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# Effect of Location-Based Health Messages on Tourist Knowledge of Travel Disease Risks in Bantimurung National Park, Indonesia

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Location Based Advertising; Tourist Health Knowledge; Travel Disease Prevention; Digital Health Intervention

**ABSTRACT**

**Introduction:** Bantimurung National Park faces health risks such as dengue fever transmission due to its location in an endemic area and the potential for zoonotic transmission through frequent tourist interactions with Macaca maura. The lack of health promotion media related to disease prevention in tourism exacerbates these health risks. This study aims to analyze tourists' knowledge after receiving health messages via location-based advertising, specifically examining whether perceived susceptibility, perceived severity, perceived benefits, and perceived barriers that influence the effectiveness of digital health promotion in high-risk ecotourism environments.

**Methods:** The study used a quantitative approach with a survey method, involving 92 tourist respondents who accessed health information through LBA messages while in the Bantimurung tourist area. The LBA system delivered tailored health messages via mobile devices using geofencing technology within the park area. Data were analyzed using descriptive and inferential statistical tests to measure changes in knowledge levels before and after receiving the information.

**Results:** The results show a significant increase in tourists' knowledge after receiving location-based health messages. Before the intervention, only 23.9% of tourists fully understood disease types, transmission modes, and prevention methods. This figure rose to 67.7% post-intervention, while those with no understanding dropped from 1.1% to 1.0%, and partial understanding decreased from 75.0% to 31.3%.

**Conclusion:** This study concluded that location-based health messages significantly improved tourists' understanding of disease risks and addressed the gap in health promotion in Bantimurung National Park. This research is essential for international health studies, particularly in strengthening health promotion within global health security through the tourism cluster.

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## INTRODUCTION

The increasing trend of tourism has also increased health risks associated with tourism activities, including in Indonesia, a popular tourist destination. In "A Study of Tourist Perception Towards Travel Risk Factors in Tourist Decision Making," it is explained that the high mobility of tourists during travel is a risk factor for the transmission of travel diseases and other health risks at tourist destinations (1). In the travel disease transmission risk category, a 2022 study in Bali showed a 0.74% increase in Dengue Fever cases for every 1,000 additional tourists. In early 2025, the Australian government issued a travel warning for Australians planning to travel to Bali, following the discovery of an Australian citizen contracting dengue fever after traveling to Bali.

The Bantimurung National Park area is a conservation area for butterflies and wildlife such as the macaca maura monkey. This area is a popular and superior destination located in Maros Regency, South Sulawesi, one of the National Parks, and has received an award as an ASEAN Heritage Park (AHP) (2). The natural conditions of the damp, slippery rocky area and the lack of awareness of tourists regarding clean and healthy living behavior can increase the risk of injury, skin infections, respiratory disorders, and the spread of infectious diseases. Dengue fever and zoonotic disease transmission pose serious risks, given the area's status as a dengue-endemic zone and a conservation site for *Macaca maura* wildlife (3).

Furthermore, climate change and increased human activity in this conservation area contribute to the potential for animal-to-human disease transmission, or zoonosis. Based on behavioral observations, some tourists engage in direct contact, such as feeding wild animals. This tourist behavior carries the risk of disease transmission and threatens wildlife's natural habitat and behavior. The study, "The Impact of Human Activities on Zoonotic Infection Transmissions," explains that frequent human visits and interactions with the environment in this area pose significant health risks that demand attention (4).

Literature studies show that despite the high health risks and frequent accidents during tourism, tourist areas have not implemented health risk prevention services, such as risk mitigation communication management for tourists. Furthermore, tourists' lack of awareness leads to risky behavior during tourism activities. This lack of awareness is caused by a lack of knowledge and information regarding health risks at tourist sites. However, implementing health promotion at tourist sites is effective in controlling behavior. A study of tourism health in Bali showed that tourists aware of the risk of rabies transmission demonstrated a high level of preventive behavior while traveling (5).

