

Community Resilience in Border Areas: Health Governance and Preparedness for Emerging Diseases in Batam City

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Abstract

Border regions have high levels of health vulnerability due to the intensity of population mobility, cross-border interactions, and governance complexity. However, empirical evidence on the role of health governance in strengthening community resilience in border regions at the subnational level is still limited. This study aims to analyse the role of health governance in strengthening community resilience to new infectious diseases in Batam City as an international border region with high cross-border mobility, using a Global Health Governance perspective. This study uses a descriptive qualitative approach with a case study design. Data sources include health policy and planning documents, health sector performance reports, Batam City statistics, national and regional health regulations, and international frameworks such as the International Health Regulations (IHR). Analysis was conducted through qualitative content analysis to identify patterns of health system capacity, governance mechanisms, and community involvement. The results show that Batam City has relatively strong health surveillance capacity in primary health care and hospitals, thereby supporting the early detection of new infectious diseases. However, this capacity is not yet fully supported by systemic preparedness, particularly in terms of planning, funding, laboratory capacity, and health promotion. Cross-sectoral coordination is in place but remains sectoral and reactive. Community-Based Health Efforts (UKBM) have strong coverage and social capital, but have not been optimally integrated into the formal early warning system. This study emphasises the importance of integrating surveillance systems, institutionalising cross-sectoral coordination, and strengthening the role of communities to improve health resilience in border areas. Theoretically, these findings enrich the Global Health Governance literature by showing how global norms are adapted in the local context of border areas.

Keywords:

Community Resilience in Border Areas, Global Health Governance, Emerging Infectious Diseases

1. Introduction

The city of Batam is a strategic area on the Indonesian border, directly adjacent to Singapore and Malaysia, making it one of the main hubs for international mobility in the Southeast Asian region. This geographical position makes Batam an area with high cross-border mobility, reflected in around 2.6 million international passenger movements per year. This intense mobility increases the region's vulnerability to the spread of cross-border infectious diseases, in addition to internal challenges such as population density in residential centres and disparities in access to health services. Although national trends show a decline in COVID-19 cases, regional surveillance reports for the city still record new cases and ongoing surveillance activities in health facilities, while vigilance against other diseases such as dengue fever and MERS remains a concern in local health strategies (Batam City Health Office, 2025).

In the context of these cross-border health threats, the local health system not only functions in a curative capacity but also plays a strategic role in maintaining community resilience to extraordinary events (Semenza et al., 2019). The Global Health Governance (GHG) framework, through instruments such as the International Health Regulations (IHR) and the National Action Plan for Health Security (NAPHS) 2020–2024, emphasises the importance of cross-sectoral coordination, integrated surveillance systems, and community empowerment as part of health preparedness (Sebong et al., 2025; Harman & Papamichail, 2025). However, empirical studies that specifically assess the implementation of GHG at the local level in border areas are still very limited. Most previous studies have focused on health responses at the national level or pandemic governance models in large urban areas, while analyses linking health data integration, cross-sectoral coordination, and public health education in building community resilience in border areas such as Batam are still rare in scientific literature.

Based on this gap, this study aims to analyse the role of health governance in strengthening community resilience in border areas, with an operational focus on three main components, namely: (1) integration of health data and information systems, (2) effectiveness of cross-sectoral coordination in health responses, and (3) implementation of public health education programmes. The research objectives are formulated in measurable terms to provide evaluation benchmarks for the contribution of each governance component in the context of community resilience to cross-border infectious diseases.

The novelty of this research lies in its integrative approach, which simultaneously links the three pillars of health governance data, coordination, and education in the context of border areas, while positioning Batam as a local policy laboratory in GHG practice. This approach expands GHG studies, which have mostly been macro or national in nature, by providing an empirical focus on the dynamics of global policy implementation in local practice in areas vulnerable to cross-border threats.

