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Computer Literacy for Barangay Health Workers: Supporting the Philippines' Digital Health Transformation

Nolan M. Yumen, MIS [1]
1 – University of Antique Tario-Lim Memorial Campus

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Abstract

This study investigates computer literacy among Barangay Health Workers (BHWs) in Tibiao, Antique, Philippines, within the context of the country's digital health transformation. Using a sequential explanatory mixed-methods design, 118 BHWs were selected through Slovin's formula (95% confidence level) from 21 barangays. Data collection involved surveys, skills assessments, interviews, and focus group discussions. Results reveal only 32.2% of BHWs meet basic computer literacy standards, with significant disparities between Poblacion (52.1%) and upland barangays (24.3%). BHWs with higher computer literacy demonstrated measurably improved performance: 46% greater reporting efficiency, 59% improved data accuracy, and 41% better digital health program engagement. Key barriers include limited technology access (71.2%), insufficient training (82.5%), and unreliable infrastructure (74.6% reporting connectivity issues). The study identified innovative local solutions including mobile technology initiatives and peer-learning networks. Based on these findings, the research recommends context-specific interventions: rural-appropriate digital competency frameworks, mobile-first applications, local language training materials, and geographically accessible learning opportunities. This research contributes to understanding digital health implementation in rural settings, providing evidence-based strategies to strengthen the Philippines' healthcare system by ensuring frontline rural health workers can effectively participate in digital transformation.

Keywords: *Barangay Health Workers, computer literacy, digital health, primary healthcare, Philippines, Tibiao, Antique, healthcare digitalization*

INTRODUCTION

Barangay Health Workers (BHWs) constitute the frontline of the Philippine healthcare system, serving as the primary link between communities and formal health services, particularly in geographically isolated and disadvantaged areas like the Municipality of Tibiao in Antique Province (Labarda, 2020). Recognized under Republic Act 7883, the Barangay Health Workers' Benefits and Incentives Act of 1995, BHWs provide essential services including health education, basic health monitoring, maternal and child

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health support, immunization assistance, and community health surveillance (Official Gazette, 1995). With over 200,000 BHWs nationwide, these community health volunteers form the backbone of the country's primary healthcare system (Department of Health, 2022a).

The Philippines has embarked on an ambitious digital transformation of its healthcare system. The Department of Health's (DOH) eHealth Strategic Framework and Plan 2020-2025 outlines a comprehensive approach to digitalize health information systems, enhance telemedicine capabilities, and implement electronic medical records nationwide (Department of Health, 2020a). This transformation has been accelerated by the COVID-19 pandemic, which highlighted the urgent need for robust digital health infrastructure and competencies (Amit et al., 2021).

The Municipality of Tibiao, located in the northern part of Antique Province in Western Visayas, consists of 21 barangays with varying levels of development and accessibility. The municipality faces unique healthcare challenges due to its geographical features, with several upland barangays that are difficult to access, especially during inclement weather. According to the Municipal Health Office of Tibiao (2023), there are approximately 165 active BHWs serving a population of approximately 28,600 residents. These BHWs are vital in delivering primary healthcare services, particularly to remote communities where access to healthcare facilities is limited.

The importance of computer literacy among BHWs is anchored in several key legal and policy frameworks: Republic Act 11223, the Universal Health Care Act of 2019, specifically mandates the "adoption of health technology assessment" and "development of electronic health systems" as fundamental components of the national health strategy (Official Gazette, 2019). Section 36 of the implementing rules and regulations specifically calls for the "development of competencies of the health workforce in line with new and emerging technologies" (Department of Health, 2020b).

Department of Health Administrative Order No. 2020-0034, "Guidelines on Electronic Health Records Adoption in Health Facilities," establishes standards for implementing electronic health records systems in all health facilities, including barangay health stations where BHWs typically operate (Department of Health, 2020c).

At the local level, the Municipality of Tibiao has implemented Municipal Ordinance No. 2022-04, "An Ordinance Strengthening the Barangay Health Worker Program in the Municipality of Tibiao," which includes provisions for capacity building and skills development of BHWs, including digital skills (Municipal Government of Tibiao, 2022).

Despite the clear legal and policy directives promoting digitalization in healthcare and the implicit need for computer literacy among healthcare workers, there exists a significant gap in research specifically addressing BHW computer literacy in rural municipalities like Tibiao, Antique. While studies have examined healthcare digitalization broadly (Dayrit et al., 2022; Santos et al., 2023), and others have focused on BHW training needs generally (Labarda, 2020; Valderama-Wallace & Apeles, 2020), the intersection of these areas—computer literacy among BHWs within the context of healthcare digitalization in rural settings—remains inadequately explored.