Behavior during tourism activities is a group that epidemiologically influences public health. The 2015 study "Health Promotion: An Effective Tool for Global Health" explained that health promotion practices are essential to support the control of transnational disease transmission. However, researchers have not conducted studies on tourism development that utilize health promotion to strengthen tourist destinations (6).

Integrated health promotion efforts are needed to control the behavior of tourists. Health promotion in tourism management has become necessary to stimulate the tourism economy while protecting public health. Therefore, developing health promotion media is crucial as a preventative measure to reduce the risk of travel disease transmission. The study, "The Regulations of Protection of Tourists in High-Risk Tourism Destinations," explains that through health information, tourists can obtain information about travel behavior, the importance of environmental cleanliness, personal protective equipment, and first aid measures for minor accidents (7).

Advances in information technology have opened up new opportunities for delivering health messages, one of which is Location-Based Advertising (LBA). Marketers have long used this technology in commercial marketing to deliver specific messages based on the user's location (8). This article examines tourists' perceptions after receiving messages from LBA technology and the potential feasibility of utilizing Location-Based Advertising (LBA) technology for educational purposes as a location-based health promotion medium to increase awareness and healthy lifestyles among tourists (9). With a contextual, interactive, and real-time approach, LBA can be an innovative solution for increasing health awareness in busy tourist destinations like Bantimurung.

## METHOD

This study used a quantitative approach with a descriptive analysis design to determine increased tourist knowledge. To obtain quantitative data, tourists who visited during the survey were selected as respondents to measure the effectiveness of the message on tourist awareness.

The research location was at the Bantimurung Destination, Maros Regency, South Sulawesi, Indonesia. The study population consisted of all tourists visiting the area. Researchers used the number of tourist visits per day as a reference to determine the research sample. Using the Slovin formula and a 10% margin of error, the sample size required was 91 respondents. To facilitate data collection and ensure representativeness, researchers rounded up the sample size to 92 tourists present during the survey. This sample was selected to measure the effectiveness of health messages on tourist awareness at the research location.

In the first phase, 92 tourists were selected as initial respondents (pre-message delivery) to assess their baseline knowledge of health risks in the Bantimurung area before the intervention. The researchers collected data using a structured questionnaire to assess tourists' understanding of health risks in the tourist environment. The questionnaire included specific questions about common health risks in the area, tourists' knowledge of preventive measures, and their general awareness of health issues while traveling.

The next stage, the intervention involved delivering a broadcast message containing information about health risks and preventive measures. Health messages include warnings not to interact with wild animals to prevent the transmission of zoonoses and recommendations to use mosquito repellent lotion to reduce the risk of dengue fever transmission. The researchers distributed this practical and efficient intervention method via WhatsApp, a platform widely used by tourists. Then they collected data from 92 tourists who received the broadcast messages to determine differences in their knowledge levels regarding travel disease risks.

The analysis uses descriptive analysis to describe the characteristics of respondents and the distribution of tourists' level of understanding of disease risks.

**Ethical Approval**

The ethical approval for this study is obtained from The Health Research Ethic Committee, College of Health Science Maluku Husada with approval number: 191/KEPKSTIK/VI/2025. Information collected through WhatsApp on encrypted devices and transferred to secure institutional storage in accordance with ethical standards and data protection protocols.

**RESULTS**

Respondents' knowledge of the risk of travel disease transmission due to tourism activities was measured to obtain a baseline understanding of the types of accidents and diseases that could occur in tourist destinations, behaviors at risk of accidents and transmission, and prevention methods. Based on the health risk assessment in the tourist area, Bantimurung is at risk of transmitting travel diseases such as zoonoses, dengue fever, skin diseases, and diarrhea.

Most respondents (41.3%) identified the flu as the most common illness. This was followed by skin diseases (29.3%) and dengue fever (19.6%). Meanwhile, diarrhea (2%) and leptospirosis, with respondents who didn't know, accounted for only 2.2%. Rabies was also recorded in a small number, at 4.3%. The following illustrates respondents' knowledge regarding the types of travel diseases that can potentially occur in tourist areas.