Theoretically, this study is expected to enrich the literature on community resilience and health governance in border regions from a GHG perspective, as well as serve as a conceptual reference for further studies in similar contexts. In practical terms, the findings of this study are expected to serve as a basis for policymakers and relevant stakeholders in formulating strategies to strengthen local health systems through data integration, improved cross-sectoral coordination capacity, and community empowerment to strengthen preparedness and mitigate the risk of cross-border infectious diseases.

2. Method

This study uses a descriptive qualitative approach with a case study design to analyse the contribution of Batam City's health service governance in building community resilience to infectious diseases in border areas. This design was chosen because it allows for in-depth analysis of contemporary phenomena in a real context and answers research questions that focus on the aspects of how and why (Yin, 2018; Creswell & Creswell, 2018). The research case is limited to Batam City as an international border region. The data used is secondary data sourced from official documents, including the Strategic Plan and Performance Report of the Batam City Health Office, the Batam City BPS report for the 2023–2025 period, national and regional health regulations, and international guidelines such as the International Health Regulations (IHR) and WHO documents. Scientific literature from accredited journals is used as a conceptual basis. Data analysis was conducted through qualitative content analysis, which included the processes of coding, categorisation, and interpretation of data to identify patterns and relationships between policies and actors within the framework of Global Health Governance (K Yin, 2011 ; Miles et al, 2014). The validity of the findings was strengthened through triangulation of sources by comparing policy documents, statistical reports, and scientific literature.

3. Results and Discussion

3.1 Results

3.1.1. Regional Characteristics and Population Vulnerability to Health Risks

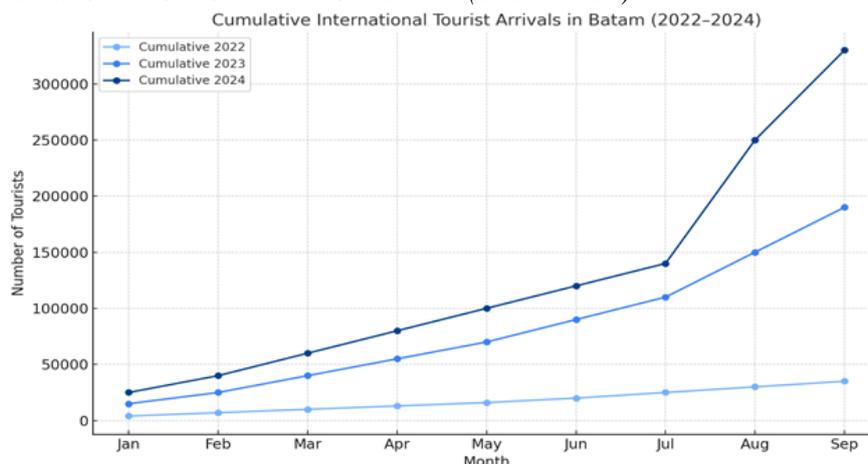
Batam City is an international border region characterised by high population density, intensive population mobility, and complex socio-economic dynamics. In 2023, the population of Batam City reached 1,282,219, with the highest concentration of density in coastal and industrial areas (BPS, 2024a). This spatial pattern correlates with high levels of social interaction, particularly in areas that serve as centres of industry, trade, and transportation.

The intensity of cross-border mobility in Batam City is reflected in the movement of international tourists and passengers. During the 2023–2024 period, the cumulative number of international tourist visits showed an upward trend, as shown in Figure 3. During the same period, Batam City recorded more than 7 million domestic and international passenger movements and imports worth USD 13.84 billion, demonstrating Batam's strategic role as a major hub for the movement of people and goods in the border region (BPS, 2024b; 2025).

Socio-economic indicators also show positive developments. Batam City's Human Development Index (HDI) has increased consistently, from 81.67 in 2022 to 82.64 in 2023 and reaching 83.32 in 2024 (BPS, 2023; 2024a; 2025). This increase reflects improvements in education, health, and living standards in recent years.

