion has offers valuable insights and recommendations for policymakers, urban planners, and park management to enhance the effectiveness and impact of urban parks on community health and well-being.

***Keywords*:** urban park, community health, importance, challenges, and opportunities

INTRODUCTION

Urban parks play a vital role in promoting the health and well-being of their surrounding communities by offering readily accessible spaces for recreation, relaxation, and social interaction. There is mounting evidence that parks and other green spaces in urban areas improve people's well-being by reducing stress,

improving the sense of community, and lowering blood pressure. The purpose of this in-depth analysis is to draw attention to the role that urban parks play in improving the health and happiness of local communities, as well as to discuss the obstacles and strategies to overcome them. Urban parks offer health benefits, including reducing chronic diseases, reducing stress, anxiety, and depression, and improving cognitive performance and attention restoration.

Urban parks provide numerous benefits, but ensuring equal access to all community members can be challenging. Inequality in park's accessibility in low-income neighbourhoods hinders their health benefits. Elderly, disabled, and minority groups face unique obstacles in accessing parks. Therefore, age-friendly design, accessible infrastructure, and inclusive programming are essential for these groups. Additionally, certain communities may face barriers like crime, transportation, and cultural obstacles (Rushing et al., 2019) making it difficult for them to fully utilize urban parks.

Identifying and resolving inequalities in park provision requires concerted efforts by government agencies, urban planners, community organizations, and citizens. The gap can be closed using strategies, such as improving infrastructure, increasing financing, and prioritizing underserved areas for inclusive parks.

Urban parks are critical to the health and well-being of their surrounding communities because they offer places for people to exercise, unwind, and connect. However, issues of park distribution, infrastructure, and inclusiveness arise when attempting to ensure that these advantages are available to everybody. Urban parks can become effective instruments for promoting healthier and more vibrant communities by tackling these difficulties via collaborative efforts and inclusive planning.

CHARACTERISTICS OF URBAN PARKS

Urban parks in a region are influenced by factors like culture, climate, and policies. Malaysian parks differ from other countries such as Europe and the Arabic Middle East, which feature distinct seasons and natural facets. In Europe, parks showcase colourful fall foliage, while in Arabic countries, due to the prevalent extreme heat, parks in this region prominently showcase a multitude of water features to aid visitors in staying cool (Pakzad et al., 2018).

There are several requirements for urban parks in Malaysia. First, parks should be easily accessible from major thoroughfares and public buildings like schools and hospitals. This ease of access helps to integrate parks into daily life and fosters community involvement. Second, urban parks require good air circulation to maintain healthy air quality, promote comfort to park visitors, support plant health, mitigate heat, and contribute to overall sustainability and well-being of the park environment. Parks should be laid out for maximum visibility, increasing security, and creating open, peaceful spaces with unobstructed views of greenery, recreation centres, and gathering areas.

The quality of public infrastructure is crucial to the success of Malaysia's urban parks in providing for the demands of their visitors. The accessibility of facilities like restrooms, drinking fountains, and picnic areas improves the comfort of visitors. The park's user experience and security are further improved by well-maintained paths, lighting, and signs (Gupta & Yusuf, 2019). With these essential features in place, urban parks in Malaysia may become welcoming gathering places for people of all backgrounds and interests. These parks become essential parts of the urban fabric, encouraging exercise and social contact while also improving the health and happiness of locals and tourists.

IMPORTANCE OF URBAN PARKS

Urban parks greatly increase community health and well-being by offering benefits for physical, mental, and social health. These parks offer opportunities for exercise, such as walking, running, cycling, and sports, which can boost cardiovascular fitness, muscle building, and weight management. Regular exercise in urban parks reduces the risk of chronic diseases like obesity, diabetes, and cardiovascular disease. Additionally, urban parks have a significant impact on mental health. Spending time in natural environments can help to reduce stress and boost mood. These parks provide an escape from the city's hustle and bustle, facilitating relaxation and stress reduction.

Urban parks enhance daily lives, provide aesthetic, social, and cultural significance, and foster community through events, social interactions, and cultural activities, fostering a sense of belonging as it also offers opportunity for people from all backgrounds to interact. They serve as outdoor classrooms for environmental education and cultural appreciation, helping to preserve and celebrate local heritage.

Prof Madya Dr Azlan Abas has pointed out that urban parks have significant effects on people's physical and mental well-being. As we are living in an ageing society, the community especially elderly people can exercise and relax as it is important for a good

health. Additionally, urban parks have important cultural, aesthetic, and social significance, which raises people's quality of life. Spending time in urban parks might bring back fond memories for people who have relocated from the country to the city. These green havens in the centre of the city provide a tranquil getaway from the hectic metropolitan environment. Dr Fong Chng Saun pointed out:

"Urban parks have the extraordinary capacity to help keep cities cool. It contributes significantly to reduce the negative consequences of urban heat".