Tourist activities such as interaction with wildlife and mosquito bites are transmission routes of travel diseases that require vigilance. However, not all respondents were aware of the transmission routes in the Bantimurung National Park area. The results showed that 63 of the 92 respondents (68.5%) had sufficient knowledge of the transmission routes of travel diseases, as indicated by their ability to name one transmission route that could occur in the bird tourism area. Meanwhile, only 25 respondents (27.2%) had good knowledge of transmission routes, as indicated by their ability to name two or more potential routes.

To control health risks in the tourist area, tourists must know about health risk prevention behaviors in Bantimurung National Park. Based on the results of the hazard identification in tourist areas, measures such as avoiding direct contact with wildlife, using mosquito and insect repellent, not feeding monkeys, and maintaining hand hygiene are steps to prevent disease transmission that tourists need to know.

The study results showed that almost all respondents knew that maintaining hand hygiene during travel is a disease prevention measure. Only 13 respondents knew that avoiding direct contact with wildlife is necessary to prevent the risk of transmission. The data above shows that 69 respondents (75%) had sufficient knowledge, as indicated by their ability to name one step to prevent the risk of transmitting travel-related illnesses in tourist areas.

Referring to the research results, this low level of knowledge was because most respondents (67.4%) did not seek information about the health risks that could occur while traveling. Consequently, respondents lacked adequate knowledge regarding the risk of travel disease transmission in tourist areas. Furthermore, observations revealed that tourism operators did not provide health information regarding the risk of disease transmission.

Measuring the effectiveness of using Travel-Based Infection Prevention as a health promotionfor health risk prevention in the Bantimurung National Park tourist area aims to test the feasibility of health promotion innovations utilizing Travel-Based Infection Prevention (LBA) technology by measuring changes in knowledge after being exposed to health promotion messages using LBA technology.

The result study shows that all respondents could identify travel disease risks in tourist destinations. More than 50% of respondents knew that dengue fever, rabies, and skin diseases were travel risks in the Bantimurung tourist area. Referring to the data above, there was an increase in the number of respondents with good knowledge after receiving the LBA message, from 22.8% to 42.7%. Good knowledge means respondents could identify three or more travel disease risks in this context.

The health messages distributed using LBA technology addressed potential disease transmission media. The messages outlined several disease transmission channels in tourist areas, such as insect/mosquito bites and interactions with wildlife. The results showed that after receiving the health message, almost all respondents (88.7%) understood that interaction with wildlife could potentially transmit disease.

Referring to the data above, all respondents could identify the means of disease transmission in tourist areas after receiving the health broadcast. This indicates that respondents read the messages received via WhatsApp. These results suggest increased respondents' knowledge after receiving the health information broadcast, as indicated by their ability to name three means of disease transmission, from 27.2% to 71.9%.

Furthermore, the health promotion messages distributed via broadcast included preventive measures tourists can take to increase their travel vigilance. The result of study shows that almost all respondents (93.8%) know that avoiding contact with wild animals prevents the risk of disease transmission. There was an increase in respondents who understood the need to avoid contact with wild animals, from only 13% initially. Furthermore, 82.3% of respondents knew mosquito repellent was necessary to prevent disease transmission. Referring to the data above, the number of respondents with good knowledge, indicated by their ability to name the required precautions to prevent disease transmission in tourist areas, increased from only 23.9% of respondents who were able to answer three preventive measures to avoid disease transmission to 81.3% of respondents who were knowledgeable about all three. The study results indicate that providing health promotion via WhatsApp broadcasts using LBA increased respondents' knowledge regarding the risk of travel disease transmission in tourist areas. The following table compares the figures for tourists with and without WhatsApp broadcasts.