Figure 1

Cumulative International Tourism Arrivals in Batam (2023 - 2024)



Source: Personal Analysis (2025). Adapted from BPS Batam City (BPS, 2024b; 2025)

The results of health risk mapping show that the subcategory of population characteristics scored 71.43 %, indicating a relatively high level of structural exposure. In addition, the subcategory of visits by people from high-risk countries or regions also scored 71.43 %, in line with the high flow of interregional and cross-border mobility. These findings illustrate the level of exposure of Batam City to the potential risk of infectious diseases in the context of cross-border mobility.

Further findings are reflected in the Batam City Infectious Disease Risk Index, as presented in Table 1. Middle East Respiratory Syndrome (MERS) is in the moderate risk category with a Risk Index value of 89 and a Vulnerability Index of 95. Polio is also classified as a moderate risk with a Risk Index value of 12. Conversely, COVID-19 and meningitis are classified as low risk, with Risk Index values of 34 and 31 respectively, indicating variations in risk levels between types of infectious diseases (Ministry of Health/MoH, 2025). In terms of resilience and preparedness, the population resilience subcategory achieved a score of 100 per cent, reflecting the existence of community structures that support health promotion and prevention activities. However, the subcategory of district/city preparedness only achieved a score of 42.86 %, indicating a discrepancy between the social capacity of the community and the level of preparedness of formal mechanisms for early detection and response to new infectious diseases.

Table 1

Results of Population Vulnerability Mapping and Emerging Infectious Disease Risk Index in Batam City

	Vulnerability Subcategory	W	S (%)	C		TI	VI	CI	RI	RC	
	POPULATION	Population characteristics	25%	71.43		High	DISEASE	Polio	28	23	53
Community resilience		25%	100	Low	MERS	74		95	77	89	Moderate
District/City alertness		25%	42.86	Moderate	Meningitis	61		16	76	31	Low
Population in high-risk areas		25%	71.43	High	COVID 19	54		24	71	34	Low

Source: Personal Analysis. (2025). Adapted from MoH (2025)

Noted : W (Weight) S (Score), C (Category), TI (Threat Index), VI (Vulnerability Index), CI (Capacity Index), RI (Risk Index), RC (Risk Classification)

3.1.2. Regional Capacity and Health Care System

Batam City From a regional capacity perspective, it is supported by health service infrastructure that is relatively adequate for a border region with a high level of population mobility. The healthcare system in Batam City consists of three type B referral hospitals, eleven general hospitals, twenty-one community health centres, and 205 private clinics. These facilities form the backbone of healthcare provision, particularly in addressing the risk of cross-border infectious diseases influenced by the dynamics of international trade and mobility (Batam City Health Office, 2025).

There are 2,131 health workers in Batam City. However, the distribution of health workers is uneven across regions, especially between economic growth centres and peripheral areas. In addition, the limited capacity of diagnostic laboratories and the availability of infectious disease specialists remain structural obstacles to strengthening early detection and rapid response to new infectious diseases. This condition is reflected in the regional health sector performance document and the Batam City health statistics report (Batam City Health Office, 2025; BPS Batam City, 2024a).

The results of the mapping of surveillance capacity and health preparedness presented in Table 2 show variations in achievement between indicators. The hospital-based surveillance indicator scored 100 per cent, indicating that case detection mechanisms based on health care facilities, referral systems, and clinical reporting are functioning optimally. This achievement confirms the strong technical and operational capacity at the formal health service level. On the other hand, indicators related to preparedness funding show lower scores, indicating limited fiscal support in ensuring the sustainability of long-term health preparedness and response.

The imbalance between technical capacity and resource support is also reflected in the Infectious Disease Management Capacity Index. The capacity of Batam City's health system to handle meningitis scored 76 and COVID-19 scored 71, indicating a relatively good level of preparedness. Meanwhile, the capacity to handle Middle East Respiratory Syndrome (MERS) scored 77 and was in the moderate category when compared to the very high vulnerability to the disease. This pattern shows that although operational capacity is available, the level of preparedness is not yet fully commensurate with the risk characteristics of diseases that have a cross-border dimension (MoH, 2025).

