# Enhancing the Integrated Injury Surveillance System for All Age Groups in the Decentralized Areas to Local Governments in Ubon Ratchathani Province, Thailand

**Sansiritawisuk, G.,* Wankham, C., Bootkan, C., Sommai, M., Natitphuwaphong, P. and Srichiangsa, W.**
The Office of Disease Prevention and Control 10th Ubon Ratchathani, Thailand
E-mail: getsaraepid7@gmail.com
*Corresponding Author*

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**Abstract**

*This developmental research aims to enhancing and extend the implementation of an integrated injury surveillance system for all age groups in areas where responsibilities have been transferred to local authorities in Ubon Ratchathani Province. The study period is from February to April 2024. The target groups include 208 individuals from government agencies, community leaders, and public health volunteers, as well as 200 individuals from all age groups at risk. The tools used in this research include the surveillance forms created and developed by the researchers in the model areas, communication and public relations strategies for injury warnings, health literacy assessments for at-risk groups, random helmet use surveys, and participation and satisfaction assessments. Data analysis involves qualitative methods using content analysis and quantitative methods using descriptive statistics, including percentages, medians, and paired t-tests. The study results indicate that after expanding the model, there was an integration of networks participating in the surveillance system. The use of surveillance tools for risk assessment facilitated communication and risk management at the individual, causative agent, and environmental levels. Consequently, participants' health literacy significantly increased, with a p-value < 0.01. Helmet use rose from 32.00% to 82.00%. Additionally, the management of risk points increased to 5 from the initial target of 4. Network participation post-implementation reached its highest level at 86.06%, and satisfaction was at 81.73%. The injury rate from major causes across all age groups decreased compared to the median rate of the past five years during the same period. Therefore, the surveillance system should focus on proactive measures to provide warnings before incidents occur. It should also encourage public participation, with local administrative organizations playing a central role in driving and coordinating efforts. This approach ensures continuous and sustainable integration of network operations.*

**Keywords:** Injury Across All Age Groups, Integration, Surveillance System

## 1. Introduction

Injuries from accidents can occur at any age and represent a significant public health issue due to the loss of life and property they cause [1]. According to data from 2019, there were 3.16 million deaths worldwide due to injuries [2]. Thailand has the highest road traffic fatality rate in ASEAN [3] and the second highest in the world [4]. Between 2017 and 2021, the incidence of injuries from all causes across all age groups showed a continuous upward trend, with injury and mortality rates increasing from 583.14 to 1,517.11 per 100,000 population. The mortality rate rose from 7.21 to 16.68 per 100,000 population, which is 41.7 times higher than the mortality rate from pneumonia [5]. In the northeastern region, specifically Health Region 10, the rates of injuries and fatalities from all causes also demonstrated an increasing trend between 2017 and 2021, rising from 55.70 to 781.45 per 100,000 population. The mortality rate from all causes increased from 0.43 to 15.57 per 100,000 population. In Ubon Ratchathani Province, the injury rate from all causes was 1,438.79 per 100,000 population [6], ranking third in Health Region 10, with the highest case fatality rate (CFR) from injuries in the region.


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In Lao Suea Kok District, which has transferred responsibilities to local administrative organizations (LAOs), the injury rate from all causes in 2021 was 1,917.65 per 100,000 population [7], ranking first among the areas where responsibilities were transferred to local authorities in Ubon Ratchathani Province.

From the Phase 1 study, conducted from October 2022 to February 2024, a proactive surveillance model focusing on pre-event warnings to prevent injuries across all age groups was developed. This model helps reduce the incidence of injuries and establishes a prototype for integrated injury prevention across all age groups. Thus, it is an efficient and effective model. The research team recognizes the importance of expanding the use of this model, aiming to *enhancing and extend* an integrated injury surveillance and prevention system for all age groups. The results of this study will be highly beneficial for planning and formulating injury surveillance and prevention policies for all age groups in other areas in the future.

Integrated Injury Prevention for All Age Groups refers to the collaboration of relevant networks, including local government agencies, community leaders, and public health volunteers (PHVs), to jointly monitor injuries across different age groups. These groups are defined as follows: children under 15 years old, adolescents aged 15–24 years, working adults aged 25–59 years, and elderly individuals aged 60 years and older.

## 2. Methodology

### *2.1 Study Area*

The study area for this article is the Nong Bok sub-district, Lao Suea Kok district, Ubon Ratchathani Province, Thailand (Figure 1). This sub-district serves as the primary site for the development and implementation of an integrated injury surveillance system. Overall, the study area serves as a practical testing ground for the integrated injury surveillance model, with an emphasis on community engagement and tailored interventions to improve public health outcomes across all age groups.