This research gap is particularly concerning given the rapid implementation of digital health initiatives at the barangay level, including the Community Health Information Tracking System (CHITS), the Barangay Health Management Information System (BHMIS), and the Electronic Immunization Registry (EIR), all of which require basic computer competencies to operate effectively (Department of Health, 2021b). In Tibiao, the Municipal Health Office has begun implementing the Integrated Provincial Health Office Information System (IPHOIS), which requires BHWs to input and manage digital health records (Provincial Health Office of Antique, 2023).

Research Objectives

This study aims to address this gap by examining the importance of computer literacy among BHWs in the Municipality of Tibiao, Antique, within the context of the Philippines' digital health transformation. Specifically, the research seeks to:

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1. Assess the current levels of computer literacy among BHWs across different geographical and demographic contexts within Tibiao municipality
2. Analyze the relationship between BHW computer literacy and performance in key healthcare delivery metrics
3. Identify barriers and enablers to computer literacy development among BHWs in Tibiao
4. Examine the alignment between current legal and policy frameworks and the practical realities of BHW computer literacy needs in rural settings
5. Develop evidence-based recommendations for enhancing computer literacy among BHWs to support the municipality's and the country's digital health transformation

This paper first presents the mixed-methods research design, detailing participant selection, data collection instruments, and analysis procedures used to investigate BHW computer literacy in Tibiao. Quantitative findings on current literacy levels and their relationship to performance metrics are then presented, followed by qualitative insights into barriers, enablers, and BHW perspectives. The analysis examines patterns and relationships between digital literacy and healthcare performance, with particular attention to rural contextual factors. Finally, implications for policy and practice are discussed, offering specific recommendations for addressing the digital literacy gap among rural BHWs to strengthen primary healthcare delivery.

METHODS

Research Design

The study employed a sequential explanatory mixed-methods design, combining quantitative and qualitative approaches to provide a comprehensive understanding of BHW computer literacy in Tibiao, Antique (Creswell & Creswell, 2023). The research was conducted in two phases: (1) a quantitative phase involving surveys and skills assessments, and (2) a qualitative phase consisting of in-depth interviews and focus group discussions to explain and elaborate on the quantitative findings.

This design was selected to capitalize on the complementary strengths of both quantitative and qualitative methods. The quantitative component enabled measurement of computer literacy levels and their statistical relationship with performance metrics, while the qualitative component facilitated deeper exploration of the contextual factors, barriers, and enablers affecting BHW computer literacy in the rural context of Tibiao (Schoonenboom & Johnson, 2022).

Research Setting and Participants

The study was conducted in the Municipality of Tibiao, Antique Province, located in the Western Visayas region of the Philippines. Tibiao consists of 21 barangays categorized into Poblacion (town center) and upland barangays. This municipality was purposively selected due to its representation of the rural healthcare context in the Philippines, with varied geographical accessibility challenges that typify the situations where BHWs are most critical to healthcare delivery.

For participant selection, the total population of active BHWs in Tibiao (N = 165) was considered. The sample size was determined using Slovin's formula:

$$n = N / (1 + Ne^2)$$

Where: n = sample size
N = total population
e = margin of error (0.05 for 95% confidence level)

$$n = 165 / (1 + 165 \times 0.05^2)$$
$$n = 165 / (1 + 165 \times 0.0025)$$
$$n = 165 / (1 + 0.4125)$$
$$n = 165 / 1.4125$$
$$n = 116.81 \approx 118$$

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Based on this calculation, 118 BHWs were selected for the study. To ensure proportional representation across all 21 barangays, stratified random sampling was employed, with the number of participants from each barangay proportional to the total number of BHWs in that barangay. To be eligible, participants had to be officially registered BHWs with at least one year of service in Tibiao.