At the community level, Community-Based Health Efforts (UKBM), which include Posyandu, Posbindu, and the Healthy Living Community Movement (GERMAS), have achieved 100 per cent coverage based on the results of regional risk mapping. This achievement indicates the availability of community structures and social capital that support health promotion and prevention activities. However, variations in cadre capacity, health literacy, and digital literacy are still found in the implementation of UKBM, which has implications for differences in the quality of community-based education and surveillance (Batam City Health Office, 2025).

Institutionally, the regional capacity of Batam City is strengthened through cross-sectoral coordination involving the Health Office, the Health Quarantine Centre (BBKK), the Health Laboratory Centre (BLK), the Batam Business Entity, Immigration, as well as professional and civil society organisations. This coordination is supported by national and regional regulations governing surveillance, health quarantine, and health emergency response, including the International Health Regulations framework (WHO, 2005; WHO, 2025). Overall, these results indicate that Batam City has a foundation of collaborative health capacity and governance, although it still faces challenges in aligning technical operational capacity with policy support and health preparedness funding.

Tabel 2

Mapping Results of Health Surveillance and Preparedness Capacity in Batam City

No.	Subcategory	Weight	Score (%)	Batam City Category
1	Preparedness and Emergency Response Budget	20%	42.86	Low
2	Laboratory Preparedness	10%	42.86	High
3	Primary Health Care (Puskesmas) Preparedness	10%	71.43	High
4	Hospital Preparedness	10%	57.14	High
5	District/City Preparedness	10%	57.14	High
6	Surveillance Capacity at Primary Health Care Level	7.5%	85.71	High
7	Hospital-Based Surveillance Capacity	7.5%	100.00	High
8	District/City Surveillance Capacity	7.5%	85.71	High
9	Port Health Surveillance (Quarantine Offices)	7.5%	71.43	High
10	Health Promotion and Risk Communication	10%	42.86	High
11	Local Government Policy on Emerging Disease Management (in terms of number)	-	5	

Capacity Index (max. 60): 53

Source: Personal Analysis. (2025). Adapted from MoH, 2025 ; Batam City Health Office, 2025)

3.2 Discussion

3.2.1 Population Mobility and Health Vulnerability in Border Areas

The findings of this study confirm that cross-border population mobility is a key structural factor shaping health vulnerability in Batam City as an international border region. From a Global Health Governance (GHG) perspective, population mobility is not merely a demographic phenomenon, but rather a mechanism through which health risks transcend national sovereignty and challenge territorially bound public health approaches (Kickbusch & Szabo, 2014).

These findings are consistent with the global health literature that conceptualises border regions as hotspots of vulnerability, where intensive movement of people, goods, and services creates complex conditions for exposure to new infectious diseases. Semenza et al. (2019) show that border regions in Europe face higher systemic risks to cross-border outbreaks due to high mobility, inequalities in health system capacity, and fragmented cross-jurisdictional governance. Similarly, McMichael (2015) highlights that globalisation and increased human mobility have become key drivers of contemporary global health risks.

In the context of Batam City, high cross-border mobility—reflected in population flows, international trade activities, and the movement of migrant workers—creates what Frenk et al. (2014) describe as transnational health exposure. Under these conditions, health risks can no longer be effectively managed by a single national health system, as new infectious diseases increasingly cross administrative, sectoral, and territorial boundaries. This reinforces the argument that border regions require a health governance approach that transcends conventional sectoral and administrative frameworks.

This study also shows that population mobility acts as a risk amplifier. High mobility increases the likelihood of pathogen introduction, accelerates transmission, and complicates epidemiological monitoring and tracking. Global health studies show that regions with high mobility often experience delays in early detection and greater difficulty in breaking the chain of transmission, especially when monitoring capacity does not develop in line with mobility dynamics (Gostin et al., 2017; Haldane et al., 2021).

In the context of national policy, Rai et al. (2020) note that Indonesia has strengthened its health emergency preparedness through an enhanced monitoring system and alignment with the International Health Regulations (IHR). However, the findings of this study reveal implementation gaps in border areas such as Batam, where the national warning system has not been fully responsive to the rapid and fluctuating dynamics of cross-border mobility.

