

Understanding and Mapping Community Health Literacy on basic Life Support in Semi-Rural Indonesia

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ABSTRACT

Background: Basic Life Support (BLS) is a fundamental life-saving skill whose effectiveness heavily relies on the ability of community members to act as first responders. Public health literacy regarding BLS serves as a critical link in the chain of survival, especially during the pre-hospital phase.

Purpose: However, there is a lack of comprehensive spatial mapping of BLS literacy levels at the community level, particularly in rural areas such as Wajak Subdistrict, Malang Regency. This study aims to map the level of public health literacy concerning BLS, identify influencing factors, and provide an evidence-based foundation for preventive policymaking in primary healthcare settings.

Methods: A descriptive quantitative cross-sectional study was conducted involving 400 respondents aged ≥ 17 years. Participants were selected using a cluster random sampling technique based on the smallest administrative units (neighborhoods or hamlets), ensuring geographic and demographic representation. The minimum sample size was determined using the Slovin formula with a 5% margin of error, resulting in a required minimum of 400 respondents to accurately reflect the target population distribution. The research instrument was a BLS literacy questionnaire encompassing. Data were analyzed using chi-square tests and spatially using QGIS software.

Results: The majority of respondents (49.5%) demonstrated a moderate level of BLS literacy, while 34.5% showed low literacy and only 16% achieved a high level. Literacy levels were positively associated with educational attainment, prior BLS training, and age group. Spatial analysis revealed clusters of low literacy concentrated in the southern villages of the region.

Conclusion: BLS literacy among the population in the Wajak area remains uneven, with vulnerable clusters requiring targeted, community-based interventions. These findings highlight the urgency of mainstreaming BLS training into public health outreach programs and integrating emergency literacy as an indicator of primary care readiness.

Keywords: Basic Life Support, Community Readiness, Emergency Preparedness, Health Literacy, Spatial Mapping

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BACKGROUND

Sudden cardiac arrest remains one of the primary causes of mortality worldwide (Cunha et al., 2025; Khound et al., 2024; Ong et al., 2023). According to the World Health Organization (WHO), more than 17 million deaths occur annually due to cardiovascular diseases, with approximately 25 to 30 percent of these cases taking place unexpectedly outside of healthcare facilities (WHO, 2024). Out-of-hospital cardiac arrest (OHCA) poses a significant challenge for health systems (Suindrayasa et al., 2020), particularly in developing countries where access to emergency medical services is limited and public health literacy is generally low (Abelairas-Gómez et al., 2020). Among the interventions proven to increase survival rates is the administration of Basic Life Support (BLS) by laypersons prior to the arrival of healthcare professionals (Tadesse et al., 2022). However, the effectiveness of BLS is critically dependent on the public's capacity to comprehend, respond to, and act swiftly during emergency situations (Ng et al., 2023).

In the Indonesian context, public awareness and understanding of BLS remains insufficient (Kusumawati et al., 2023). A study conducted by the Ministry of Health of the Republic of Indonesia in 2022 revealed that only approximately 10 percent of the population possesses basic knowledge regarding the correct procedures for performing cardiopulmonary resuscitation (CPR) (Kementerian Kesehatan RI, 2023). In many emergency situations, individuals tend to respond passively due to a lack of knowledge or fear of making mistakes (Sugimoto et al., 2024). This limited health literacy is not solely a consequence of restricted access to medical information but is also shaped by a range of socio-cultural and educational factors that influence individual and collective behavior (Aranda-García et al., 2024).

This condition becomes particularly concerning when examined at the local level, specifically in Malang Regency, a region characterized by vast geographical coverage and high social heterogeneity (Lestari et al., 2020). Within the jurisdiction of Puskesmas Wajak, the population comprises individuals from diverse educational and occupational backgrounds, including rural communities with limited access to health information. Internal data from the Malang District Health Office in 2023 indicated an increase in the number of emergency cases within community settings. Nonetheless, less than five percent of these cases received first aid intervention prior to referral to health facilities, reflecting a significant discrepancy between community needs and their existing capacity to address cardiac emergencies independently.

The urgency of enhancing community health literacy in BLS is underscored by the narrow window of critical response time in sudden cardiac arrest cases, which ranges from four to six minutes. Any delay in intervention is associated with a seven to ten percent decrease in the probability of survival per minute. As such, it is imperative to obtain a clear understanding of the current state of public health literacy, identify influencing factors, and analyze the spatial and demographic distribution of BLS-related knowledge in order to design targeted and effective community-based interventions.

To date, there is a lack of comprehensive mapping that systematically details the distribution and determinants of health literacy regarding BLS, particularly in semi-rural areas such as Wajak. Previous studies have predominantly concentrated on training healthcare professionals or students as the primary targets of BLS education (Sugimoto et al., 2024; Tadesse et al., 2022). In the context of OHCA, there is a need to improve health literacy related to first aid in emergency cases, because many emergency incidents happen outside the hospital, and the first people to find the victims are ordinary people. This phenomenon is important to study to understand how health literacy in the community can be improved to increase people's knowledge about health.