Table 1 presents the demographic characteristics of the participants:

Table 1. Demographic Profile of BHW Participants in Tibiao, Antique (N=118)

Characteristic	n (%)
Age Group	
20-30 years	14 (11.9%)
31-40 years	25 (21.2%)
41-50 years	42 (35.6%)
51-60 years	31 (26.3%)
Above 60 years	6 (5.1%)
Gender	
Female	102 (86.4%)
Male	16 (13.6%)
Educational Attainment	
Elementary graduate	12 (10.2%)
High school graduate	63 (53.4%)
College level	31 (26.3%)
College graduate	12 (10.2%)
Years of Service as BHW	
1-5 years	31 (26.3%)
6-10 years	39 (33.1%)
11-15 years	28 (23.7%)
Above 15 years	20 (16.9%)
Geographic Location	
Poblacion barangays	48 (40.7%)
Upland barangays	70 (59.3%)

Data Collection Methods

Quantitative Phase

For the quantitative phase, three main instruments were developed and utilized:

Computer Literacy Assessment Tool (CLAT): This validated instrument was adapted from the Healthcare Information and Management Systems Society (HIMSS) Digital Health Competency Framework (2021) and contextualized for the Philippine rural setting. The CLAT assessed five domains of computer literacy on a scale of 1-5: basic computer operations, internet usage, communication applications, health information systems usage, and data privacy awareness. The tool was translated into Kinaray-a, the predominant language in Tibiao, and back-translated to ensure accuracy. The final instrument demonstrated good internal consistency with a Cronbach's alpha of 0.89.

BHW Performance Metrics Questionnaire (BPMQ): This instrument was developed based on the DOH BHW Program Implementation Guidelines (Department of Health, 2020d) and the Tibiao Municipal Health Office performance evaluation criteria. It measured performance across key BHW responsibilities:

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reporting timeliness, data accuracy, client engagement, health program implementation, and continuing education participation. Performance data were triangulated with official records from barangay health stations and the Municipal Health Office where available.

Technology Access and Usage Survey (TAUS): This survey collected data on BHWs' access to technological devices, internet connectivity, frequency of technology use, and perceived barriers and enablers to technology adoption, with specific questions addressing the unique challenges of the rural Tibiao context.

Quantitative data collection was conducted from January to March 2024. The instruments were administered in person at barangay health stations or at the Tibiao Rural Health Unit, with assistance from trained research assistants fluent in Kinaray-a, ensuring participant comfort and privacy.

Qualitative Phase

For the qualitative phase, three data collection methods were employed:

In-depth Interviews: Semi-structured interviews were conducted with 24 purposively selected BHWs (12 from poblacion barangays and 12 from upland barangays) representing varying levels of computer literacy based on the CLAT results. The interviews explored personal experiences with technology, perceived impacts on work performance, challenges, and support needs specific to the Tibiao context.

Focus Group Discussions (FGDs): Four FGDs were facilitated (two in poblacion barangays and two in upland barangays) with 8-10 participants each. The FGDs examined collective experiences and perceptions regarding computer literacy requirements, institutional support, and community expectations.

Key Informant Interviews (KIIs): Interviews were conducted with 10 key stakeholders, including the Municipal Health Officer of Tibiao, barangay captains, Antique Provincial Health Office representatives, local government officials, and BHW program coordinators, to gain insights into policy implementation, resource allocation, and strategic priorities related to BHW computer literacy in the municipality.

Qualitative data collection was conducted from April to June 2024. All interviews and FGDs were audio-recorded with participant consent and transcribed verbatim. Sessions were conducted in Kinaray-a or Filipino, according to participant preference, and later translated to English for analysis.

Data Analysis

Quantitative Analysis

Quantitative data were analyzed using SPSS version 28.0. Descriptive statistics (frequencies, percentages, means, and standard deviations) were calculated to characterize computer literacy levels and performance metrics. For inferential statistics, the following were employed:

- Independent samples t-tests and one-way ANOVA to compare computer literacy levels across demographic variables
- Pearson's correlation coefficient to examine relationships between computer literacy scores and performance metrics
- Multiple regression analysis to identify predictors of computer literacy among BHWs in Tibiao
- Chi-square tests to analyze associations between categorical variables

Post-hoc analyses using Tukey's HSD were conducted for significant ANOVA results to identify specific group differences. Effect sizes were calculated using Cohen's d for t-tests and partial eta squared (η^2) for ANOVA to determine the practical significance of statistical findings.

Qualitative Analysis

Qualitative data were analyzed using thematic analysis following Braun and Clarke's (2021) six-phase approach. NVivo 14 software facilitated the coding and analysis process. The analysis involved:

1. Familiarization with the data through repeated reading of transcripts
2. Generation of initial codes using both inductive and deductive approaches
3. Searching for themes by grouping related codes

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4. Reviewing themes for coherence and distinctiveness
5. Defining and naming themes
6. Producing the final analysis with illustrative quotes

To enhance trustworthiness, several strategies were employed:

- Member checking with a subset of participants to verify interpretations
- Analyst triangulation with two independent researchers coding a portion of the data to verify coding consistency
- Thick descriptions to enable transferability judgments
- Reflexive journaling throughout the research process to acknowledge researcher positionality

Integration of Quantitative and Qualitative Findings

Following the sequential explanatory design, integration occurred primarily at the interpretation phase. Qualitative findings were used to explain and elaborate on quantitative results, with joint displays created to visualize the integration of both data types. A meta-inference process was employed to develop integrated conclusions that addressed the research objectives. Discrepancies between quantitative and qualitative findings were explicitly addressed and explored as areas for further research.

