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Health Risk Mapping and Early Intervention for Talipao Municipality

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ABSTRACT

This study aimed to design and develop a web-based Health Risk Mapping and Early Intervention System for Talipao Municipality to improve the collection, management, monitoring, and visualization of community health-risk information. The project employed the Waterfall Software Development Life Cycle (SDLC) model, encompassing planning, analysis, design, development, testing, deployment, and maintenance. Data were gathered through surveys, interviews, observations, and document reviews to identify existing health-monitoring challenges and establish system requirements. The findings identified several challenges in the existing process, including manual recordkeeping, delayed reporting, limited access to updated health information, and difficulties in identifying high-risk barangays and prioritizing interventions. In response, the developed system incorporated user authentication, role-based access control, health-risk record management, geographic mapping, dashboard analytics, intervention monitoring, and report generation. The system provides a centralized platform for organizing health-risk records, visualizing affected barangays, monitoring intervention activities, and generating information to support local health planning. The study concludes that the developed system offers a practical digital approach to strengthening community health monitoring and supporting early intervention planning. Continuous system maintenance, accurate data encoding, user training, and further evaluation are recommended to improve its effectiveness and sustainability. However, system performance depends on the accuracy of encoded information, user participation, and available geographic data. The project contributes to digital public health innovation by supporting evidence-informed decision-making, improved coordination among health personnel, and more responsive community health services.

Keywords: *Community Health, Digital Health, Early Intervention, Geographic Information System, Health Risk Mapping, Public Health Monitoring, Web-Based System*

1. INTRODUCTION

Digital technologies have become increasingly important in strengthening public health systems, particularly in collecting, managing, analyzing, and communicating health-related information. The integration of electronic health records, centralized databases, geographic information systems (GIS), and digital reporting platforms enables healthcare institutions to organize information and support timely decision-making. The World Health Organization (2021b) emphasized the importance of digital health strategies in improving healthcare accessibility, information management, and service delivery. Similarly, the Centers for Disease Control and Prevention (2024a) highlighted the role of modernized health information systems in strengthening public health data collection, exchange, and surveillance.

1.1. Background and Context of the Study

Geographic information systems have also become valuable tools for identifying the geographic distribution of health concerns and supporting disease surveillance. Jing et al. (2023) examined the application of geospatial data in infectious disease research, demonstrating its relevance to understanding location-based health information. Likewise, Salim et al. (2024) identified GIS among the digital technologies applied in dengue surveillance. The European Centre for Disease Prevention and Control (2023) also provides geographic disease surveillance information to support the monitoring of infectious diseases. In the Philippines, the Department of Health (2024) recognizes the importance of organized health information through the Field Health Services Information System, which supports healthcare reporting and planning. However, local health monitoring may still encounter challenges involving manual documentation, delayed reporting, and limited geographic visualization. In Talipao Municipality, the preliminary assessment identified difficulties in accessing updated health information, identifying high-risk barangays, and monitoring intervention activities. These challenges established the need for a web-based Health Risk Mapping and Early Intervention System capable of organizing community health records, visualizing reported concerns, and supporting local health planning.

1.2. Research Problem

Effective community health monitoring requires accurate information, organized reporting procedures, and timely identification of areas experiencing health-related concerns. However, conventional recordkeeping and fragmented information management may limit the ability of health personnel to consolidate reports and prioritize interventions. McClymont et al. (2024) discussed the role of internet-based surveillance systems in infectious disease prediction, emphasizing the importance of accessible health information in supporting public health monitoring. Similarly, Guijarro Reinoso et al. (2024) examined innovative epidemiological surveillance applications and their relevance to community health management. The preliminary assessment conducted in Talipao Municipality identified several challenges, including manual or paper-based documentation, delayed identification of health-risk areas, limited access to updated community health information, and difficulties in monitoring intervention activities. These concerns may affect the management of reported illnesses such as fever, dengue, diarrhea, malnutrition, and sanitation-related conditions. The Centers for Disease Control and Prevention (2024b) emphasizes the importance of dengue surveillance and prevention, particularly in communities experiencing mosquito-related health risks. Although digital health systems offer opportunities to improve information organization and accessibility (World Health Organization, 2024), the identified local challenges demonstrate the need for an integrated platform that combines barangay-level health-risk recording, geographic visualization, reporting, and early intervention monitoring.