Compared to the surrounding constructed area, the microclimate created by green spaces is cooler and more comfortable because of the abundance of plants and trees. Plants release moisture into the air through a process called transpiration, which raises humidity levels and provides a cooling effect through evaporation in the park. This mechanism lowers the average temperature in each area, which in turn minimizes the amount of heat stress that people are subjected to.

Urban parks provide ecosystem benefits by providing natural shade, reducing direct sunlight exposure, and reducing ground temperature. Trees block the sun, lowering air temperature and preventing precipitation from reaching the ground. The "green land of the city" refers to the incorporation of urban parks and gardens into the built environment, which act as the city's "lungs." The urban parks can clean the air, produce beneficial gases, and promote ecological balance by providing habitat for various species.

Dr. Fong Chng Saun concurs that urban park help in reducing the impact of the urban heat island. Urban parks benefit from shade, reducing heat island impact through thick tree canopy, reducing heat and glare on surfaces. Surface temperatures are lowered, and the amount of heat absorbed by buildings, roads, and other infrastructure is reduced because of the shading effect. Consequently, urban parks help to chill the surroundings.

In addition, urban parks contribute to reduce the impact of heat waves that can bring uncomfortable high temperatures to urban areas. Through the process of evapotranspiration, urban parks function as natural coolants, relieving residents of the stifling effects of high temperatures. The cooling impact of urban parks is due in part to the shadowing effect and the evaporation of moisture from plant leaves. Introducing more green infrastructure as such in urban parks will help improve the urban environment and promote better outdoor thermal comfort for city dwellers (Fong et al., 2023).

Urban parks can cut down on greenhouse gas emissions in addition to keeping people cool. Through photosynthesis, plants remove carbon dioxide (a greenhouse gas) from the atmosphere and release oxygen. Cities may help reduce carbon emissions, mitigate climate change, and promote environmental sustainability by planting trees in urban parks in large numbers.

In conclusion, city parks are valuable resources for reducing the impact of the urban heat island. They are useful tools for producing more liveable and comfortable urban environments because of their shading properties, capacity to moderate heat waves, and ability to reduce carbon emissions.

CHALLENGES OF URBAN PARKS

Numerous obstacles threaten to undermine urban parks' potential for growth, upkeep, and community benefit. Space constraints in urban and fast developing areas make it challenging to choose appropriate locations for new parks (Xu et al., 2019). Abandoned places within parks become breeding grounds for disease-carrying vectors like mosquitoes, which poses an additional concern (Nguyen-Tien et al., 2019). While technical limitations hinder effective monitoring and control, poor design and structure can lead to safety issues and a poor user experience (Wang et al., 2021). Low public involvement and knowledge, for example, contribute to the overuse and neglect of park facilities (Cheng et al., 2021).

Inadequate lighting and fallen trees are two examples of safety concerns that can discourage park use. Effective park management is further hampered by issues with enforcement, such as a lack of defined norms and collaboration among authorities (Hausmann et al., 2017). Maintaining urban parks cleanly and sustainably is complicated by environmental contamination brought on by things like garbage and pesticide use. To overcome these obstacles, we need concerted teamwork, which includes things like the creation of thorough guidelines, funding for technical advances, public education and awareness campaigns, routine upkeep and monitoring, and stronger enforcement mechanisms (Wang et al., 2021). Urban parks can survive and continue to benefit their surrounding communities if these issues are addressed head-on.

One of the significant challenges faced in the development of urban parks is the limitation of available space within cities and development areas. This limitation poses obstacles for urban

planners and park developers who strive to create green spaces for the community.

LAr. Khairul Amin highlighted the difficulties encountered in securing suitable areas for urban park development. In some cases, park advocates must contend for land that has not yet been designated as open space, leading to contentious battles. Unfortunately, the outcomes of such endeavours do not always favour the establishment of urban parks. Access to land and obtaining permission to develop urban parks can be complex and time-consuming. Authorities and stakeholders need to navigate the legal processes and acquire the necessary permits to ensure that the land is suitable for park development. Checking the status of land ownership, zoning regulations, and potential conflicts with other development plans are crucial steps that require access and permission.