Ethical Considerations

Ethical approval for the study was obtained from the Research Ethics Board of the University of the Philippines Manila (REBUP? REB 2023-0421-EX). Additional approvals were secured from the Antique Provincial Health Office, the Municipal Government of Tibiao, and the Municipal Health Office of Tibiao. Informed consent was obtained from all participants, with particular attention to ensuring comprehension of the research objectives and procedures.

The informed consent process and all research materials were provided in both English and Kinaray-a to ensure full comprehension. Participants were explicitly informed that their participation or non-participation would not affect their status or benefits as BHWs.

Data confidentiality was maintained through coded identifiers, secure storage of digital files using encryption, and restricted access to raw data. Participants were informed of their right to withdraw at any time without penalty. As a gesture of appreciation and to minimize participation burden, participants received a modest honorarium and a certificate of participation that could be added to their professional portfolios.

The research adhered to the principles of community-based participatory research by engaging local stakeholders in the research design and implementation, ensuring that the study addressed community-identified needs and priorities.

RESULTS

Current Levels of Computer Literacy Among BHWs in Tibiao

Overall Computer Literacy Scores

Based on the Computer Literacy Assessment Tool (CLAT), which measured proficiency on a scale of 1-5 across five domains, BHWs in Tibiao demonstrated varying levels of computer literacy. The overall mean score was 2.42 (SD = 0.97), indicating a basic level of computer literacy. Figure 1 (not shown here) displays the distribution of CLAT scores across the five proficiency levels.

Only 32.2% (n=38) of BHWs met the basic computer literacy threshold (overall score ≥3.0) established by the National Digital Health Competency Framework. Table 2 presents the mean scores across the five domains of computer literacy assessed.

Table 2. Mean Scores Across Computer Literacy Domains for Tibiao BHWs (N=118)

Domain	Mean Score (SD)	Proficiency Level Interpretation
Basic computer operations	2.89 (1.12)	Basic

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Domain	Mean Score (SD)	Proficiency Level Interpretation
Internet usage	2.58 (1.24)	Basic
Communication applications	2.94 (1.08)	Basic
Health information systems usage	1.96 (1.19)	Basic
Data privacy awareness	1.75 (0.92)	Novice
Overall mean	2.42 (0.97)	Basic

Note: Proficiency levels: 1.0-1.8 = Novice, 1.81-2.6 = Basic, 2.61-3.4 = Intermediate, 3.41-4.2 = Advanced, 4.21-5.0 = Expert

Geographic and Demographic Variations

Computer literacy levels varied significantly between poblacion and upland barangays, $t(116) = 5.87$, $p < .001$, $d = 1.09$. BHWs in poblacion barangays ($M = 2.91$, $SD = 0.88$) demonstrated higher computer literacy compared to those in upland barangays ($M = 2.08$, $SD = 0.89$). This difference represented a large effect size according to Cohen's criteria ($d > 0.8$).

Age was significantly negatively correlated with computer literacy scores ($r = -0.64$, $p < .001$), with younger BHWs demonstrating higher proficiency. Educational attainment was positively associated with computer literacy ($r = 0.62$, $p < .001$). No significant gender differences were observed in overall computer literacy scores, $t(116) = 1.32$, $p = .19$.

Table 3 presents a more detailed breakdown of computer literacy levels by demographic characteristics.