**Table 1.** Changes in Respondents' Understanding of Travel Diseases Before and After Location-Based Health Promotion

| No | Knowledge about travel disease | Frequency | % |
|---|---|---|---|
| | Before LBA | | |
| 1 | Does not understand types of diseases, transmission modes, and prevention | 10 | 1.1 |
| 2 | Partially understands types of diseases, transmission, and prevention | 69 | 75.0 |
| 3 | Fully understands types of diseases, transmission, and prevention | 22 | 23.9 |
| | After LBA | | |
| 4 | Does not understand types of diseases, transmission modes, and prevention | 1 | 1.0 |
| | Partially understands types of diseases, transmission, and prevention | 29 | 31.3 |
| | Fully understands types of diseases, transmission, and prevention | 62 | 67.7 |

Source: Primary Data

The table above categorizes respondents' knowledge by assessing their understanding of the types of travel diseases at risk in the Bantimurung area, the transmission media for travel diseases, and the preventive measures taken to prevent travel disease transmission in the Bantimurung National Park area. The results of the study, which show an increase in the number of respondents with good knowledge, indicate that disseminating information via WhatsApp broadcasts has successfully increased tourists' knowledge regarding the risks of travel diseases at tourist attractions Disseminating information via broadcasts increases respondents' knowledge regarding the risks of disease transmission due to tourism activities.

Based on observations, the availability of health communication media related to increasing health risks in the Bantimurung area is minimal. There is no provision of information on the risk of disease transmission, such as the risk of mosquito-borne vector-borne diseases and the risk of zoonotic transmission due to interactions with wild animals, the Macaca Maura. Therefore, the increase in respondents' knowledge regarding the risk of travel disease in tourist areas is validly influenced by the provision of health promotion using location-based advertising.

The results of this study indicate that the implementation of LBA in health promotion has an impact on increasing tourists' knowledge regarding health risk prevention. These impacts include increased vigilance and awareness and more targeted and contextual information dissemination, as promotional messages are delivered according to tourists' geographic locations, increasing message relevance and effectiveness, with a 73% readability rate of 993 messages sent. Based on these impacts, the feasibility test for using LBA for health promotion meets the feasibility criteria for effects.

## DISCUSSION

Bantimurung National Park still lacks informative and easily accessible health promotion media for visitors. This situation indicates that health education has not been a top priority in managing the Bantimurung tourist area, despite having various potential health risks. Furthermore, administrative control has not been met within the risk control hierarchy (10).

The lack of health and safety information for tourists reflects the suboptimal implementation of administrative controls. However, health information in high-risk tourist areas is crucial for increasing tourist awareness (11). Greater exposure to health information may encourage tourists to be more vigilant. A study entitled "Tourists' Knowledge and Behavior towards Rabies Prevention," conducted in Bali, indicated that tourists who received information about rabies tended to be more cautious when interacting with monkeys in the Ubud Monkey Forest area (12). Meanwhile, a study entitled "Visitor Awareness to Protect and Preserve Biodiversity and the Environment at the Bantimurung Natural Tourism Object, Bantimurung Bulusaraung National Park" suggested that the level of education does not necessarily determine the level of tourist awareness in protecting biological and non-biological natural resources (13).

The limited understanding of tourists regarding travel-related diseases may also reflect a lack of awareness of how to recognize illnesses that could occur at tourist destinations. Although zoonotic diseases such as rabies (4.3%), avian influenza (5.4%), and leptospirosis (2.2%) have relatively low prevalence rates, the Bantimurung tourist area with its frequent interactions between tourists and wildlife, including monkeys and birds presents potential exposure pathways. The risk of rabies transmission through bites or scratches and leptospirosis from water contaminated with rodent urine should therefore be interpreted as exploratory concerns based on contextual risk factors rather than confirmed epidemiological findings. The Implications of Tourist–Macaque Interactions for Disease Transmission study in Morocco showed that interactions between tourists and macaques lead to zoonotic transmission, and tourists who lack awareness of risky behaviors tend to engage in intense interactions with wildlife. (14) This situation indicates a weak awareness campaign about zoonotic diseases, even though these diseases have the potential to be dangerous if not managed properly.