An alternative approach to address the limitation of available space is by utilizing areas that have not yet been officially designated as open space. One such approach is the concept of "tree banking," where areas are temporarily designated and managed as tree nurseries to support reforestation efforts and the reduction of carbon dioxide emissions (Department of Town and Country Planning Malaysia, 2018). This innovative approach not only helps in addressing the space constraint but also aligns with Malaysia's goal of reducing CO2 emissions by 45% by 2030.

DISEASE IN URBAN PARKS

Without regular maintenance, abandoned spaces, like those found in the crevices of urban parks, can become a haven for disease-carrying vectors, as brought to light by Ms. Haryati and Ms. Noor Aniza. Particularly dangerous are mosquitoes due to the diseases they spread (WHO, 2021). These include dengue fever, malaria, and other zoonotic illnesses. It is critical to manage the breeding places of mosquitoes in urban parks because of the devastating effects these diseases can have on persons and communities. Rats carry leptospirosis, a disease caused by improperly disposed food scraps by the park goers and can spread the bacterium to people through contact with contaminated water or soil.

Additionally, pockets of stagnant water can form when tree fronds and leaves from various plant species accumulate in urban parks. These plant segments collect water and provide ideal conditions for mosquitoes and other disease-spreading insects to breed. Because disease-causing organisms thrive in stagnant water, the prevalence of infectious diseases is elevated (Enkhbold & Matsui, 2021)

Ms. Haryati gave a good illustration of how even well-intentioned actions can have unforeseen results. When the COVID-19 pandemic hit, residents of a PPR (Public Housing Project) established a garden in their park. The garden's benefits were undermined, however, when it became a mosquito breeding ground due to a lack of routine upkeep, increasing the danger of mosquito-borne illnesses. Stagnant water and improperly discarded organic waste are two examples of breeding grounds for disease vectors that should be eliminated through routine cleaning and inspections.

The efficiency and usefulness of urban parks greatly depend on their layout and design. Both Ms. Haryati and Ms. Noor Aniza underlined the need for playground equipment that is both sturdy and unlikely to break, as damaged pieces can leave gaps that disease-carrying vectors can use as breeding grounds. This emphasizes the significance of giving due thought to the durability and safety of park facilities when designing them.

DESIGN AND STRUCTURE IN URBAN PARKS

LAr. Khairul Amin was concerned about the lack of tree canopy in urban parks, which he said creates hotspots in the park. For better tree and plant coverage throughout the development, he advocated setting aside at least 10% of the land. This finding highlights the need of designing urban parks with sufficient green spaces and tree canopies.

However, budget constraints frequently prevent the full potential of urban parks from being realized. It can be difficult to establish parks that fully achieve their objectives and potential due to the high expenditures associated with site acquisition, planning, construction, and maintenance.

Additionally, the quality and security of urban parks can be significantly impacted by a lack of upkeep or periodic monitoring by the competent authorities. Poor maintenance methods can lead to aging infrastructure and wasteful spending on personnel and materials. To overcome these obstacles and guarantee the proper operation and safety of urban parks, regular inspections, maintenance operations, and effective management systems are required.

Problems with vandalism in urban parks can also be caused by poorly thought-out designs and inadequate illumination. The park's safety and appeal could be jeopardized if vandals found

places where the lighting was inadequate. With careful and strategic planning, as well as sufficient illumination, parks can be made more inviting and safer for visitors.

Ms. Farhana voiced her disagreement on the utilization of overly mature trees in urban parks. Overcrowding, decreased light levels, and species competition are among problems that can result from plants expanding too quickly. That is why it is crucial to pick and tend to tree species with care to make sure they fit in with the urban park's ecosystem.

Prof Madya Dr Azlan Abas warned about the harm that could come from planting foreign tree and plant species. Changes in ecological dynamics and the interactions between native species might result from the emergence and adaptation of new species. That is why, Ms. Farhana emphasized the selection and introduction of plant species in urban parks should be carefully considered to minimize disruptions and retain the local ecosystem's integrity.

In conclusion, many factors need to be considered when planning the layout and construction of urban parks. By meeting these obstacles and using best practices in park design, urban parks may serve as places that are both safe for visitors and useful for the local community.

TECHNOLOGY IN URBAN PARKS

Dr. Fong Chng Saun's points about the need for constant and precise monitoring of urban parks due to a lack of technology and informatics systems are very valid ones. The ability to collect real-time data on park utilization, environmental conditions, and community health indicators is hampered in the absence of such technical improvements. It is difficult to determine the impact urban parks have on community health without a reliable method of measuring the positive effects they have on people's lives.

In addition, there is not yet a complete forecasting system in Malaysia that is designed for urban parks. Heat waves and other weather conditions that are hazardous to park visitors' health and comfort might be predicted and tracked with such a system. The problem is made worse by the lack of heat wave rules in Malaysia, which could prevent people from making healthy use of urban parks.