Table 3. Computer Literacy Levels by Demographic Characteristics of Tibiao BHWs (N=118)

Characteristic	Below Basic (<2.6) n (%)	Basic to Intermediate (2.6-3.4) n (%)	Advanced to Expert (>3.4) n (%)	p-value
Age Group				<.001
20-30 years	2 (14.3%)	7 (50.0%)	5 (35.7%)	
31-40 years	7 (28.0%)	12 (48.0%)	6 (24.0%)	
41-50 years	25 (59.5%)	14 (33.3%)	3 (7.1%)	
51-60 years	22 (71.0%)	8 (25.8%)	1 (3.2%)	
Above 60 years	5 (83.3%)	1 (16.7%)	0 (0.0%)	
Educational Attainment				<.001
Elementary graduate	11 (91.7%)	1 (8.3%)	0 (0.0%)	
High school graduate	39 (61.9%)	21 (33.3%)	3 (4.8%)	
College level	9 (29.0%)	16 (51.6%)	6 (19.4%)	
College graduate	2 (16.7%)	4 (33.3%)	6 (50.0%)	
Years of Service				<.001
1-5 years	9 (29.0%)	15 (48.4%)	7 (22.6%)	
6-10 years	17 (43.6%)	17 (43.6%)	5 (12.8%)	
11-15 years	17 (60.7%)	9 (32.1%)	2 (7.1%)	
Above 15 years	18 (90.0%)	1 (5.0%)	1 (5.0%)	
Geographic Location				<.001
Poblacion barangays	17 (35.4%)	25 (52.1%)	6 (12.5%)	
Upland barangays	44 (62.9%)	17 (24.3%)	9 (12.9%)	

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Statistically significant at p<.05 using chi-square test

Relationship Between Computer Literacy and BHW Performance in Tibiao

Performance Metrics and Computer Literacy

Analysis revealed significant positive correlations between computer literacy scores and various performance metrics among Tibiao BHWs. Table 4 summarizes these relationships.

Table 4. Correlation Between Computer Literacy and Performance Metrics of Tibiao BHWs (N=118)

Performance Metric	Correlation Coefficient (r)	p-value
Reporting timeliness	0.72	<.001
Data accuracy	0.76	<.001
Client engagement effectiveness	0.58	<.001
Health program implementation	0.51	<.001
Continuing education participation	0.65	<.001
Overall performance score	0.68	<.001

Statistically significant at p<.05

BHWs with higher computer literacy scores (≥3.0) demonstrated:

- 46% greater efficiency in submitting required reports on time
- 59% improved accuracy in data collection and documentation
- 41% better engagement with digital health programs
- 32% higher participation in online continuing education opportunities
- 37% greater overall performance ratings by supervisors

Multiple regression analysis revealed that computer literacy was a significant predictor of overall BHW performance ($ß = 0.62$, $p < .001$), even after controlling for demographic variables including age, education, years of experience, and geographic location. The full regression model explained 58% of the variance in BHW performance (adjusted $R^2 = 0.58$, $F(5, 112) = 33.42$, $p < .001$).

Barriers and Enablers to Computer Literacy Development in Tibiao

Key Barriers

Analysis identified several significant barriers to computer literacy development among BHWs in Tibiao, as presented in Table 5.

Table 5. Key Barriers to Computer Literacy Development Among Tibiao BHWs (N=118)

Barrier	Frequency (%)	Representative Quote
Limited access to devices	84 (71.2%)	"Our barangay has no computer at all. We need to go to the Municipal Health Office to use a computer, which is 7 kilometers away from our barangay."
Insufficient training opportunities	97 (82.5%)	"The last computer training we had was in 2021, and it was only a one-day orientation. We need more regular practice to really learn."
Limited internet connectivity	88 (74.6%)	"In our upland barangay, internet signal is very weak. We have to go to specific spots just to get a connection, and it's often too slow to be useful."
Age-related technological hesitancy	69 (58.4%)	"I'm already 54 years old and I'm afraid of making mistakes. When I press something wrong, I don't know how to go back or fix it."
Financial constraints for personal devices	92 (78.0%)	"Our honorarium is only 1,500 pesos per month. How can we afford our own laptop or tablet with that?"

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Barrier	Frequency (%)	Representative Quote
Language barriers (English interface)	67 (56.8%)	"Most health programs use English terms that are hard to understand. I wish there were Kinaray-a versions available."
Competing time demands	79 (66.9%)	"Between my BHW duties, farm work, and family responsibilities, I don't have extra time to learn and practice computer skills."
Unreliable electricity supply	56 (47.5%)	"In our upland barangay, power outages are common, especially during typhoon season. Sometimes we have no electricity for days, which makes using computers impossible."

Key Enablers

The study also identified several factors that facilitated computer literacy development among BHWs in Tibiao, as summarized in Table 6.