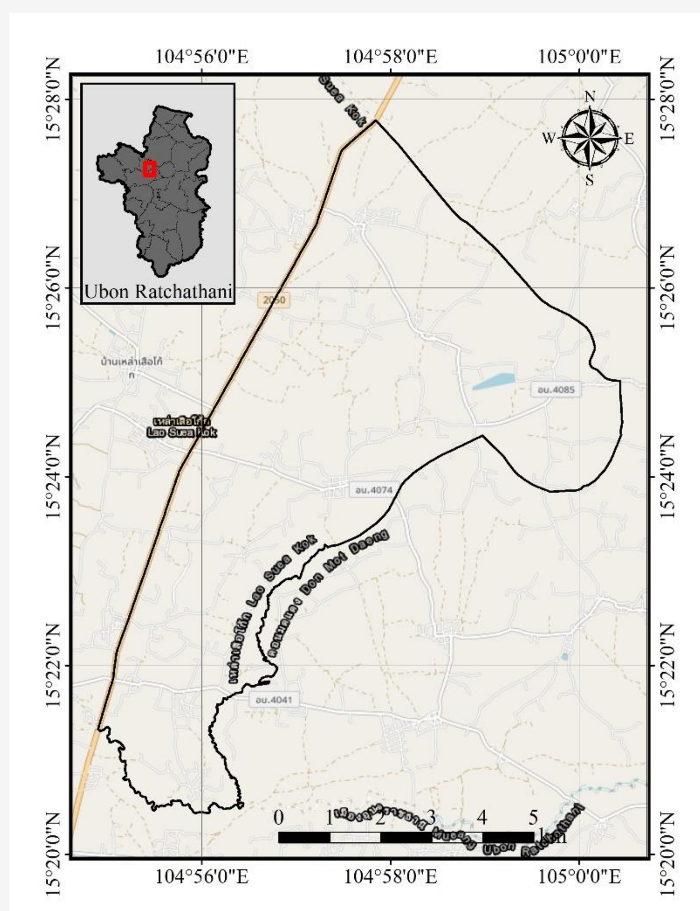


**Figure 1**: Nong Bok sub-district, Lao Suea Kok district, Ubon Ratchathani


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The methodology in this study is divided into 2 phases as follows:

*Phase 1*: During Phase 1, which took place from October 2022 to January 2024, the focus was on creating the surveillance system. This involved identifying local injury patterns, assessing current resources, and establishing a framework for data collection and analysis. The dissemination of the model began in early February 2024, aiming to engage local stakeholders and ensure their understanding of the system's importance.

*Phase 2*: Phase 2 is set to extend from February to April 2024. This phase aims to enhance and expand the model developed in Phase 1, continuing for a total of three months. It covers areas where responsibilities have been transferred to local authorities, allowing for adaptations to fit the unique context of the local community. This ensures that the surveillance system is not only relevant but also effective in addressing the specific injury-related challenges faced by the population.

*2.2 Number of Samplings*

The target groups for driving the model include a total of 13 academic members, consisting of researchers, independent scholars, and those responsible for injury management at the regional or provincial level. The target group for implementing and expanding the model comprises 208 individuals, including local government officials, such as administrators and those responsible for tasks at the Subdistrict Administrative Organization (SAO), Subdistrict Health Promoting Hospitals (SHPH), Child Development Centers (CDC), and schools (40 individuals in total). Additionally, there are 168 public health volunteer leaders. For the at-risk groups to be assessed for health literacy, there will be 50 individuals from each age group, totalling 200 people, the sample size can be determined from Equation 1 [8].

$$n = \frac{Z^2 \cdot SD \cdot (1 - SD)}{d^2}$$

Equation 1

Where:

$n$ = Sampling numbers

$Z$ = Z-score at the confidence level 95% (1.96)

$d$ = the margin of error (0.05)

$SD$ = Standard deviation

Based on the sample size calculation, n=30 people. However, to ensure comprehensive data collection, the sample size will be increased to 50 individuals per age group. This will be done by randomly selecting samples proportionate to the population in each sub-district, and then randomly choosing one village from each sub-district using simple random sampling. The at-risk groups willing to participate in the project will be interviewed.

*2.3 Study Phases*

The research and development process for an Injury Surveillance Model for All Age Groups consists of two phases. In Phase 1, the process involves analyzing the current situation (R1), creating an initial model (D1), testing the preliminary model (R2), refining the system based on real-world conditions (D2), testing the developed model in practical settings (R3), improving the model based on feedback (D3), and disseminating the final model (R4). The outcome is a comprehensive surveillance system that integrates operations for all age groups, designs participatory surveillance tools, ensures continuous operation, and manages risks. Phase 2 involves expanding the surveillance system to local areas by conducting debriefing sessions with stakeholders to identify and correct deficiencies, holding capacity-building meetings with participants from various sectors, using surveillance tools to assess risks, and conducting workshops to improve health literacy and injury prevention knowledge. Additionally, data is collected before and after a 60-day intervention period, including random helmet use surveys among motorcyclists at high-risk points, and evaluating stakeholder participation and satisfaction to ensure the system's sustainability and effectiveness. This comprehensive approach ensures a robust and adaptable injury surveillance system, contributing to better injury prevention and management in the community.