The creation and implementation of urban informatics technologies that allow for constant monitoring and evaluation of urban parks is necessary to meet these problems. Sensors, data analytics, and data visualization platforms are all examples of technology that can be used to monitor and analyse park usage, air quality, temperature, and other pertinent metrics. By combining data from multiple sources, park planners and managers may better understand how urban parks affect residents' health, make more informed decisions, and shape the parks of the future.

The benefits and possible constraints of urban parks could be better understood with the introduction of standardized indicators that link urban parks to community health outcomes. As a result, legislators, urban planners, and health experts would be better equipped to make evidence-based decisions and develop interventions that fully realize urban parks' health benefits.

Maximizing the benefits of urban parks in promoting community well-being requires the integration of technology and informatics systems for continuous monitoring, standardized indicators for assessing the relationship between urban parks and community health, and the development of heat wave guidelines. Malaysia may improve the administration and utilization of urban parks by utilizing technology and data-driven techniques, allowing them to realize their full potential as significant assets for community health and the overall liveability of communities.

SAFETY FEATURES OF URBAN PARKS

A major threat to the security of urban parks is vandalism. When vandals destroy park infrastructure, amenities, or other property, they not only waste money but also put others in danger. Vandalism in parks can have harm public health and wellness because it discourages park goers from using the park's amenities.

Another source of risks in urban parks is falling trees. Maintaining the safety of the trees in parks calls for routine checks, trimming, and other forms of maintenance. Falling branches or even the full collapse of a neglected or rotting tree can cause serious injury or death. To reduce the likelihood of injuries occurring in urban parks, timely maintenance and appropriate tree care are essential.

Visitors to urban parks are also at danger of getting attacked by wild animals. Although wild animal attacks are relatively rare, they do occur, particularly in areas where human and wildlife ecosystems coexist. To protect the well-being of park visitors, authorities should take steps to reduce the likelihood of animal-human confrontations, such as posting warnings and employing effective wildlife management techniques.

It is crucial to use suitable design features and management strategies to increase safety in urban parks. Safer and more

comfortable environments can be created by installing well-maintained walkways, sufficient lighting, and security features. To address potential dangers and reduce risks, it is essential to conduct routine inspections, perform necessary maintenance, and respond quickly to safety concerns.

SOCIETY AND LACK OF ENFORCEMENT FROM RELATED AUTHORITY AND AGENCY

To effectively manage and utilize urban parks, societal considerations must be considered. While the potential for community involvement and ethical use of these areas is immense, their realization is hampered by several obstacles. To begin, despite being the principal users, the public is typically disengaged from the maintenance of urban parks. The public has as much of a duty as the government to treat urban parks with respect, as both have a hand in their upkeep (Stenseke et al., 2016). To ensure the long-term survival and prosperity of these parks, the local community must feel a sense of ownership over them and take an active role in maintaining them.

Misuse of urban parks is caused by a lack of awareness, interest, and respect, which come from a misunderstanding of their value and public health benefits (Huang et al., 2022). To inculcate a sense of responsibility and cultivate a positive park culture among all members of society, this underscores the necessity for extensive educational programs and awareness efforts.

One of the biggest problems is that there is not enough enforcement and cooperation between different authorities and institutions. Holistic and successful administration of urban park projects is hindered by siloed departments including forestry, arboriculture, health, R&D, education, landscape, and town planning not working together. Further complicating the planning and execution process is the lack of clear norms and rules for urban park development in Malaysia (Mokhtar et al., 2021).

The difficulties of running an urban park can be compounded by political unrest. As stated by Yang et al. (2020), variations in park building and management techniques might result from a lack of clarity in policies, visions, and missions emphasizing the value of urban parks for community health.

Neglect and deterioration of urban parks can also be exacerbated by a lack of daily inspection, monitoring, and supervision. Problems with upkeep, security, and sanitation that affect the quality of these areas and the satisfaction of its users may go unreported without consistent monitoring.

It is crucial to design a uniform system of management for urban parks that is geared to address these societal concerns. To maintain uniform and efficient park administration, it is necessary to have clear norms, regular inspections, and coordination among relevant authorities (Zhou et al., 2022). Furthermore, accountability may be maintained, and responsible behaviour among park users can be encouraged, through the enforcement of regulations and fines for overuse or noncompliance (Huang et al., 2022).

Vital steps in tackling the obstacles and maximizing the benefits of urban parks for community health and well-being include encouraging public involvement, boosting awareness, improving education, promoting collaboration among authorities, and developing effective management systems.