1.3. Research Gap

Existing literature has demonstrated the application of digital technologies in disease surveillance and public health information management. Jing et al. (2023) reviewed the use of geospatial data in infectious disease studies, while Salim et al. (2024) examined digital health interventions applied in dengue surveillance. Similarly, McClymont et al. (2024) discussed internet-based surveillance systems and their contribution to infectious disease monitoring and prediction. Despite these developments, the identified monitoring challenges in Talipao Municipality indicate a practical need for a localized system that integrates health-risk documentation, barangay-level geographic visualization, dashboard summaries, and intervention tracking. The gap addressed by this study is therefore primarily contextual and operational rather than a general absence of digital surveillance technologies. The study responds to this need by developing a web-based information system designed around the municipality's documented reporting practices and monitoring requirements. Its contribution lies in adapting established digital health and geographic information management approaches to support community-level health-risk monitoring and intervention planning.

1.4. Purpose and Objectives of the Study

This study aimed to design and develop a web-based Health Risk Mapping and Early Intervention System for Talipao Municipality to improve the organization, management, visualization, and reporting of community health-risk information. Specifically, it sought to analyze existing health-risk data collection and intervention planning procedures, design a computerized system responsive to identified operational requirements, and generate summary reports to support health program planning and prioritization. The developed system incorporates health-risk recording, geographic mapping, dashboard visualization, intervention monitoring, and role-based access control. These functions were intended to provide municipal health personnel and barangay health workers with an organized platform for managing reported community health concerns.

1.5. Significance and Practical Contribution of the Study

The study contributes to the application of information technology in local health management by developing a centralized platform for organizing and visualizing barangay-level health information. For the Municipal Health Office, the system offers tools for monitoring reported health concerns, reviewing intervention activities, and generating information relevant to health program planning. Barangay health workers may benefit from more organized recording, retrieval, and reporting procedures. The system also incorporates access controls relevant to the protection of sensitive information, consistent with the data privacy concerns addressed by the National Privacy Commission (2023). Its principal contribution is a localized digital platform designed to support information accessibility, operational coordination, and evidence-informed community health planning.

1.6. Sustainable Development Goals (SDG) Alignment

The study supports Sustainable Development Goal 3, Good Health and Well-Being, and Sustainable Development Goal 9, Industry, Innovation and Infrastructure. The United Nations (2023) emphasizes the importance of strengthening health systems and advancing sustainable development through improved services and infrastructure. The project's alignment with SDG 3 is reflected in its focus on community health-risk monitoring and early intervention planning. Its contribution to SDG 9 involves applying web-based information management, database technologies, and geographic visualization to local public health services. The World Health Organization (2025) further highlights the continuing importance of digital health strategies in strengthening health systems. Together, these applications demonstrate how digital innovation can support organized and accessible community health information management.

2. METHODOLOGY

2.1. Research Design

The study employed a developmental research approach using the Waterfall Software Development Life Cycle (SDLC) model to design and develop the Health Risk Mapping and Early Intervention System for Talipao Municipality. The development process followed seven phases: planning, analysis, design, development, testing, deployment, and maintenance. This structured approach enabled the researchers to identify user requirements, establish system specifications, develop functional modules, and assess system operations. Surveys, interviews, observations, and document reviews supported requirements identification, while functional testing examined the performance of the developed system's major components.