From a GHG perspective, this situation highlights the limitations of a state-centred approach to managing transnational health risks. Kickbusch et al. (2016) emphasise that effective global health governance requires adaptive, risk-based and collaborative mechanisms, especially in border areas where various actors, interests and policy frameworks intersect. The case of Batam shows that health vulnerability is not only caused by limitations in the health system, but also by intensive mobility patterns that have not been adequately integrated into regional preparedness planning.

Furthermore, population mobility in Batam has social and economic dimensions that deepen health vulnerability. Studies by McMichael (2015) show that labour mobility and regional migration are often associated with unequal access to health services and higher risk exposure among certain groups, particularly migrant workers and temporary populations. This implies that health vulnerability in border areas is unevenly distributed and can exacerbate health inequalities if not addressed through inclusive governance strategies.

Thus, this study contributes to the Global Health Governance literature by highlighting population mobility as a critical variable in understanding health vulnerability in border areas. The case of Batam shows that cross-border mobility shapes patterns of health risk that cannot be adequately explained through conventional administrative approaches alone, reinforcing the need for adaptive, risk-based health governance models that are explicitly integrated with regional mobility dynamics.

3.2.2 Health Service System Capacity and Regional Preparedness

The capacity of Batam City's health system shows a relatively strong technical configuration, but still faces structural challenges related to readiness and sustainability. Batam is supported by a network of referral hospitals, community health centres, and private health facilities that form the backbone of curative and preventive services. However, capacity mapping shows that this strength is not evenly distributed across all components of the health system.

Despite strong surveillance capacity, regional preparedness remains uneven. Readiness scores at the district/city and hospital levels reached 57.14 %, while budget allocation for preparedness and response was only 42.86 %, categorised as low. This gap indicates that although early threat detection is relatively strong, the ability to respond quickly and sustainably is limited by weak fiscal support and inadequate preparedness planning. As emphasised by Greer et al. (2021), the resilience of health systems depends not only on technical capacity, but also on consistent policy commitment and adequate resource allocation.

Laboratory preparedness is also still limited, with an achievement rate of 42.86 %, indicating inadequate diagnostic capacity to support rapid confirmation of new infectious diseases. In the context of a high-mobility border such as Batam, these limitations can delay the initial response to public health emergencies, reinforcing the argument of Semenza et al. (2019) that border areas require integrated and adaptive laboratory systems to reduce the risk of cross-border transmission.

Similarly, health promotion and risk communication capacities are relatively weak, with an achievement score of 42.86 %. These findings indicate that behaviour change-based mitigation strategies have not been fully institutionalised, despite strong detection capabilities. Weak risk communication has been shown to reduce the effectiveness of public health responses, particularly in managing infectious diseases that require collective compliance and active community involvement (Kickbusch, 2021; Bloom et al, 2025).

From a Global Health Governance perspective, these findings reveal an unbalanced configuration of capacities within Batam City's health system: strong in technical monitoring, but weaker in strategic preparedness, financing, laboratory capacity, and health promotion. This pattern reflects a common challenge faced by middle-income countries, where the adoption of global instruments such as the International Health Regulations has increased technical capacity without accompanying institutional strengthening and sustainable financing at the local level (Rai et al., 2020). Enhancing Batam's health system capacity therefore requires not only investment in infrastructure and technology, but also policy

consolidation, sustainable financing mechanisms, and deeper cross-sectoral integration as a foundation for regional health resilience.

3.2.3 Population Mobility and Health Vulnerability in Border Areas

Border regions have structural characteristics that distinguish them from non-border regions, particularly in terms of population mobility, economic openness, and high levels of cross-jurisdictional interaction. The city of Batam, which borders Singapore and Malaysia, clearly exhibits these characteristics. The high level of cross-border mobility, reflected in more than seven million domestic and international passenger movements and imports worth USD 13.84 billion, confirms Batam's position as a regional connectivity hub. At the same time, this condition increases the potential exposure to new infectious diseases, especially those with transnational characteristics. These findings are in line with Semenza et al. (2019), who stated that border areas have a higher systemic risk of transnational disease outbreaks due to the intensity of movement of people, goods, and services.