ENVIRONMENTAL IMPACT OF URBAN PARKS

Environmental pollution poses significant challenges to the maintenance and sustainability of urban parks. One major concern is the generation of waste through maintenance activities or by park users themselves, which can have detrimental impacts on cleanliness and overall environmental quality (Cai et al., 2023) Proper waste management practices, including adequate bins and recycling facilities, regular waste collection, and public education, are essential to mitigate pollution and maintain the cleanliness of urban parks.

Another aspect of environmental pollution in urban parks is the use of pesticides and hazardous chemicals for the growth of plants and trees. While these substances may be necessary for pest control and plant health management, their improper use and disposal can lead to water and soil pollution, negatively affecting the overall ecological balance (Yuan et al., 2019). Implementing integrated pest management strategies and promoting environmentally friendly alternatives can minimize the reliance on harmful chemicals and reduce the environmental impact.

Furthermore, the issue of air quality maintenance arises due to high levels of development in certain areas surrounding urban parks. The increased urbanization and industrial activities can contribute to air pollution, leading to the occurrence of haze and rising temperatures, particularly in regions where air circulation is restricted (Wang et al., 2020). Air pollution may have a negative impact on human health and the park's ecosystems. Implementing effective air pollution control measures, such as reducing industrial emissions, promoting green transportation, and implementing tree

planting initiatives, can help mitigate these challenges and improve air quality within and around urban parks.

OPPORTUNITIES FOR URBAN PARKS

Urban parks offer economic benefits, including small businesses, local economy, entrepreneurship, and job creation. They attract tourists, increase property values, and promote investment in residential and commercial districts (Huang et al., 2018).

Landscapers, arborists, environmentalists, and park management may all generate income by creating and maintaining urban parks. These professionals plan, design, and construct urban parks so that the public can enjoy well-designed, sustainable green spaces (Kemperman et al., 2016).

Technology aids in managing and monitoring urban parks through informatics sensors, data gathering systems, and analytics platforms (Van den Bosch et al., 2018). In Sarawak, carbon dioxide from urban parks can be used as electricity to minimize air pollution (Tan et al., 2020). Technology readiness and advanced monitoring systems help park management and evidence-based decision-making (Heritage et al., 2020).

To be effective, the city's parks must have a strong foundation. Consider the local climate while introducing new urban tree and plant species (Kowarik et al., 2017). Stricter plant and tree selection criteria help maintain ecosystem equilibrium and prevent disruptions. Natural repellents can solve environmental problems without chemicals (Hernández-Montoya et al., 2017). Durable park infrastructure materials save maintenance and repair expenses, prolonging the park's facilities (Schäffler et al., 2020). Authorities and agencies evaluate park amenities regularly to identify repair requirements and assure safety and functionality (Mandal et al., 2018).

Improve user experience with safety-focused CCTV systems to curb vandalism and criminal activity (Smaniotto Costa et al., 2017). Avoiding excessive tree growth protects park users (Oliveira et al., 2021). Solar-powered lighting systems illuminate parks during the day and night, meeting the demands of varied park users (Castro et al., 2020).

Park development pre-assessment, including environmental impact studies, mitigates environmental and social consequences (Ng et al., 2019). Park development standards and guidelines ensure uniformity and quality in planning and implementation (Rogers et al., 2015). Diverse viewpoints and expertise from agencies and stakeholders improve decision-making and management (Robinson et al., 2017). Early education curricula also instil a sense of responsibility and appreciation for urban parks (Mehrotra et al., 2019).

CONCLUSION

In conclusion, urban parks play a vital role in promoting the mental, physical, and social well-being of the surrounding community. These green spaces serve as therapeutic environments, offering respite from the stresses of urban life and providing opportunities for relaxation, exercise, and social interaction.

Proper planning, design, and maintenance of trees within urban parks are essential for providing a healthy and sustainable green space that offers numerous benefits to the community, including improved air quality, biodiversity support, and temperature regulation.

Urban parks serve as important therapy for the surrounding community, providing mental, physical, and social benefits. Proper planning, design, and tree maintenance are crucial for creating beneficial green spaces. Lastly, promoting awareness and responsible park usage among visitors ensures urban parks' upkeep and preservation for future generations' enjoyment.

CONTRIBUTION STATEMENT

The MAEH Urban Health Forum was held at National Institute of Health Setia Alam from 19-20 June 2023. HS, NHS, WNAWR, WRWR and FAS conceived the forum, applied for and obtained the funding from Malaysian Association of Environmental Health and Universiti Teknologi MARA and also drafted the first version of the article. FCS, AA, KAMH, FY, HI, and NAI analysed the issue. All participants at the forum contributed to the focus group discussion that produced the article and all approved the final version.