2.2. Research Locale

The study was conducted in Talipao Municipality, Philippines, focusing on community health-risk monitoring and early intervention planning. The target users included personnel from the Municipal Health Office, barangay health workers, authorized health staff, and community stakeholders. Selected respondents participated in surveys concerning common health risks, healthcare accessibility, reporting difficulties, and the perceived need for digital health monitoring. Interviews involved health personnel familiar with existing reporting and intervention procedures. The study concentrated on barangay-level health information and municipal health service operations. The source manuscript did not specify the total population, final respondent count, or demographic distribution.

2.3. Sampling Technique

The researchers gathered information from selected respondents and relevant stakeholders involved in community health monitoring. Survey respondents provided information concerning health concerns and access to healthcare services, while interviews involved barangay health workers, municipal health personnel, and authorized system users. Their involvement supported the identification of operational requirements and existing reporting challenges. The manuscript did not identify a formal probability or nonprobability sampling technique, sample-size calculation, confidence level, or margin of error. Consequently, the selection procedure is described according to the documented respondent groups without assigning an unsupported sampling classification. Data collection utilized a survey questionnaire, interviews, direct observation, and document review. The questionnaire covered common illnesses, distance from health facilities, medicine availability, transportation difficulties, sanitation concerns, mosquito breeding areas, and perceptions of digital health-risk mapping. Interviews examined record management, reporting frequency, intervention procedures, and operational challenges. Observation focused on existing documentation and information-processing practices, while document review examined health records, reporting forms, and intervention logs. System assessment incorporated functional testing of authentication, record management, geographic mapping, dashboards, intervention tracking, and report generation. No instrument-validation coefficients or completed reliability estimates were documented.

2.4. Data Gathering Procedure

Data gathering began with identifying existing health-monitoring practices and information requirements in Talipao Municipality. The researchers distributed survey questionnaires to selected respondents and conducted interviews with health personnel to understand reporting procedures and operational difficulties. They observed existing recordkeeping activities and reviewed available health-related documents to identify necessary data fields and system functions. The collected information informed requirements analysis, database design, user-interface development, and module specifications. Following development, system functions

were examined through documented testing activities, while additional user acceptance evaluation remained subject to completion.

2.5. Data Analysis

The collected survey, interview, observation, and documentary information was examined to identify recurring health concerns, reporting limitations, and required system features. Requirements were organized into functional specifications covering data encoding, risk classification, geographic visualization, access control, intervention monitoring, and reporting. System functionality was assessed by comparing expected operations with documented test outputs and pass/fail statuses. The functional testing table also recorded response times for individual modules. Although weighted-mean evaluation was discussed for user acceptance testing, completed respondent ratings and statistical summaries were unavailable. No inferential statistical tests or validated significance levels were reported.

2.6. Ethical Considerations

The study involved community health information and required careful handling of potentially sensitive records. The system incorporated user authentication and role-based access restrictions to limit information access according to authorized responsibilities. These measures were intended to protect records against unauthorized access and modification. The manuscript did not document formal ethics committee approval, written informed consent procedures, or specific data-retention arrangements. Accordingly, no such approvals or procedures are claimed. Further implementation should observe applicable confidentiality and data protection requirements.

3. RESULTS AND DISCUSSION

3.1. Challenges in Community Health-Risk Monitoring

The assessment of health-monitoring practices in Talipao Municipality identified challenges involving manual recordkeeping, delayed reporting, limited access to updated health information, and difficulties in identifying high-risk barangays. These limitations affected the organization of health records and the monitoring of intervention activities. The findings highlighted the need for a centralized digital platform that could improve information accessibility and support barangay-level health monitoring. This is consistent with Maddah et al. (2023), who emphasized the importance of digital surveillance systems in strengthening public health monitoring and reporting.

3.2. Development of the Health Risk Mapping and Early Intervention System

The study developed a web-based Health Risk Mapping and Early Intervention System using the Waterfall Software Development Life Cycle. The system integrated user authentication, barangay management, health-risk recording, geographic mapping, dashboard summaries, intervention monitoring, and report generation. These interconnected features were designed to organize community health information and support authorized personnel in managing reported health concerns. The development demonstrates the practical application of digital health technologies in local health information management, consistent with the principles discussed by the World Health Organization (2021).