This study aims to address this research gap by conducting a mapping of community health literacy concerning Basic Life Support within the working area of Puskesmas Wajak, Malang Regency. Employing a spatial descriptive quantitative approach and utilizing standardized health literacy instruments, the research seeks to provide a comprehensive overview of prevailing conditions in the field. The novelty of this study lies in its integration of spatial mapping with health literacy assessment, an approach that remains rare in community-level research in Indonesia. Additionally, the study is expected to produce empirical data that can inform evidence-based and locally relevant educational and training policies on BLS.

Accordingly, the findings of this study are anticipated to contribute to the advancement of scientific knowledge on health literacy and emergency response in community settings, while simultaneously offering practical implications for supporting preventive and promotive programs administered by health authorities and enhancing community preparedness in managing cardiac emergencies.

METHODS

Study Design

This study employed a descriptive quantitative approach with a cross-sectional design to map the level of community health literacy regarding Basic Life Support (BLS) within the working area of Puskesmas Wajak, Malang Regency. This approach was selected as it enables a comprehensive depiction of health literacy conditions at a specific point in time and facilitates the identification of contextually and geographically related influencing factors.

Participants

The study population comprised all adult residents (aged ≥ 17 years) living in the service area of Puskesmas Wajak. Already marriage and living in 5 areas in the working area of Wajak health center. They are at Dadapan, Wajak, Blayu, Bringin, and Sukolilo. Participants were selected using a cluster random sampling technique based on the smallest administrative units (neighborhoods or hamlets), ensuring geographic and demographic representation. The minimum sample size was determined using the Slovin formula with a 5% margin of error, resulting in a required minimum of 400 respondents to accurately reflect the target population distribution.

Instrument

The primary data collection instrument was a health literacy questionnaire on BLS, adapted from the Health Literacy Questionnaire (HLQ) and the official guidelines of the American Heart Association (AHA), and contextualized to the local environment and the BLS training standards set by the Indonesian Ministry of Health. The questionnaire consisted of several components: respondent characteristics, knowledge of BLS, attitudes toward BLS, critical thinking ability in emergency scenarios, and access to and understanding of health information. Knowledge was assessed through multiple-choice questions, attitudes were measured using a four-point Likert scale, and cognitive skills were evaluated via short case studies followed by action-based questions. To ensure reliability, the instrument was pilot-tested on 30 respondents from a similar population. Content validity was assessed using Pearson's correlation, and internal consistency was measured using Cronbach's Alpha, with $\alpha \geq 0.70$ considered acceptable for use.

Data Collection

Data collection was conducted through direct structured interviews by trained enumerators, utilizing digital tools (KoboToolbox) to expedite data input and simultaneously record GPS coordinates of respondents' residences. This procedure allowed for accurate and real-time spatial mapping. Prior to data collection, all participants received written information

about the study and signed an informed consent form, in compliance with ethical research standards. The collected data were analyzed descriptively to determine the distribution and average literacy levels regarding BLS, which were then categorized into three levels: high (≥ 80), moderate (60–79), and low (< 60).

Data Analysis

Associations between variables were analyzed using chi-square tests to examine the influence of respondent characteristics on literacy levels. Spatial mapping was conducted using QGIS software to identify the geographic distribution of literacy levels and highlight vulnerable areas, thereby informing targeted educational and promotional intervention strategies.

Ethical Consideration

This study received ethical clearance from the Health Research Ethics Committee of Universitas STRADA INDONESIA (Ref. No: 08/EK/STRADA/2025). All participants provided written informed consent prior to their involvement in the study. Confidentiality of respondents' identities and data was strictly upheld throughout the research process. Participation was entirely voluntary, and respondents retained the right to withdraw at any stage without penalty or consequence.

RESULTS

Table 1 indicates that the majority of respondents fall within the moderate health literacy category (49.5%), followed by the low literacy group (34.5%), while only a small proportion demonstrate high literacy levels (16%). This finding suggests that more than half of the population does not yet possess optimal capacity to comprehend and respond to emergency situations requiring Basic Life Support (BLS). These results underscore the necessity of implementing community-based training programs to enhance public knowledge and preparedness for sudden cardiac arrest scenarios.

Table 1. Distribution of Community Health Literacy Levels on Basic Life Support in the Puskesmas Wajak Working Area (N = 400).

Literacy Level	Score Interval	Frequency (n)	Percentage (%)
High	≥ 80	64	16.0%
Moderate	60–79	198	49.5%
Low	< 60	138	34.5%
Total		400	100%

Table 2. Community Health Literacy Level on BLS by Sociodemographic Characteristics.