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TOWARDS SUSTAINABLE URBAN ENVIRONMENTS

MAEH URBAN HEALTH FORUM 2023

Understanding The Human Health Consequences of Water Pollution and The Call for Action

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ABSTRACT

Water, the elixir of life, is one of the most fundamental and essential substances on our planet. It is a clear, tasteless, and odourless liquid that covers about 71% of Earth's surface. The effects of human activities cause water quality levels to deteriorate daily, impacting human health. A recent Focused Group Discussion (FGD) held at the National Institute of Health, Setia Alam, Selangor, aimed to address water quality issues. Key points discussed include: 1. the identification of sources and causes of water pollution in Sepang, Selangor, 2. assessment of the effects of consuming contaminated water on human health, 3. emphasis on collaboration between Federal and State Governments for effective water safety management, 4. evaluation of the effectiveness of laws and regulations in regulating water safety and 5. the recognition of the need for public education to prevent water pollution. The objective is to ensure citizens receive clean potable water, mitigating long-term health effects. Authorities must enforce the prevention of surface water pollution as the basis for guaranteeing water quality which aligns with health standards.

***Keywords*:** effluent, industrialization, human health

INTRODUCTION

Water is a precious gift that must be preserved in all situations. Public health and the natural environment are both significantly influenced by the quality of the water (Xu et al., 2019). Water is the most basic need for living things such as humans and other creatures. Humans may live comfortably for days without electricity, computers, internet, and anything else but not without water. Water supply, transportation, sewage discharge, waterlogging drainage, and urban defence are some of the roles that rivers play in the process of urban development. These roles assure the stability of the city, encourage population agglomeration, and foster the growth of industry and trade (Yin et al., 2022). Water can be used to carry out various life activities as a very beneficial resource. Chemically, water comprises two hydrogen atoms bonded to a single oxygen atom, giving it the molecular formula H_2O. This simple yet powerful structure is the basis for many remarkable properties, such as its high heat capacity, surface tension, and solvent abilities (Chen et al., 2019).

These characteristics enable water to sustain life, shape our landscapes, and influence weather patterns.

In recent times, there have been many human activities that can cause an impact on raw water resources that are the cause of human daily use. Achieving long-term and intricate global water quality safety targets greatly depends on quantifying the effects of climate change and human activity on water quality (Mishra et al., 2021). There are a few examples of the many human activities that can affect water quality. Deforestation is an activity in which the removal of trees can increase soil erosion and sedimentation, negatively impacting water quality. Razali et al. (2018) focused their research on the river system network in Malaysia's Cameron Highlands and examined case studies of land use change in highland areas and its effects on river water quality.

Another example is industrial activities. Many industrial processes generate wastewater containing various chemicals, including heavy metals, solvents, and other pollutants. One factor influencing the sources of water quality changes due to urbanisation. Growing urban areas have been identified as one of the main causes of the global rise in pollution in freshwater environments (Mello et al., 2018). This is because they generate more wastewater, which can contain a variety of pollutants such as oil, grease, and human waste. Agricultural practices make runoff from agricultural fields that can contain fertiliser, pesticides, and other chemicals, which can pollute nearby waterways. One of the main causes of high levels of phosphorus and nitrogen is the overuse of fertilisers on agricultural land (Pérez-Gutiérrez et al., 2017). The quality of raw water supplies is impacted by all these activities, which result in changes. To preserve the health of our rivers and the species that depend on them, it is imperative to reduce these effects by appropriate behaviour and legislation.

Changes in water quality sources can also be caused by weather changes that occur throughout the year. Malaysia is one of the countries that experience weather changes throughout the year, namely heat and rain. Weather change refers to variations in a region's regular or average weather conditions over time. Natural phenomena like variations in solar radiation, volcanic activity, and shifts in the Earth's orbit could be the source of these changes or human actions like the combustion of fossil fuels, deforestation, and industrial processes.

2. METHODOLOGY

This program is in the form of a Focus Group Discussion (FGD) to open space to discuss urban health issues that are increasingly becoming a concern and parallel to the urbanization process which is also an important aspect of environmental health. The program’s goal is to bring together parties with expertise and experience in identifying environmental health issues that can impact the health of urban communities and propose strategies to deal with them. To discuss the issues several agencies from various backgrounds and expertise were invited to give their input and views related to water issues in Selangor. The topic presented this time is related to water issues in Selangor. During the Focus Group Discussion, participants exchanged views, ideas and methods that should be implemented in dealing with the issues that arise. In addition, there is also information obtained from the mass media that aims to further strengthen the arguments brought during the discussion. Each idea and finding from the discussions that have been conducted are presented during the final session of the FGD.