*2.4 Tools Used for Injury Surveillance Across all Age Groups*

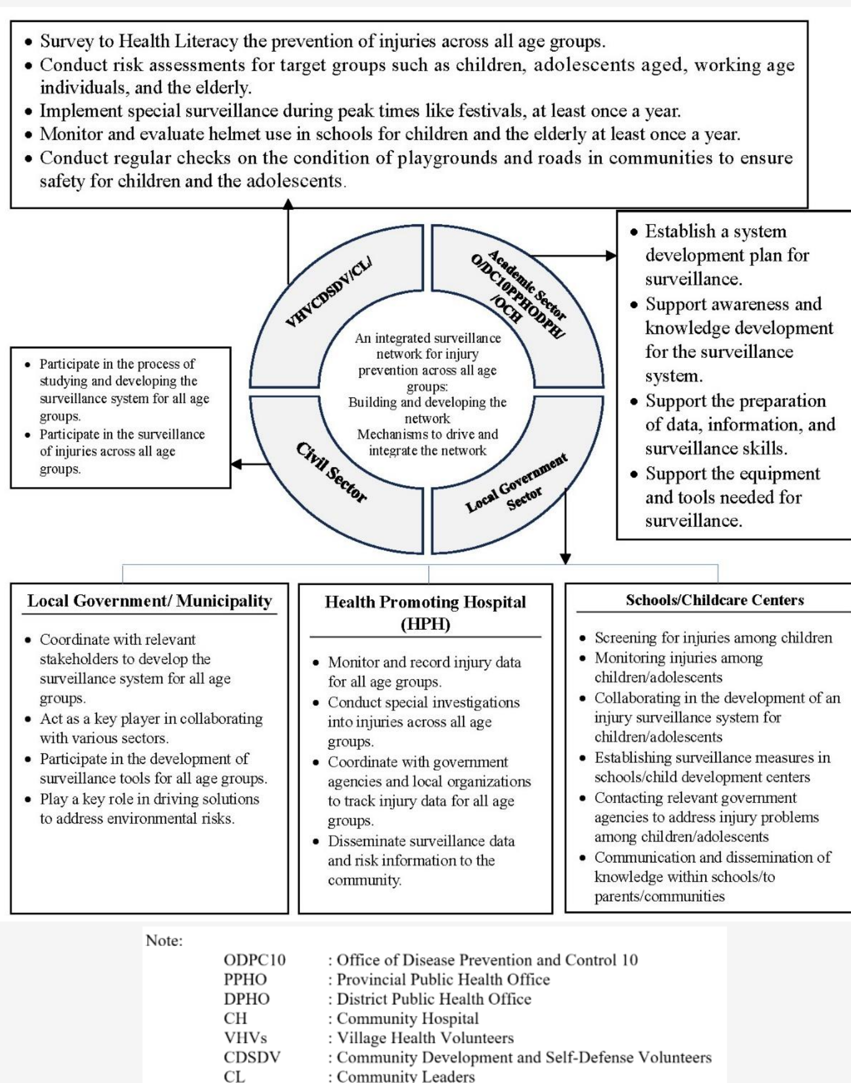
The tools used for injury surveillance across all age groups include risk surveillance forms for individuals, causative agents, and the environment. These tools were developed and refined during Phase 1, with input from local networks in pilot areas and lessons learned from volunteers who collected data. The interview forms were tested with a sample of 30 individuals, and their reliability was assessed using the Kuder-Richardson Formula 20 (KR-20), yielding values between 0.75 and 0.88. The interview forms for assessing health literacy in different age groups are scored on a scale of 0-4 points. The evaluation forms for participation and satisfaction use a 5-point Likert scale, with each aspect having a maximum score of 25 points.

The scoring levels are as follows: least (5.00-7.50 points), low (7.60-12.50 points), moderate (12.60-17.50 points), high (17.60-22.50 points), and highest (22.60-25.00 points). Qualitative tools include criteria for assessing the credibility of the injury surveillance model, with validity established through field studies by the research team and triangulation of data to verify reliability, as well as rechecking with informants.