Similarly, with the transmission of dengue fever, based on research results, only 19.6% of tourists are aware of the risk of dengue fever, even though the risk of dengue fever is high because Bantimurung National Park is in a dengue endemic area. The importance of dengue fever control in endemic areas is emphasized in the study "Global Dengue Importation: A Systematic Review," which explains that tourism activities with high tourist mobility in endemic regions have the potential to become a source of transmission in non-endemic areas. Therefore, risk

management in the tourism sector is necessary, one of which is increasing awareness of disease transmission among tourist groups to prevent imported cases in non-endemic areas (15) (16,17).

The study "Understanding International Travelers' Health Risk Perceptions, Preferences, and Decisions: A Segmentation Analysis" shows that threat perceptions of infectious diseases, particularly diseases transmitted through the natural environment and wildlife, remain very low among tourists (18). Studies in health promotion and behavioral science explain that the Health Belief Model explains that a person will take preventive measures if they feel susceptible (perceived susceptibility) to a disease, consider the disease severe (perceived severity), understand the benefits of preventive measures, and do not see any significant barriers to taking such measures. These limitations directly impact the low level of awareness and minimal preventive behaviors undertaken while traveling in Bantimurung.

In the context of this study, most tourists do not feel vulnerable to serious diseases, as they are unaware of risks such as dengue fever, rabies, or leptospirosis. Without a perceived vulnerability and seriousness, the incentive to take preventative measures is weakened (19). This is reflected in the lack of preventive measures, such as mosquito repellent or maintaining distance from wildlife. The relationship between awareness levels and behavior was also demonstrated in the study Health Seeking Behaviors and Knowledge of Infectious Disease Risks in Western Australian Travelers to Southeast Asian Destinations, which showed that Western Australian tourists with low knowledge tended not to take disease prevention measures such as using mosquito nets when traveling in Thailand (20).

In health communication, location-based advertising (LBA) functions as a medium for delivering preventative messages tailored to the context of the location and individual situation. Theoretically, this can be explained through contextual marketing and situational communication theory, which argue that message effectiveness increases when delivered at a relevant time and place (21). The implication is that health advisory messages delivered while tourists are in a specific location are more relevant, immediate, and generate greater attention, increasing their knowledge of health risks.

After receiving location-based messages, the proportion of tourists with good knowledge increased sharply to 67.7%, while those with fair knowledge decreased drastically to 31.3%. This indicates that LBA significantly improves tourists' understanding of health risks while in tourist areas. This aligns with the study "Predicting Tourists' Health Risk Preventative Behavior and Traveling Satisfaction in Tibet," which demonstrated that the complexity of tourists' knowledge when traveling in Tibet positively influences preventative efforts (22). The study results showed that after the intervention through LBA, there was a significant increase in tourists' ability to recognize and name the types of travel illnesses they could experience during their activities in the Bantimurung nature tourism area.

Tourist awareness of the risk of dengue fever transmission and zoonotic transmission increased (62.9%). Tourists already had a basic understanding of the risks of insect and wild animal bites. LBA effectively acted as cues to action by conveying contextual information about the dangers of mosquitoes and wild animals. Rabies is typically less well-known in the general tourism industry, but the high mention level indicates that LBA messages successfully formed new knowledge among tourists. Many tourists fail to recognize rabies as a health risk, and this is not just true for tourists in Indonesia. A study on the Knowledge Gap and Risk Behaviors of Rabies in Dutch Tourists revealed a lack of awareness of the risk of rabies infection in tourist areas.

Health messages delivered in a specific and contextual manner, tailored to the characteristics of the tourist location, successfully increased tourists' awareness of the risks of travel-related illnesses they may face. This is in line with the principle of effective communication, which states that relevant and contextual information is more effective in influencing audience understanding and attitudes. This principle was also applied in the study, An interdisciplinary study: dissemination of information on dengue fever prevention and control in the world-renowned tourist destination, Bali, Indonesia (23). LBA serves as a concrete reminder that increases the perception of susceptibility and seriousness of risk (perceived severity) to travel-related illnesses. This trigger effectively encourages tourists to internalize the risk and seek further information, thereby strengthening their knowledge. A similar concept was also found in this study, using the Health Belief Model, to assess tourists' willingness to vaccinate and support pre-travel vaccination requirements, which encourages tourists to take preventive measures through vaccination (24).