The results of health vulnerability mapping show that the subcategories of population characteristics and visits from countries or regions at risk each scored 71.43 percent and were classified as high vulnerability levels. This achievement reflects a combination of population density, coastal and industrial settlement patterns, and high intensity of social interaction that has the potential to accelerate the transmission of infectious diseases. These findings reinforce the argument of Haldane et al. (2021) that high mobility and rapid urbanization are major determinants of increased health vulnerability in regions with strong global connectivity, especially when not balanced by an integrated early warning system.

On the other hand, the resilience aspect of Batam City's population showed a maximum achievement of 100 percent, indicating the existence of relatively strong social capital and community capacity. Castleden et al. (2011) explain that community resilience in the context of health includes the collective ability of a community to anticipate, adapt, and maintain basic social functions when faced with health disturbances. In the context of Batam, this achievement reflects the existence and full coverage of Community-Based Health Efforts (UKBM), which act as a link between the formal health system and the social life of the community, as well as supporting the dissemination of health information, strengthening preventive behaviors, and providing social support at the local level.

However, this high level of community resilience has not been fully matched by the preparedness of the regional alert system. The subcategory of district/city alertness only achieved a score of 42.86 percent and was classified as moderate. This gap shows that although the community has strong adaptive capacity, early detection systems, data-based surveillance, and cross-sectoral information integration still need to be strengthened. This condition is consistent with the findings of Rai et al. (2020), which show that the main challenges to health preparedness in Indonesia lie in the limited capacity for implementation and integration of systems at the regional level, not in the absence of a policy framework.

Overall, these findings confirm that health vulnerability in border areas such as Batam City is not solely determined by the magnitude of population mobility, but rather by the extent to which this mobility is managed through integrated surveillance systems and meaningful community participation. The interaction between global structural factors, local institutional capacity, and community social capital shapes the level of health resilience in border areas, while also determining the effectiveness of responses to transnational infectious disease risks.

3.2.4 Health Governance and Global Health Governance Implementation

Research findings show that health governance in Batam City is shaped through cross-sector coordination mechanisms involving central and local government actors, technical health institutions, non-health authorities, professional organizations, and civil society. The involvement of the Health Office, the Center for Health Quarantine (BBKK), the Health Laboratory Center (BLK), the Batam Business Entity, Immigration, and non-state actors reflects the application of a whole-of-government and whole-of-society approach to health risk management. This pattern is in line with the concept of collaborative governance, which emphasizes the importance of structured interaction between state and non-state actors in addressing complex and cross-sectoral public issues (Ansell & Gash, 2008; Emerson et al., 2012).

In the context of new infectious diseases, collaborative governance is crucial because health risks are not only within the health sector but are also closely related to population mobility, trade, tourism,

and border management. The results of the study show that cross-sectoral coordination in Batam City has enabled information exchange, role sharing in surveillance at the country's entry points, and operational support in health responses. However, the level of integration between actors is still functional and based on sectoral regulations, and has not been fully institutionalized in an integrated governance system oriented towards long-term risk management.

From a Global Health Governance perspective, Batam City can be understood as a space for the implementation of global health policies at the subnational level, where the principles of the International Health Regulations (IHR) are tested in a local context characterized by high cross-border mobility and limited institutional capacity. Harman and Papamichail (2025) emphasize that GHG is not hierarchical and top-down, but rather operates through a network of cross-level actors that requires contextual adaptation for global policies to function effectively at the local level. Findings in Batam show that although global and national normative frameworks are in place, their effective implementation is highly dependent on coordination capacity, data integration, and clarity of roles and authorities of actors at the regional level.