## 3. Results

*3.1 Network Building and Development*

From the analysis of the injury surveillance system in the expanded areas, it was found that the previous surveillance model focused on reactive measures post-incident, lacked systematic and continuous reporting, and the relevant agencies including government, private sector, and local community members operated independently without a clear collaborative network. Therefore, network building and development involved the following: the Local Government Network, which includes the District Public Health Office (DHO), Sub-district Administrative Organization (SAO) staff, Sub-district Health Promoting Hospitals (SHPH), school health teachers, and early childhood development center caregivers; the Community Leaders and Village Health Volunteers Network, who play a crucial role in the surveillance system; the Academic Network, comprising academic units from outside the area at both provincial and regional levels, whose role is to provide academic support, management assistance, and create platforms for knowledge exchange to ensure effective injury surveillance and prevention; and the newly established Community Network, which includes community knowledge bearers and volunteers. The roles and responsibilities of each network are divided as shown in Figure 2.




Note:

| | |
|---|---|
| ODPC10 | : Office of Disease Prevention and Control 10 |
| PPHO | : Provincial Public Health Office |
| DPHO | : District Public Health Office |
| CH | : Community Hospital |
| VHVs | : Village Health Volunteers |
| CDSDV | : Community Development and Self-Defense Volunteers |
| CL | : Community Leaders |

**Figure 2**: Networks and roles in community injury surveillance and prevention

*3.2 Development of Surveillance Tools for Each Age Group*

The development of surveillance tools for each age group involved lessons learned from relevant government agencies and volunteers who collected data for each age group, as well as a review of existing knowledge and injury investigation reports. This process led to the improvement of surveillance tools in the expanded areas, resulting in both existing and newly enhanced tools, including health literacy assessments, risk factor evaluations, risk point surveys, and helmet use surveys among motorcycle riders. The surveillance system covers risk factors related to individuals, causative agents, and the environment, and encompasses risk management across three stages of incident occurrence. The details of the surveillance tools used are shown in Table 1.

*3.3 Model and Mechanism for Driving the Surveillance System in the Expanded Areas*

The model and mechanism for driving the surveillance system in the expanded areas include processes led by relevant network partners and the community jointly conducting surveillance. Information is fed back to the community to raise awareness and recognition, fostering a sense of shared ownership of the problem for the benefit of the community. This results in the acquisition of information that provides early warnings before incidents occur, leading to communication and risk management to enhance community safety, as shown in Figure 3.

**Table 1:** Tools used for injury surveillance across all age groups

| Surveillance Tools | Target Group | Responsible Parties | Reporting Frequency | Reporting Agencies |
|---|---|---|---|---|
| **Before the Incident** | | | | |
| - Health Literacy Survey Form | All age groups | VHVs/Caregivers/Teachers | At least once a year | Health Promoting Hospital (HPH) |
| - Risk Assessment Form | All age groups | VHVs/Caregivers/Teachers | At least once a year | HPH and Local Government (LG) |
| - Environmental/Spot Surveillance Form | All age groups | VHVs/Caregivers/Teachers | At least once a year | HPH and LG |
| - Helmet Use Survey Form | Motorcyclists | VHVs/Community Leaders | Before and after festivals | HPH and LG |
| **During the Incident** | | | | |
| - Incident Report Form | All age groups | Witnesses/VHVs/Community Leaders | Every time an incident occurs | HPH and LG |
| **After the Incident** | | | | |
| - Injury Investigation Form | All age groups | HPH Network/LG/Community | Every time an incident occurs | HPH/LG/Hospital |

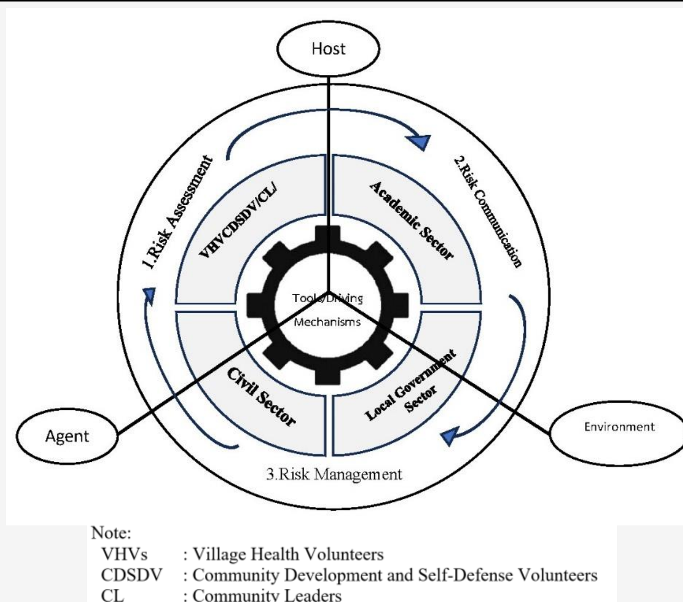



**Figure 3:** Surveillance system driving mechanism

The results of injury surveillance across all age groups provided valuable data for risk analysis and management. For instance, during the implementation of surveillance and injury prevention operations during the 2024 festival season, the injury rate decreased from 9 cases to 8 cases compared to the same period the previous year. When compared to the 5-year median, there was a reduction of 3 cases. Additionally, the management of risk points increased to 5 points, exceeding the target of 4 points. The locations of the risk points illustrates in Figure 4.