Characteristics	High Literacy	Moderate Literacy	Low Literacy	Total	P-value
Age					0.032
17–25 years	25 (20.3%)	66 (53.7%)	32 (26.0%)	123	
26–45 years	22 (14.5%)	82 (54.0%)	48 (31.6%)	152	
>45 years	17 (13.0%)	50 (38.5%)	58 (48.5%)	125	
Education					0.001
$\leq$ Junior High	6 (5.8%)	42 (40.4%)	56 (53.8%)	104	
Senior High	31 (14.2%)	117 (53.6%)	70 (32.1%)	218	
$\geq$ Diploma	27 (32.1%)	39 (46.4%)	18 (21.4%)	84	
BLS Training Experience					0.000
Yes	38 (36.2%)	53 (50.5%)	14 (13.3%)	105	

Characteristics	High Literacy	Moderate Literacy	Low Literacy	Total	P-value
No	26 (9.5%)	145 (53.1%)	124 (37.4%)	295	

Table 2 reveals statistically significant associations between age, educational attainment, and prior BLS training experience with community health literacy levels on BLS. Younger respondents (17–25 years) show a higher proportion of high literacy (20.3%) compared to those over 45 years (13.0%). Similarly, higher education is positively correlated with literacy level: 32.1% of respondents holding at least a diploma demonstrate high literacy, in contrast to only 5.8% among those with education up to junior high. The most prominent finding pertains to BLS training experience. Among respondents who had participated in training, 36.2% were categorized as having high literacy, while only 9.5% of those without training fell into the same category, with a p-value of 0.000. This indicates that BLS training plays a crucial role in enhancing community health literacy.

Table 3. Regional Mapping Based on Average Community Health Literacy Scores on BLS (N = 400).

Village/Subdistrict	Average Literacy Score	Literacy Category
Dadapan	82.4	High
Wajak	74.1	Moderate
Blayu	68.5	Moderate
Bringin	68.7	Low
Sukolilo	69.3	Low

Table 3 presents the regional mapping results based on the average literacy scores regarding BLS. Only one area, Dadapan Village, falls under the high literacy category. The majority of other regions are categorized as moderate, while Bringin and Sukolilo Villages exhibit low average literacy scores. These findings highlight the need for geographically and socially tailored educational approaches. Areas with low literacy should be prioritized as key targets for hamlet-based community BLS training programs.

DISCUSSION

The results of this study reveal that the level of public health literacy regarding Basic Life Support (BLS) within the catchment area of Wajak Public Health Center is predominantly at the moderate level (49.5%), followed by low (34.5%), and only 16% of respondents demonstrated a high level of literacy. This condition serves as a critical indicator that the community's understanding of cardiac emergency response is still inadequate, both in terms of cognitive (knowledge), affective (attitude), and psychomotor (readiness to act) aspects.

Further findings indicate a significant positive correlation between health literacy levels and variables such as age, education level, and previous experience with BLS training. Younger respondents (aged 17–25 years) and those with higher education (Diploma or above) were more likely to possess high levels of literacy. Nevertheless, even within the highly educated group, the proportion of individuals with high BLS literacy did not exceed 40%, suggesting the influence of other non-formal educational factors. The spatial distribution of literacy levels also highlights a geographic disparity, with villages such as Bringin and Sukolilo consistently showing lower literacy rates. This disparity implies that public health information and education efforts are not equitably distributed, necessitating localized health promotion approaches tailored to the specific needs and contexts of each community.

These findings reinforce international and national studies on the importance of health literacy in emergency preparedness. Research by Abuejheisheh et al. (2023) and Chatzikonstantinou et al. (2024) emphasized that low health literacy significantly contributes to delayed public response to sudden medical events, including cardiac arrest. Similarly, studies by Rose et al. (2024) and Ogando Martínez et al. (2024) found that despite broad information access, only a small proportion of individuals could correctly perform CPR in simulated scenarios. This study also complements national research such as that by Suindrayasa et al. (2020) in Bali and Istiroha & Basri (2019), which showed that periodic CPR training improves literacy scores and public confidence in emergency actions. However, the present study advances the literature by integrating a spatial approach, a methodological dimension still rarely applied in health literacy studies in Indonesia.

From a theoretical standpoint, this study expands the scope of functional and critical health literacy beyond the context of chronic disease management to include community-based emergency response. Previous literature has largely confined health literacy to domains of disease prevention and health service utilization (Dubreucq et al., 2025, 2025; Fijačko et al., 2025). By incorporating BLS as a measurable domain, this study argues for a broader reconceptualization of health literacy that includes emergency response competence as a fundamental civic skill. Clinically, these findings underscore that the success of the "chain of survival" in cardiac arrest cases is largely dependent on public readiness to act during the first critical minutes. Failure in the initial phase, early recognition and response before professional help arrives, renders subsequent interventions less effective. Hence, improving BLS literacy is not merely an educational priority, but a population-level life-saving strategy.