Accurate and easily accessible information through location-based advertising (LBA) is a direct educational resource that improves tourists' understanding of the health risks inherent in tourist environments. This study's findings confirm that using location-based advertising (LBA) as a medium for delivering health advisories is highly effective in increasing tourists' awareness of the risks of travel illness. In commercial marketing, location-based advertising (LBA) is a communication strategy that utilizes location-based media. It offers advantages because it delivers timely, targeted messages and has been proven to increase interest in the products offered (25). Therefore, relevant technology is used for tourism promotion.

Increasing tourist awareness through health promotion strategies, particularly the provision of location-based health advisories, not only contributes to individual health protection but also has a broader impact on public health and environmental conservation in the Bantimurung tourist area. The importance of education to increase awareness in Bantimurung National Park is also explained in the study "Efforts to increase visitors to seven wonders ecotourism in Bantimurung Bulusaraung National Park through tourism packages," which states that developing ecotourism in Bantimurung requires increased health education for tourists (26).

This health communication intervention demonstrates that a well-targeted educational strategy can bridge the interests of individual health, public health, and environmental conservation. A similar finding is demonstrated in the study "Sustainable Ecotourism Communication Framework Based on Social and Cultural Capital to Build Community Engagement in Ecotourism Practices" in Rutong Tourism Village, Indonesia, which emphasized the importance of an integrated communication strategy about risks in tourism areas (27). Therefore, strengthening health advisory messages in the context of nature tourism is crucial to ensuring the sustainability of tourism while protecting ecosystems and wildlife in the Bantimurung area.

The increased awareness of traveler-related disease risks in the Bantimurung tourist area reflects the success of the health promotion intervention through the LBA. This strategy not only strengthens tourist safety and comfort but also significantly contributes to the development of sustainable, safe, and healthy tourism, which aligns with nature conservation and the preservation of wildlife ecosystems.

**Limitations and Cautions**

A limitation of this study was the limited reach of health messages sent through Location-Based Advertising (LBA) technology, which used WhatsApp's broadcast feature. Messages could only be received by tourists with an active internet connection and using the WhatsApp application on their mobile devices. This limits the distribution of messages to all visitors. Furthermore, the lack of initial outreach to tourists regarding the health message intervention led some tourists to perceive the messages as spam or digital fraud. This negative perception also hindered message readability and acceptance. This study did not include a control group such as a concurrent health campaign that might have influenced tourists' awareness and behavioral responses. Consequently, causal inferences regarding the effectiveness of the messaging intervention should be interpreted with caution.

## CONCLUSION

This study demonstrates that location-based health messaging significantly improves tourists' understanding of travel-related disease risks, particularly in high-risk ecotourism areas such as Bantimurung National Park. This intervention effectively raises awareness of dengue fever and zoonotic disease transmission, addressing the lack of health promotion in these locations and the broader gap in digital health communication strategies in the tourism sector. Despite technical and perceptual limitations, location-based messaging demonstrates potential as a practical tool to support global health resilience efforts through targeted health promotion in tourism clusters.

## AUTHOR'S CONTRIBUTION STATEMENT

The first and second authors were responsible for the conceptualization and methodology. The third author, along with the first author, collected the data and prepared the LBA technology. The first author wrote the original draft. All authors read and approved the final manuscript.

## CONFLICTS OF INTEREST

The authors have declared no potential conflicts of interest that might affect the impartiality of this research. The authors have no relationships that could affect the integrity of the authors' presentation of the results of this research.

## DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

This manuscript was not compiled and written using AI. Grammarly was used in some editing to improve the English structure of this manuscript.

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