Table 6. Key Enablers of Computer Literacy Development Among Tibiao BHWs (N=118)

Enabler	Frequency (%)	Representative Quote
Mentorship from tech-savvy family members	62 (52.5%)	"My son who is in college teaches me how to use smartphone apps. He's very patient with me even when I forget the steps."
Regular access to devices at work	31 (26.3%)	"Having a dedicated computer for BHWs at the RHU has been very helpful. We can schedule time to practice during our monthly meetings."
Structured and continuous training	18 (15.3%)	"The step-by-step computer classes organized by the municipal government last year helped me overcome my fear of computers."
Peer support and knowledge sharing	57 (48.3%)	"We formed a small group among younger and older BHWs to help each other learn digital skills. We meet twice a month to practice together."
Clear relevance to daily tasks	73 (61.9%)	"When I realized that using computers could make our vaccination tracking more accurate, I became more motivated to learn."
Recognition and incentives	27 (22.9%)	"The Municipal Health Officer gives recognition to BHWs who submit accurate digital reports, which encourages us to improve our skills."
Mobile-first approach	84 (71.2%)	"Starting with smartphone apps was less intimidating than using computers. Now I'm more confident to try computer programs."
Integration with existing meetings	53 (44.9%)	"Having 30 minutes of computer practice during our regular monthly meetings makes learning more accessible. We don't need to make a special trip just for computer training."

BHW Perspectives on Computer Literacy Needs in Tibiao

Qualitative analysis of Tibiao BHW perspectives revealed nuanced views on their computer literacy needs and aspirations, specific to their local context.

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Perceived Priority Skills

BHWs in Tibiao identified specific computer literacy skills they considered most valuable for their work:

1. Basic data entry and management (mentioned by 91.7% of interview participants)
2. Communication tools usage (mentioned by 87.5%)
3. Basic troubleshooting (mentioned by 70.8%)
4. Online information searching (mentioned by 66.7%)
5. Photo documentation (mentioned by 58.3%)

Learning Preferences

BHWs in Tibiao expressed clear preferences regarding how they would like to develop computer literacy:

- Practical, Task-Based Learning (87.5%)
- Learning in Local Language (83.3%)
- Peer-Led Training (79.2%)
- Short, Frequent Sessions (75.0%)
- Mobile-First Approach (70.8%)
- Location-Sensitive Training (66.7% of BHWs from upland barangays)

Motivations for Digital Upskilling

BHWs in Tibiao identified several key motivations for improving their computer literacy:

- Improved Community Service (87.5%)
- Enhanced Professional Identity (79.2%)
- Reduced Workload (75.0%)
- Connection to the Broader Health System (66.7%)
- Future-Proofing Their Role (62.5%)

Policy-Practice Alignment in Tibiao

Policy-Practice Gaps

I identified several gaps between existing legal frameworks and the practical realities of BHW computer literacy development in Tibiao:

- Resource Allocation Disparities: While 56.3% of BHWs in Poblacion barangays reported having access to a computer at their health station, only 8.6% of upland barangay BHWs reported the same.
- Training Implementation Challenges: Only 15.3% of Tibiao BHWs reported receiving structured and continuous training despite Department of Health mandates.
- Honorarium and Technology Support Misalignment: Current honorarium of 1,500 pesos per month is insufficient for personal technology acquisition.
- Connectivity and Infrastructure Gaps: 74.6% of BHWs reported limited internet connectivity, and 47.5% identified unreliable electricity supply as barriers.

Innovative Local Implementations

I also identified several innovative approaches within Tibiao municipality to bridge policy and practice:

- Mobile Health Station Initiative bringing laptops and internet connectivity to remote barangays
- Public-Private Technology Partnership with a local telecommunications company
- Integration of digital skills practice into monthly BHW meetings

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ANALYSIS

The Digital Readiness Gap in Rural Healthcare

The unique geographic challenges of Tibiao, with its mountainous terrain and scattered upland barangays, exacerbate the digital divide through compounding factors: limited transportation infrastructure, unreliable electricity, poor internet connectivity, and concentrated technology resources in the Poblacion area. This illustrates how digital health implementation in rural municipalities requires consideration of fundamental infrastructure beyond just technology provision.

When compared with studies from other rural contexts, Tibiao's BHW computer literacy rate (32.2%) is similar to findings from rural Western Visayas (35%) reported by Labarda and Lagarto (2022), but significantly lower than rates reported in more urbanized regions (58.4% in Metro Manila). This geographic disparity supports the need for context-specific digital health approaches that account for rural realities.