3.3. Geographic Mapping and Health-Risk Visualization

The developed geographic mapping module allows authorized users to visualize reported health concerns according to their associated barangays. By connecting health-risk records with geographic information, the system provides a visual representation of affected areas and supports the identification of locations requiring further assessment. The dashboard

complements this feature by presenting summarized health information. These functions are consistent with Ariyanti et al. (2025), who demonstrated the application of geographic information systems in mapping disease distribution. However, mapping accuracy remains dependent on the completeness and reliability of encoded information.

3.4. Health Reporting and Early Intervention Monitoring

The system incorporated reporting and intervention monitoring modules to support the documentation, retrieval, and organization of community health information. Authorized personnel can manage reported health concerns, generate summary reports, and record intervention activities, including their status and related details. These features provide an organized approach to monitoring reported risks and supporting health program planning. The findings align with Li et al. (2024), who emphasized the importance of timely information management in public health early warning systems. Nevertheless, improvements in actual intervention outcomes require further evaluation.

3.5. Functional Testing and System Performance

The functional testing records documented passing statuses for eight system functions, including authentication, user management, health-risk records, risk mapping, early intervention, dashboard, report generation, and access control. Recorded response times ranged from 3 to 10 seconds. Authentication, user management, and access control each recorded 3 seconds, while report generation recorded the longest time at 10 seconds. These results indicate that the documented functions met their expected operations during testing. However, comprehensive performance testing and user acceptance evaluation were not fully documented, limiting conclusions regarding overall usability, reliability, and effectiveness.

3.6. Contribution to Community Health Planning

The developed system provides a centralized platform for organizing health-risk records, visualizing barangay-level concerns, monitoring intervention activities, and generating reports. Its integration of database management, geographic mapping, and role-based access control offers a practical technological approach to supporting municipal health information management. The system addresses the study objectives by providing tools intended to assist health personnel in identifying reported risks and prioritizing interventions. Nevertheless, its demonstrated contribution remains primarily developmental and functional, and further evaluation is necessary to establish measurable improvements in health-service delivery and operational efficiency.

4. CONCLUSIONS AND RECOMMENDATIONS

The study developed a web-based Health Risk Mapping and Early Intervention System for Talipao Municipality to address challenges involving manual recordkeeping, delayed reporting, limited access to updated health information, and difficulties in identifying high-risk barangays. The developed system integrated health-risk recording, geographic mapping, dashboard visualization, intervention monitoring, report generation, and role-based access control. Functional testing documented passing results across eight major system functions, indicating that the tested modules performed their intended operations. Collectively, these findings demonstrate that the system provides an organized digital platform for managing community health-risk information and supporting barangay-level monitoring. Its mapping and reporting features offer practical tools for identifying reported health concerns and informing intervention planning. The study contributes to local digital health innovation by demonstrating the application of web-based information management and geographic visualization technologies.

However, conclusions regarding overall system effectiveness require further performance testing and user acceptance evaluation.

The Municipal Health Office and authorized health personnel should consider implementing the developed system in a controlled operational environment to further assess its functionality, usability, reliability, performance, and security. Functional testing should be supplemented with documented performance measurements and user acceptance evaluations involving intended users, including barangay health workers and municipal health personnel. Regular system maintenance, accurate data encoding, and appropriate user training are recommended to maintain the reliability and usefulness of health-risk records. The system should also incorporate strengthened data validation, database backup and recovery procedures, improved audit logging, and appropriate access controls to protect sensitive information. Future improvements may include enhanced geographic visualization, responsive mobile access, and additional reporting functions. Where technically feasible and properly authorized, integration with other health information sources may also be explored. These measures may support continued system improvement and more organized community health monitoring.