In addition, the configuration of health governance in Batam City also reflects the dynamics of decentralization in the Indonesian health system, where operational responsibilities lie at the regional level, while standards and policy frameworks are set nationally and globally. This condition is in line with the findings of Greer et al. (2021), which show that in health crisis situations, the tension between centralization and decentralization is a determining factor in the effectiveness of governance. In Batam, this tension is evident in the need for a rapid and coordinated cross-sectoral response, which has not been fully matched by adaptive decision-making mechanisms and adequate system integration.

Overall, the results of this study confirm that the implementation of Global Health Governance in border areas such as Batam City is not only determined by the level of compliance with international regulations, but also by the quality of collaborative governance at the local level. Effective health governance requires not only the existence of actors and regulations, but also institutional capacity to integrate cross-sectoral interests, manage information in an integrated manner, and coordinate health responses in a sustainable manner. These findings reinforce the argument that border regions are strategic arenas for understanding how the principles of Global Health Governance are operationalized in practice, particularly in the context of middle-income countries.

3.2.5 Lessons from Singapore and Denmark: A Contextual Analysis

A comparison with Singapore and Denmark offers a focused framework for understanding effective health governance in a context characterised by high mobility and cross-border health risks. These two countries are often cited in global health literature for their institutional cohesion, strong cross-sectoral coordination, and ability to implement Global Health Governance (GHG) principles in a sustainable manner.

Singapore exemplifies a model of health governance centred on digital integration, inter-agency coordination, and strengthening primary health care. Yip et al. (2021) show that post COVID-19 reforms institutionalised digital platforms such as HealthHub to support self-reporting, symptom monitoring, and real-time risk communication. At the same time, Primary Care Networks (PCNs) function as decentralised yet nationally integrated response units, demonstrating how data interoperability and clear institutional roles can enhance community participation as an integral component of early warning systems.

On the other hand, Batam differs mainly in terms of system integration and technology utilisation. Although Batam enjoys comprehensive UKBM coverage as a foundation for community resilience, this potential is not yet fully supported by an integrated health information system or adequate digital capacity. The key lesson from Singapore, therefore, lies not in replicating technology, but in governance arrangements that strategically connect communities, primary care, and national monitoring through digital infrastructure.

Denmark illustrates a complementary governance approach through the institutionalisation of Health in All Policies (HiAP). Greer et al. (2021; 2023) argue that the resilience of European health systems is maintained through a balance between centralised strategic policymaking and decentralised service delivery, supported by formalised cross-sectoral coordination. Within the HiAP framework, health outcomes are considered a product of interconnected social, economic, and environmental policies, rather than a sectoral responsibility.

Compared to Denmark, cross-sectoral coordination in Batam is still operational and reactive, driven by sectoral mandates rather than embedded in long-term policy cycles. This suggests that Batam's main challenge is not the absence of governance actors or regulatory frameworks, but the limited institutionalisation of cross-sectoral collaboration as a sustainable governance mechanism.

Evidence from other high-risk contexts reinforces the central role of communities in health system resilience. Haldane et al. (2021) show that expanding system capacity to the community level increases adaptability during a pandemic, while studies by Siekmans et al. (2017), Rosales et al. (2017) and Godziewski, C. (2022). highlight the effectiveness of community-based and data-driven coalitions in crisis situations, including in border areas.

Overall, this comparison shows that Batam has a strong social foundation through UKBM, but there is still a lack of integration between community capacity, monitoring systems, and policy decision-making. Lessons from Singapore and Denmark provide governance principles digital integration, institutionalised cross-sector coordination, and structured community involvement that must be contextually adapted to strengthen the sustainable implementation of Global Health Governance in Indonesia's border regions.

3.2.6 Policy Implications and Contributions to Global Health Governance Theory

The findings of this study have important policy implications for strengthening health systems in border areas facing transnational risks from emerging infectious diseases. First, the results show a clear imbalance between the level of health risk and regional preparedness capacity. High population mobility and structural vulnerability in Batam City are not adequately supported by an integrated early warning system and cross-sectoral data coordination. This highlights the need for health policies in border areas to prioritise data-driven early detection, particularly through interoperability between health information systems, immigration data, and border management authorities. This approach is in line with Rai et al. (2020), who emphasise that integrated monitoring and cross-sectoral coordination are essential for strengthening preparedness in highly connected regions.