*3.5 Effectiveness of the Surveillance System*

The evaluation of the surveillance system revealed that 100% of network agencies participated in surveillance and reporting. During the pre-incident phase, special surveillance and random sampling were conducted to assess risk and health literacy, successfully meeting the targets set for all age groups. During the incident phase, traffic accident assessments during the Songkran festival indicated timely reporting of traffic injury incidents within 3 hours, achieving 100% timeliness. In the post-incident phase, 88.89% of accidents were investigated according to the established criteria, and 77.78% of accident reports were complete in the reporting and treatment units. Additionally, 81.73% of the surveillance network expressed the highest level of satisfaction in participating as a surveillance team.

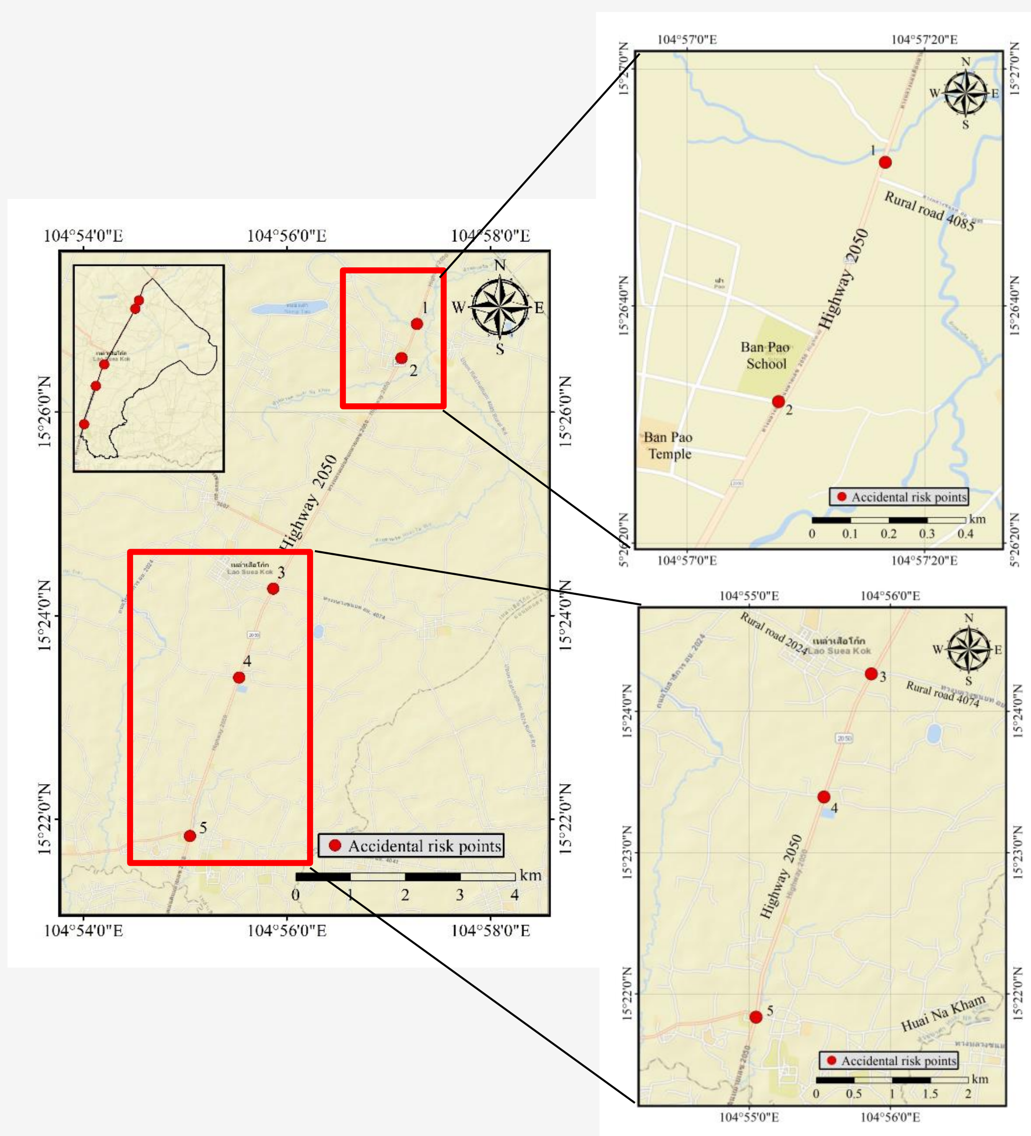



**Figure 4:** Risk points in Lao Suea Kok ditrict, Ubon Ratchathani province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*3.5.1 Behavior change*

Behavioral changes were evaluated through random surveys of motorcycle users conducted by community volunteers. The findings indicated an increase in helmet use from 32.00% to 82.00%. Additionally, random surveys conducted by the research team before and after the Songkran festival at one risk point per subdistrict (totalling four points) during the same time periods (07:30-08:30 and 16:30-17:30) showed an increase in helmet use from 21.67% to 54.17%. Health literacy among the sample group, assessed after surveillance, risk communication, and literacy promotion activities, showed a statistically significant improvement in scores related to injury prevention and problem-solving compared to before the implementation (p-value < 0.001), as shown in Table 2.