3. ISSUES RELATED TO WATER POLLUTION IN SELANGOR

Several issues were discussed during the FGD. Among the issues highlighted are the causes and sources of contamination of the Sepang District's water sources, the impact on human health because of drinking from contaminated water sources, the importance of cooperation between the central and state governments in dealing with issues related to pollution, the implementation of laws and the role of the community in assisting the government in dealing with issues related to water source pollution.

3.1 The sources and causes of water pollution in Sepang, Selangor

During the FGD, a representative from the Sepang district health office explained some of the issues faced regarding the causes of water pollution. According to Geraldine (June 19, 2023), a representative from the Drinking Water Quality Control Unit, Sepang District Health Office, one issue that comes up is the existence of errant factories that discharge their waste into the river directly. This pollutes river water, which is where treated water comes from. Excess phosphorus in the environment substantially negatively impacts aquatic ecosystems with subsequent dangers to the health of people and the economy (Ofori et al., 2021). Apart from the existence of these illegal factories, the problem of livestock farms also often arises in the area around Sepang District. Pig farms are among livestock farms that often become a nuisance to water sources. Livestock farms that exist and are cultivated traditionally are one of the causes of pollution here. In addition to causing problems for the pig farm's raw water source, it also causes odour problems that disrupt the daily activities of the surrounding residents.

Recently, the consequences of heavy metal pollution caused by human activities on mangroves, rivers, estuaries, and coastal wetlands in the Sepang region have drawn more attention. Thus, in 2022, an ecological risk assessment of heavy metal pollution in the mangrove sediments of the Sepang Besar River, West Coast Peninsular Malaysia, was carried out. The presence of heavy metals in the surface sediments of the mangrove Sepang Besar River was investigated in this study. Inductively coupled plasma mass spectrometry (ICP-MS) was used to measure the sand concentrations of arsenic (As), molybdenum (Mo), lead (Pb), chromium (Cr), cobalt (Co), cadmium (Cd), nitrate (Ni), and mercury (Hg). According to research utilising the enrichment factor and geo-accumulation index, the study determined that Arsenic is the predominant heavy metal contaminant in surface sediments of the Sepang Besar River mangrove sediments. Certain stations within the river require specific focus due to elevated pollution levels. The amounts of the metals analysed in the sediments were found to be lower than both the average shale values and the standards set by the USEPA. This indicates that adverse impacts are not always present. To mitigate potential pollution issues, it is imperative to monitor the levels of As, Mo, and Pb in the future, as indicated by the results of the enrichment factor and the geo-accumulation index (Krishnan et al., 2022).

3.2 The effects of consuming contaminated water on human health

Many past studies have published the results of their studies related to the effects of drinking water from contaminated sources. The effect on the health of the human body can be categorised into two conditions. The first effect is acute, while the other is a long-term effect. The burden of disease associated with water includes non-communicable diseases brought on by exposure to chemically contaminated water as well as communicable diseases (waterborne, water-washed, water-based, and vector-borne diseases related to water) (Boelee et al., 2019). In addition, there are also effects on human health due to excessive heavy metal content in treated water. Heavy metals are present in the Earth's crust naturally and remain as environmental pollutants due to their inability to be degraded or eliminated (Malviya et al., 2023).

Exposure to some metals, such as Hg and Pb, can also lead to the onset of autoimmunity, a condition in which an individual's immune system mistakenly targets its cells. Alzheimer's disease may arise from Pb and Cd levels in the body that enter the brain (Jyothi, 2020). The Lancet Commission on Pollution and Health has calculated that there are around 1.8 million deaths globally that can be attributed to water pollution, primarily caused by microbiological contamination. Additionally, there are approximately 0.5 million deaths that can be linked to soil pollution, heavy metals, and chemicals (Bolee et al., 2019). Multiple studies have demonstrated a correlation between prolonged exposure to lead and the development of different types of cancer, kidney damage, adverse effects on the central nervous system, and cardiovascular disease in people. Additional consequences of Pb exposure include enzyme dysfunctions, anaemia, cognitive impairments, heightened activity levels in children, low body weight and premature births, as well as elevated blood pressure in adults (Zaheer et al., 2023; Farias et al., 2020). Pb gradually builds up in our bones over a period of around 20-30 years, leading to a chronic condition (Charkiewicz & Backstrand, 2020).