Second, the achievement of full coverage of Community-Based Health Efforts (UKBM) highlights local communities as strategic assets in building health resilience in border areas. However, UKBM is still largely positioned as a supporting programme rather than as a core component of the monitoring and early warning system. The policy implication is the need to reposition UKBM as an operational node in community-based monitoring by strengthening the capacity of health workers, improving health and digital literacy, and establishing structured reporting mechanisms linked to regional health information systems. This is in line with the findings of Haldane et al. (2021) and Siekmans et al. (2017), which show that meaningful community involvement is a key factor in a resilient health system.

Third, comparative lessons from Singapore and Denmark emphasise that sustainable health resilience depends on institutionalising cross-sectoral coordination beyond short-term crisis responses. In the context of Batam, this implies the need for more formal governance mechanisms, such as permanent cross-sectoral coordination forums or the integration of health considerations into regional development planning. These recommendations reflect the broad Health in All Policies (HiAP) approach applied in the European context, where health is integrated as a strategic dimension across all areas of public policy (Greer et al., 2021; 2023).

From a theoretical perspective, this study contributes to the Global Health Governance (GHG) literature by providing empirical evidence on how GHG principles are implemented at the subnational level in border regions. These findings support Harman and Papamichail's (2025) argument that GHG does not operate through linear transmission from global to local levels, but rather through processes of adaptation, negotiation, and interaction among multilevel actors. In Batam, health resilience emerges from the dynamic interaction between global norms, national and regional institutional capacities, and local community practices.

Furthermore, this study expands the GHG discourse by highlighting communities as governance actors rather than passive policy recipients. The strong performance of UKBM demonstrates the potential for communities to function as an adaptive layer connecting global policy frameworks with local realities. However, without adequate institutional integration and policy support, this potential risks remaining untapped. Therefore, this study emphasises that strengthening GHG in border areas requires simultaneous investment in institutional capacity and structured community empowerment.

Overall, Batam can be conceptualised as a policy laboratory for developing health governance in border areas in middle-income countries. These findings provide empirical and conceptual contributions to developing more adaptive, integrated, and context-sensitive health policies, while enriching theoretical understanding of how Global Health Governance operates in dynamic and high-risk border environments.

4. Conclusion

This study analyses the role of health governance in strengthening community resilience in Batam City as an international border region with high cross-border mobility from the perspective of Global Health Governance. Findings indicate that community resilience in border regions is influenced by the integration of health monitoring and data systems, the effectiveness of cross-sectoral coordination, and active community involvement through community-based health initiatives.

The results show that Batam City has relatively strong health monitoring capacity through its primary health care system and hospital-based system, which supports the early detection of emerging infectious diseases. However, this technical capacity has not been matched by adequate systemic preparedness, particularly in planning, financing, and sustainability of response mechanisms at the regional level. Cross-sectoral coordination involving health agencies, border authorities, and non-health actors has been established, but it remains sectoral and reactive, rather than a long-term governance mechanism responsive to the dynamics of cross-border mobility.

The study also found that community-based health efforts (UKBM) are a critical foundation for community resilience, as reflected in their broad coverage and strong social capital. However, their contribution has not been fully integrated into the formal early warning system due to limitations in digital literacy and uneven health worker capacity. This study has several limitations, including reliance on secondary data that may not fully capture the dynamics of operational policies, a focus on a single border region that limits generalisation, and the absence of empirical analysis of cross-border coordination mechanisms in transnational health risk management.

Based on these findings, strengthening health security in border areas requires the integration of UKBM into community-based monitoring systems through increased capacity of health workers and digital literacy, institutionalisation of cross-sectoral coordination involving health, immigration and port authorities, and allocation of local government budgets specifically for health emergency preparedness and response. Future research should prioritise field studies and comparisons in border areas, as well as in-depth analysis of cross-border collaboration mechanisms, particularly regarding the integration and exchange of health data within the framework of Global Health Governance.

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