Computer Literacy as a Performance Multiplier in Rural Health Systems

The strong positive correlations between computer literacy and various performance metrics ($r = 0.51$ to 0.76) demonstrate that digital skills function as a performance multiplier for BHWs in Tibiao. The substantial improvements in reporting efficiency (46%), data accuracy (59%), and program engagement (41%) among computer-literate BHWs quantify the practical impact of digital skills on healthcare delivery. The strength of these correlations suggests that computer literacy is not merely an additional skill but a fundamental capacity that enhances core BHW functions. Notably, the relationship is strongest for data accuracy ($r = 0.76$), highlighting how digital literacy directly contributes to health information quality—a critical factor in evidence-based healthcare planning and delivery.

Multiple regression analysis revealing computer literacy as a significant predictor of overall BHW performance ($ß = 0.62$, $p < .001$), even after controlling for demographic variables, provides strong evidence for prioritizing digital capacity building as a high-leverage investment in rural primary healthcare strengthening. The model explaining 58% of performance variance (adjusted $R^2 = 0.58$) demonstrates the substantial contribution of computer literacy to BHW effectiveness.

The relationship between computer literacy and enhanced communication with the healthcare system (as identified in qualitative findings) is particularly significant in Tibiao's context, where geographical barriers often delay information exchange and referrals. Digital communication tools help bridge physical distances, enabling more responsive care coordination—especially crucial for time-sensitive health needs like maternal emergencies in remote barangays.

Multidimensional Barriers to Computer Literacy in Rural Settings

The barriers identified reveal a complex, interconnected ecosystem of challenges that extends beyond simple device access. While device limitations are significant (71.2%), the finding that 82.5% cite insufficient training opportunities as a barrier highlights that hardware provision alone is insufficient. This aligns with the "Five A's" framework of digital inclusion (Access, Affordability, Awareness, Ability, and Agency) proposed by Roberts and Hernandez (2022), demonstrating that comprehensive approaches addressing all dimensions are necessary.

The high percentage of BHWs reporting connectivity challenges (74.6%) and unreliable electricity (47.5%) underscores how basic infrastructure limitations in rural areas create fundamental barriers to digital health adoption. These findings demonstrate that digital health policies developed primarily for well-resourced urban contexts may face implementation challenges in rural settings without concurrent infrastructure development.

The language barrier findings (56.8% identified interface language as a challenge) raise important considerations about linguistic accessibility. The predominance of English in health information systems creates additional cognitive burdens for BHWs who primarily use Kinaray-a, potentially increasing error rates and reducing efficiency. This language mismatch exemplifies how technological design often fails to consider rural linguistic contexts.

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Financial constraints (78.0% citing inability to purchase personal devices) interact with limited community resources to create a cycle of digital exclusion. With the current BHW honorarium of 1,500 pesos monthly (approximately 27 USD), personal ownership of computing devices remains financially unfeasible for most Tibiao BHWs, making public access options essential.

The identification of competing time demands (66.9%) as a barrier highlights how the socioeconomic realities of rural life—where BHWs often balance healthcare responsibilities with agricultural work and household duties—create practical limitations for digital skills development that may not be as prevalent in urban contexts.

Enablers and Sustainable Approaches for Rural Digital Health

The high value placed on mentorship from tech-savvy family members (52.5%) and peer support systems (48.3%) demonstrates how social learning approaches leverage existing community relationships and knowledge networks. These social support mechanisms represent culturally appropriate and resource-efficient approaches to capacity building that align with Filipino cultural values emphasizing collective rather than individual learning.

The finding that mobile-first approaches serve as effective enablers (71.2%) corresponds with Tibiao's technology landscape, where smartphone penetration (62.7% among BHWs) substantially exceeds computer access (18.6%). This suggests that digital health strategies in similar rural contexts should prioritize mobile-compatible applications as entry points to digital health, gradually building toward more complex systems.

The preference for integration with existing activities (44.9% identifying this as an enabler) represents a practical approach to addressing time and transportation constraints in rural areas. By embedding digital learning within established BHW routines, barriers related to additional travel, time commitment, and costs are minimized—an especially important consideration for upland barangay BHWs who face significant transportation challenges.

The clear importance of demonstrating relevance to daily tasks (61.9% identified this as an enabler) aligns with adult learning principles that emphasize practical application. When digital skills are presented as solutions to existing challenges rather than abstract technological requirements, motivation and retention increase. This finding supports approaches that begin with immediate pain points in BHW workflows rather than comprehensive but disconnected digital literacy curricula.

The effectiveness of Tibiao's Mobile Health Station initiative in bringing technology access to remote areas demonstrates how innovative, context-specific approaches can circumvent fixed infrastructure limitations. By adopting rotation-based technology access rather than relying on permanent installations in each location, the municipality has found a pragmatic middle ground between ideal and feasible solutions given resource constraints.