*3.5.2 Environmental management*

In terms of environmental management, risk points on roads were addressed by the surveillance network, which set a joint target to manage one risk point per subdistrict before the Songkran festival, totalling four points. The results showed that the operations exceeded the set target, managing a total of five points, which is over 100% of the target.

*3.5.3 Reducing the impact of injuries*

The injury rates for the primary causes in each age group—road traffic accidents for children and adolescents, mechanical force injuries and musculoskeletal disorders from work for working-age adults, and falls for the elderly have decreased compared to the 5-year median (2019-2023) for the same period (February-April). Similarly, the overall injury rates for all causes in children, adolescents, and working-age adults have decreased compared to the 5-year median for the same period (February-April). However, the injury rate for the elderly increased by 2 cases, as shown in Figure 5.

*3.6 Dissemination of the Surveillance Model*

The surveillance model was disseminated through a workshop for five provinces in Health Region 10, with a total of 80 participants. The workshop included presentations on the surveillance system model, panel discussions with network partners sharing their experiences, exhibitions, and awards for outstanding model areas. The outcome was the widespread dissemination of the integrated injury surveillance model, enabling participants to learn about it and apply it in their own areas.

**Table 2:** Comparison of average knowledge scores of sample groups in different age groups before and after implementation in Lao Suea Kok district, Ubon Ratchathani province

| Spect of Knowledge | Number (People) | Full Score | Mean ±S.D | | t Difference | Pair t-test | p-value |
|---|---|---|---|---|---|---|---|
| | | | Before | After | | | |
| 1. Childcare Providers | 50 | 80 | 39.90±2.12 | 66.66±2.24 | 26.76 | 86.017 | <0.001 |
| 2. Adolescents | 50 | 80 | 39.70±2.31 | 67.74±2.55 | 28.04 | 58.550 | <0.001 |
| 3. Working Age | 50 | 80 | 38.34±3.37 | 68.28±2.84 | 29.94 | 56.790 | <0.001 |
| 4. Elderly/Caregivers of the Elderly | 50 | 80 | 37.44±2.97 | 53.66±2.88 | 16.22 | 27.024 | <0.001 |