A study was carried out to investigate the seasonal differences in household water quality in Hancheng City, China, which is situated on the Guanzhong Plain. The Hancheng Centre for Disease Control and Prevention's water quality monitoring data was used to analyse the health concerns. It was discovered that during the dry season as opposed to the rainy season, there are more non-carcinogenic health risks for both adults and children. The degree to which the overall non-carcinogenic risk varies with the rainy and dry seasons is determined by the risk assessment's evaluation of water quality indicators. Compared to the wet season, when people drink tap water until it runs out, people are more likely to get cancer if they drink chlorinated water during the dry season. Compared to adults, children have nearly twice the risk of developing cancer. Although the endemic sickness has been eliminated because of improved water quality, cancer is still a risk that needs to be taken into account (Ji et al., 2020).

3.3 The importance of collaboration between Federal and State Governments in managing water safety and quality control

To deal with this issue related to water, all parties need to work together to ensure that it can be implemented effectively. In general, each state's government has authority in water management in their state. This means that all activities involving raw water sources and water treatment operations up to distribution are managed by a company appointed by the state government. At the same time, they also monitor the quality of the water they produce.

Mohd Suffian (personal communication, June 19, 2023) said that apart from water supply companies, another agency under the Malaysian Ministry of Health also carries out monitoring and surveillance of treated water through routine water collection activities. This sampling involves monitoring the water quality involving the presence of microbiology, organic chemistry, heavy metals, and pesticides. The results of the monitoring carried out are reported to the water supply company for corrective action so that the water supplied to the residents is always in good condition and according to the specifications that have been set.

3.4 The effectiveness of implementing laws and regulations to regulate water safety and quality control

Based on a daily news report dated August 14, 2019, titled "Create a special body to monitor, regulate agencies to protect water resources", SPAN chairman Charles Santiago at the time thought there were too many agencies managing water (Noor, 2021).

"The problem at the moment is that we have too many related agencies and departments when there is river pollution or water supply. However, all parties will point fingers if there is pollution."

In Selangor itself, there are several agencies related to water management. Mohd Suffian (personal communication, June 19, 2023) said water-related laws have been in place for a long time, but enforcement measures have yet to be implemented. This may be because some several bodies or agencies enforce laws related to water in our country. He thinks that a special body related to the implementation of laws related to water should be established so that legal action can be taken against water supply companies that fail to treat water according to established standards. The diverse water applications are typically overseen by distinct subsectors in a fragmented manner, exhibiting variable levels of consideration for water quality. In addition to the obvious connections that exist between infectious diseases and the management of water resources (Boelee et al., 2019).

3.5 The need for public education in preventing water pollution

Many awareness campaigns have been carried out before, whether on television, in newspapers, or electronic media and have been used to educate people about the importance of caring for the river. This awareness campaign has also extended to the school level when taught in the school syllabus. This shows how important and serious the government will ensure that raw water sources need to be protected as best as possible so that they remain for future generations. Ruhaizie (personal communication, June 19, 2023) believes the awareness campaign needs to be changed to something more attractive to attract the community's interest to follow it. Using the latest materials and methods, such as *TikTok,* can attract the community's interest to

implement it. This kind of measure is seen as more suitable for the present time since most people use the application in their daily lives. In addition, it is also suitable for use as awareness campaign material because it is watched by various layers of society.

4. CONCLUSION

Various efforts and proactive measures have been made and carried out to ensure that the people receive the best water quality. It is crucial to ensure that human health is always maintained and guaranteed. To ensure that water quality is always in good condition, various measures and continuous efforts have been made by the government. Many government agencies are involved in water management in this country, whether at the federal or state level. All these agencies play their respective roles according to the responsibilities that have been entrusted. The large number of agencies is insufficient if they do not carry out their responsibilities effectively, even more so if there is a duplication of duties and responsibilities involving the state and federal governments. Therefore, a body needs to be appointed to ensure that the quality of water in this country can be adjusted so that every citizen in this country obtains water of the same quality and comparable to the standards set by the government. The reorganisation is an excellent step to ensure that there is a government agency responsible for water quality in the country so that it can be coordinated in each state.

CONTRIBUTION STATEMENT

The MAEH Urban Health Forum was held at National Institute of Health Setia Alam from 19-20 June 2023. MRH, MNNI, MDA, ERR, MNAA and FAS conceived the forum, applied for and obtained the funding from Malaysian Association of Environmental Health and Universiti Teknologi MARA and also drafted the first version of the article. MRR, MSMS, GNHH and MNAR analysed the issue. All participants at the forum contributed to the focus group discussion that produced the article and all approved the final version.

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