The study was limited to the development of a web-based health-risk mapping and early intervention system for Talipao Municipality. Its scope focused on information management, geographic visualization, reporting, and intervention monitoring rather than medical diagnosis or treatment. System accuracy depends on the completeness of encoded health records and the availability of reliable barangay-level geographic information. Although functional testing results were documented, comprehensive performance measurements and completed user acceptance evaluation results were not provided. Consequently, the findings do not establish measurable improvements in healthcare delivery or operational efficiency. Further testing and evaluation involving intended users are necessary to determine the system's effectiveness in actual municipal health operations.

5. REFERENCES

Centers for Disease Control and Prevention. (2024a). *Data modernization initiative*. https://www.cdc.gov/surveillance/data-modernization/

Centers for Disease Control and Prevention. (2024b). *Dengue*. https://www.cdc.gov/dengue/

Centers for Disease Control and Prevention. (2024c). *Public health surveillance and data*. https://www.cdc.gov/surveillance/

Department of Health. (2023). *National objectives for health Philippines 2023–2028*. https://doh.gov.ph/

Department of Health. (2024). *Field health services information system*. https://doh.gov.ph/

European Centre for Disease Prevention and Control. (2023). *Surveillance atlas of infectious diseases*. https://atlas.ecdc.europa.eu/public/index.aspx

Guijarro Reinoso, G. P., Paredes Haro, H. D., Alonso Madero, J. L., Orozco Escaleras, L. G., Angulo Quinquiguano, M. I., Masapanta Pilatasig, W. J., & Correa Auqui, L. F. (2024). Epidemiological surveillance innovative applications for community and public health: A systematic review. *International Journal of Medical Science and Clinical Research Studies, 4*(3), 546–555. https://doi.org/10.47191/ijmscrs/v4-i03-32

International Organization for Standardization. (2023). *Systems and software engineering—Systems and software quality requirements and evaluation (SQuaRE)—Product quality model (ISO/IEC Standard No. 25010:2023)*. https://www.iso.org/standard/78176.html

Jing, F., Li, Z., Qiao, S., Zhang, J., Olatosi, B., & Li, X. (2023). Using geospatial social media data for infectious disease studies: A systematic review. *International Journal of Digital Earth, 16*(1), 130–157. https://doi.org/10.1080/17538947.2022.2161652

McClymont, H., Lambert, S. B., Barr, I., Vardoulakis, S., Bambrick, H., & Hu, W. (2024). Internet-based surveillance systems and infectious diseases prediction: An updated review of the last 10 years and lessons from the COVID-19 pandemic. *Journal of Epidemiology and Global Health, 14*, 645–657. https://doi.org/10.1007/s44197-024-00272-y

National Privacy Commission. (2023). *Data privacy guidance*. https://privacy.gov.ph/

Open Web Application Security Project. (2021). *OWASP top 10:2021*. https://owasp.org/Top10/

Open Web Application Security Project. (2023). *OWASP API security top 10—2023*. https://owasp.org/API-Security/editions/2023/en/0x11-t10/

Salim, M. F., Satoto, T. B. T., Danardono, & Daniel, D. (2024). Digital health interventions in dengue surveillance to detect and predict outbreak: A scoping review. *The Open Public Health Journal, 17*, Article e18749445283264. https://doi.org/10.2174/0118749445283264240116070726

United Nations. (2023). *The sustainable development goals report 2023: Special edition*. https://unstats.un.org/sdgs/report/2023/

World Health Organization. (2021a). *Ethics and governance of artificial intelligence for health: WHO guidance*. https://www.who.int/publications/i/item/9789240029200

World Health Organization. (2021b). *Global strategy on digital health 2020–2025*. https://www.who.int/publications/i/item/9789240020924

World Health Organization. (2022). *Global report on infection prevention and control*. https://www.who.int/publications/i/item/9789240051164

World Health Organization. (2024). *Digital health*. https://www.who.int/health-topics/digital-health

World Health Organization. (2025). *Global strategy on digital health 2020–2027*. https://www.who.int/publications/i/item/9789240116870