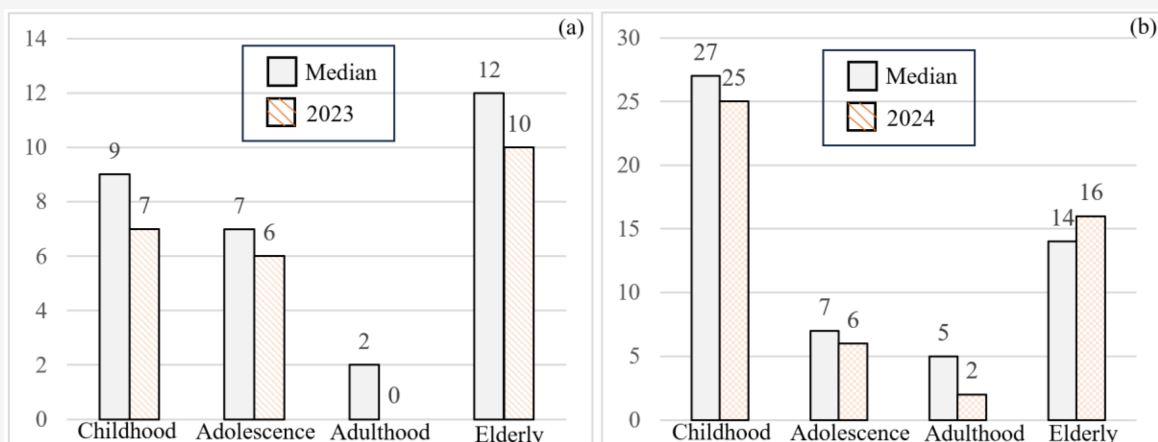


**Figure 5:** Injury rate in each age group (a) 2023 (b) 2024


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## 4. Discussion

After implementing and expanding the model, network integration for surveillance was achieved, involving academic networks, local government, community leaders, village health volunteers (VHVs), and the general public. Surveillance tools were used to assess risks and communicate them through various media channels, alongside organizing campaigns and enhancing health literacy to foster intellectual and social skills. This initiative aimed to motivate and empower individuals to access, understand, and use information to promote good health for themselves, their families, and their communities [9]. The community took ownership of the issues, participated in the development process, and benefited from sustainable improvements [10]. The study found a statistically significant increase in health literacy among the sample population (p-value $< 0.001$), consistent with the development of health literacy enhancement models for children, school-age groups [11], working-age adults [12], and the elderly [13]. These models showed that improving literacy led to positive health behavior changes. Additionally, the study observed an increase in helmet use among the surveyed sample, consistent with findings that increased knowledge, understanding, confidence, and perception abilities enhance health literacy and health behaviors [14] and [15]. Proper environmental risk management, suited to the community context, is also a critical factor in driving the surveillance system for early warnings. The collaboration among all network sectors, sharing mutual benefits, represents the true success of participatory engagement [16].

Furthermore, in terms of environmental management during the expansion phase, five high-risk traffic accident points were managed. These risk points were analyzed, and the information was fed back to the community. Actions were driven through district-level Road Safety Directing Centers, leading to problem-solving initiatives. The effective use of data is crucial for targeting clear goals, resulting in the development of integrated mechanisms. The injury rate across all age groups decreased; specifically, during the Songkran festival, injuries decreased by one case compared to the previous year and by three cases compared to the 5-year median. However, the number of injuries from all causes among the elderly increased by two cases three months post-expansion. When focusing on falls, a primary cause, there was a reduction of two cases, but this short-term measurement necessitates continuous, comprehensive efforts to reduce injuries from all causes. Addressing behavioral issues requires time and should start in childhood to ensure sustainability [17]. Therefore, all sectors, including families, communities, and society, must work together to impart knowledge and survival skills for road accidents, which are considered "traffic vaccines" [18]. Additionally, cognitive and social skills are needed to choose and use information to appropriately manage personal health [19]. Each area must compile a comprehensive injury database, analyze risk factors, prioritize injury causes according to the local context, and promote safety to cover other causes. This approach helps prevent problems and reduce premature deaths, representing a worthwhile investment for sustainable prevention and resolution of issues.

## 5. Conclusion

The development and expansion of the integrated injury surveillance system in the local areas of Ubon Ratchathani Province have led to the creation of a collaborative network that actively participates in surveillance. Risk assessments, communication, and risk management activities have been implemented, resulting in a statistically significant increase in health literacy among the sample population, with a p-value $< 0.01$. Helmet use also increased from 32.00% to 82.00%. Furthermore, five risk points were managed, exceeding the target of four. Random surveys of helmet use conducted before and after the Songkran festival at one risk point per subdistrict (totalling four points) during the same time periods (07:30-08:30 and 16:30-17:30) showed an increase in helmet use from 21.67% to 54.17%. Post-implementation, network participation reached the highest level of 86.06%, with satisfaction at 81.73%. The injury rates for primary causes in each age group road traffic accidents for children and adolescents, mechanical force injuries and work-related musculoskeletal disorders for working-age adults, and falls for the elderly decreased compared to the 5-year median (2019-2023) for the same period (February-April). Similarly, the overall injury rate for all causes in children, adolescents, and working-age adults decreased compared to the 5-year median for the same period. However, the injury rate for the elderly increased by two cases. Therefore, proactive surveillance should be emphasized to provide early warnings and should be continuously promoted to establish a sustainable safety culture through the participation of all network sectors.

## 6. Recommendations

*6.1 Utilization of Research Findings:*

1. The injury surveillance system should analyze the situation in alignment with the specific problems of each area and integrate measures to prevent injuries across all age groups. Emphasis should be placed on


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proactive surveillance to provide early warnings and reduce premature deaths.

2. Opportunities should be provided for networks, especially the public sector, to participate. Local administrative organizations should act as the main drivers and coordinators of operations with all sectors, particularly in areas where responsibilities have been transferred to local authorities.
3. Agencies and networks responsible for injury-related tasks, both within and outside the areas where responsibilities have been transferred, should adopt injury prevention surveillance models to effectively prevent and address problems.

*6.2 Future Studies*

1. The expansion of the injury prevention surveillance model has led to increased awareness across all age groups, but it has been implemented only among the sample group. Therefore, the model should be expanded to cover all at-risk populations in other areas.
2. In research aimed at extending the use of the model, the sample group for expansion should include a control group to compare the effects of the model. Additionally, qualitative data on the behavior of at-risk groups should be studied to enhance long-term safety measures.

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**References**

[1] Wyainetra, N., (2024). *Handbook on Road Traffic Injury Investigation.* [Online]. Available: https://odpc7.ddc.moph.go.th/accident/60/media/handbook_RTI02.pdf. [Accessed Jan. 28, 2024].