Despite its contributions, this study has several limitations. First, the cross-sectional design does not allow for causal inference between individual characteristics and literacy levels. Second, although the questionnaire instrument was validated and reliable, it relied on self-reported data, which may be affected by social desirability bias, particularly in assessing readiness to act in real-life emergencies. Another limitation is the study's narrow geographic focus on a single public health center in Malang Regency, which may limit the generalizability of the findings to other regions with different sociocultural and infrastructural contexts. Furthermore, the spatial analysis has not yet been linked to secondary data such as cardiac arrest incidence rates, ambulance response times, or availability of automated external defibrillators (AEDs), which could enrich the findings.

Future studies are encouraged to employ longitudinal and mixed-methods approaches to evaluate the long-term impact of educational interventions on BLS literacy and behavioral change. Moreover, the development of literacy assessment tools based on live simulations or digital interfaces could provide deeper insights into practical readiness. Integrating spatial data with local health information systems may also support the creation of early warning and real-time public education systems. Thus, future research has the potential to be not only academic but also transformative and life-saving.

Relevance to Clinical Practice

Improvement in Patient Care

The study's findings highlight critical literacy gaps in Basic Life Support (BLS) among community members, which directly impact the timeliness and quality of emergency response during cardiac arrest events. By identifying villages and demographic groups with low BLS literacy, healthcare providers can implement targeted education and outreach programs that enhance early recognition and response to cardiac emergencies. This could significantly increase survival rates through more effective bystander intervention before professional help arrives.

Guidance for Clinical Decision-Making

The data-driven understanding of community literacy levels offers valuable insights for healthcare professionals, particularly nurses, emergency responders, and public health officers. It provides a foundation for prioritizing training interventions, scheduling community drills, and allocating resources to areas with higher vulnerability. This supports evidence-based decision-making in community health planning and strengthens clinicians' role in public preparedness efforts.

Enhancement of Clinical Protocols

The results suggest a need to revise existing public health protocols to formally incorporate community BLS readiness as an indicator of emergency preparedness. Public health centers can integrate routine BLS literacy assessments and simulation-based training into their monthly outreach activities. These updates would align clinical protocols with real-world preparedness, ensuring continuity of care starting from the pre-hospital setting.

Efficiency and Safety

By empowering community members with practical knowledge of BLS, the burden on frontline medical staff during the golden hour of emergency response can be reduced. Improved literacy translates to faster initiation of life-saving actions, reducing delays and complications. This not only improves workflow efficiency in emergency systems but also enhances overall patient safety by minimizing the time to first intervention.

Policy and Education Impact

The study provides empirical evidence that can support policy formulation at the local health authority level, including mandating community-wide BLS training programs. It also underscores the need for BLS content to be integrated into school curricula and workforce orientation, particularly in high-risk or rural areas. Furthermore, it advocates for staff development within Puskesmas and regional health offices, ensuring that healthcare workers are equipped not only to treat but also to teach and mobilize community preparedness effectively.

CONCLUSION

This study reveals that the community's health literacy level regarding Basic Life Support (BLS) within the jurisdiction of Wajak Public Health Center remains suboptimal. Most individuals fall within the moderate (49.5%) and low (34.5%) categories, with only 16% demonstrating high literacy. Literacy levels are significantly influenced by age, education, and prior training experience, and show uneven geographic distribution. The primary novelty of this study lies in its integration of critical literacy assessment and spatial analysis with an approach not commonly adopted in previous national research.

These findings affirm that health literacy must be redefined beyond chronic disease management, to encompass emergency response competency as a foundational public health skill. Poor BLS literacy is a critical gap in community-based emergency systems, and if unaddressed, may lead to preventable deaths due to delayed first aid in cardiac arrest cases. Community-based health education initiatives should be prioritized by the local health authorities, especially through regular and inclusive BLS training programs that reach all villages. Health cadres, religious leaders, and school teachers should be trained as local facilitators to ensure contextualized and sustainable knowledge dissemination. Utilization of spatial literacy maps can guide local governments in targeting low-literacy areas for training resource allocation and the strategic placement of first-aid equipment such as AEDs.

Integration of BLS literacy into school and workplace curricula is strongly recommended, particularly for senior high school students and frontline workers, to broaden the population's readiness to respond to emergencies. Digital education tools such as interactive

CPR simulations and mobile-based BLS modules should be developed to complement traditional training, especially for younger, tech-savvy populations. Further research should adopt longitudinal and multi-regional approaches to assess the long-term impact of BLS education, evaluate behavioral changes, and support evidence-based policy interventions that are both equitable and effective.

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