[2] World Health Organization, (2024). Preventing Injuries and Violence: An Overview. [Online]. Available: https://www.who.int/publications/i/item/9789240047136. [Accessed Jan. 28, 2024].

[3] World Health Organization, (2023). *Global Status Report on Road Safety 2018.* [Online]. Available: https://apps.who.int/iris/bitstream/handle/10665/277370/WHO-NMH-NVI-18.20-eng.pdf?ua=1. [Accessed: Dec. 24, 2023].

[4] Emergency Medicine Institute, (2023). *Health and Emergency Medicine Trends (Global and Thailand).* [Online]. Available: https://www.niems.go.th/1/UploadAttachFile/2022/EBook/414529_20220111124457.pdf. [Accessed: Dec. 24, 2023].

[5] Digital Disease Surveillance, (2024). *National Disease Surveillance Report 506*. [Online]. Available: http://doe.moph.go.th/surdata/disease.php?dcontent=old&ds=31. [Accessed: Jan. 28, 2024]

[6] Injury Prevention Division, Department of Disease Control, Ministry of Public Health. (2024). IS Online Database. [Online]. Available: https://dip.ddc.moph.go.th/new/photo/upload/2020/1602682733_2857.pdf. [Accessed: May 10, 2024].

[7] Lao Suea Kok Hospital, (2023). *Injury Report Summary from HIS Databas*e. Lao Suea Kok Hospital.

[8] Likert, R., (1967). *The Method of Constructing an Attitude Scale*. New York: Wiley & Son.

[9] Nutbeam, D., (2008). The Evolving Concept of Health Literacy. *Social Science and Medicin*e. Vol. 67(12), 2072-2078. https://pubmed.ncbi.nlm.nih.gov/18952344/.

[10] WHO/UNICEF, (1978). *Report of the International Conference on Primary Health Care Alma-Ata, USSR*. [Online]. Available: https://iris.who.int/bitstream/handle/10665/39228/9241800011.pdf?sequence=1. [Accessed: May 10, 2024].

[11] Department of Health Education, Ministry of Public Health. (2016). Enhancing and Evaluating Health Literacy and Health Behavior for School Children and Working Age Groups. [Online]. Available: https://rbpho.moph.go.th/upload-file/doc/files/07122018-043912-3516.pdf. [Accessed: May 10, 2024]

[12] Sookpool, A., Kingmala, C., Pangsuk, P., Yeanyoun, T. and Wongmun, W., (2020). Effectiveness of Health Literacy and Health Behavior Development Program for Working People. Journal of Health Science. Vol. 29; 419-429. https://thaidj.org/index.php/JHS/article/download/9207/8357/13136

[13] Anowannaphan, M., (2020). The Development of Health Literacy Promoting Model of the Elderly in Uthai Thani Province. *Department of Health Service Support Journal*. Vol. 17(1), 15-22. https://thaidj.org/index.php/jdhss/article/download/9922/8806/14976.

[1]4 Becker, M. H., Maiman, L. A., Kirscht, J. P., Haefner, D. P. and Drachman, R. H., (1977). The Health Belief Model and Prediction of Dietary Compliance: A Field Experiment. *Journal of Health and Social Behavior*, Vol. 18(4), 348-366. https://doi.org/10.2307/2955344.

[15] Taggart, J., Williams, A., Dennis, S., Newall, A., Shortus, T. and Zwar, N., (2012). A Systematic Review of Interventions in Primary Care to Improve Health Literacy for Chronic Disease Behavioral Risk Factors. *BMC Family Practice*. Vol. 13(1); 49. https://doi.org/10.1186/1471-2296-13-49.

[16] Creighton, J. L., (2008). *The Public Participation Handbook: Making Better Decisions Through Citizen Involvement*. Translated by Wanchai Wattanasevi, Thawinwadi Burikul, and Methisa Pongsaksri. Khon Kaen: Siriphant Offset Printing.

[17] Burikul, T., Phonok, N., Udompong, L. and Wangkesem, S., (2019). Mobilizing Sustainable Development Goals (SDGs): A Case Study of Applying Participatory Democracy to Promote Road Safety in Thai Youth. Research and Development Office King Prajadhipok's Institute. [Online]. Available: https://kpi-lib.com/library/books/kpibook-25551/. [Accessed: May 10, 2024].

[18] Injury Prevention Division, Department of Disease Control, Ministry of Public Health. (2021). Learning Management Manual for Road Safety Skills for Youth Aged 13-19 Years. [Online]. Available: https://ddc.moph.go.th/dip/journal_detail.php?publish=12043&deptcode=dip. [Accessed: May 10, 2024].

[19] Nutbeam, D., McGill, B., and Premkumar, P. (2018). Improving Health Literacy in Community Populations: A Review of Progress. Health Promotion International. Vol. 33; 901-911. https://doi.org/10.1093/heapro/dax015.