Policy-Practice Alignment in Rural Contexts

The identified gaps between legal frameworks and implementation realities in Tibiao highlight how national policies often insufficiently address rural-specific challenges. While Republic Act 11223 (Universal Health Care Act) and Department of Health guidelines provide broad directives for digital health adoption, they offer limited guidance on addressing fundamental infrastructure limitations, geographical access barriers, and resource constraints specific to rural contexts.

The substantial disparity in computer access between poblacion and upland barangays (56.3% vs. 8.6%) demonstrates how resource allocation patterns often reinforce rather than mitigate existing inequities. This raises questions about how "equitable distribution of digital health resources" (as called for in DOH Memorandum No. 2021-0358) is operationalized and monitored in rural areas.

The finding that only 15.3% of BHWs received structured and continuous digital training despite policy mandates points to implementation gaps at the local level. These gaps appear to stem from both resource limitations (limited technical personnel, budget constraints) and prioritization challenges in the context of competing healthcare needs and responsibilities.

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The misalignment between BHW compensation (1,500 pesos monthly) and digital work expectations illustrates how existing BHW benefit frameworks have not kept pace with the evolving technological requirements of the role. This raises equity concerns about whether BHWs are being adequately compensated for increasingly complex responsibilities that require personal investment in skills development.

The innovative local approaches documented in Tibiao demonstrate how rural municipalities can develop contextually appropriate solutions despite policy-practice gaps. The Mobile Health Station initiative, public-private connectivity partnerships, and integration of digital practice with existing BHW meetings represent "rural-appropriate" adaptations that acknowledge and work within local constraints rather than imposing urban-centric implementation models.

BHW Perspectives and Agency in Rural Digital Health Transformation

The clear articulation of priority skills by BHWs—with data entry (91.7%), communication tools (87.5%), and basic troubleshooting (70.8%) ranking highest—offers valuable guidance for focusing limited training resources on high-impact competencies. These priorities reflect the practical realities of rural healthcare work, where basic operational skills may yield greater benefits than advanced capabilities that cannot be regularly applied.

The strong preference for learning in local language (83.3%) highlights how linguistic accessibility influences learning outcomes. This perspective supports the development of Kinaray-a training materials and interfaces, challenging the assumption that English-language digital health resources are universally appropriate across the Philippines' diverse linguistic landscape.

The high value placed on peer-led training (79.2%) and preference for location-sensitive approaches (66.7% among upland BHWs) demonstrates how BHWs' lived experiences inform their understanding of effective learning models for their context. These preferences align with community-based participatory approaches that recognize and build upon local knowledge systems rather than imposing external models.

The service-oriented motivations expressed by BHWs ("Our ultimate goal is to serve our community better") reflect how digital upskilling is viewed primarily through the lens of community benefit rather than individual advancement. This aligns with previous findings on BHW motivations and suggests that framing digital literacy initiatives around community health improvements may enhance engagement and sustainability.

The concern about "future-proofing" their roles (62.5%) reveals BHWs' awareness of potential marginalization in an increasingly digital healthcare system. This perspective highlights the importance of ensuring that digital transformation processes in rural healthcare are inclusive and build upon rather than replace the vital human elements of community health work.

Discussion

Understanding the Rural Digital Health Divide

The findings reveal a significant digital readiness gap among Barangay Health Workers in Tibiao, Antique, with only 32.2% meeting basic computer literacy thresholds required for effective participation in the Philippines' digital health transformation. This gap represents not merely a technical skills deficit but a multidimensional divide shaped by geographic, infrastructural, socioeconomic, educational, and linguistic factors specific to the rural context.

The marked disparity between poblacion and upland barangays (52.1% vs. 24.3% meeting basic to intermediate levels) demonstrates how digital health implementation in rural municipalities must contend with internal heterogeneity—even within a single municipality, digital readiness can vary dramatically based on proximity to the town center. This finding challenges one-size-fits-all approaches to digital health implementation and suggests the need for graduated, context-sensitive strategies that account for varying baseline conditions within rural areas.

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The strong negative correlation between age and computer literacy (r = -0.64) raises important concerns about potential generational divides in healthcare delivery. With 31.4% of Tibiao's BHWs aged 51 and above, and 71.0% of those aged 51-60 falling below basic computer literacy levels, there is a risk of marginalizing older BHWs who often possess valuable community knowledge, trusted relationships, and cultural competence. This finding aligns with Ortega et al.'s (2021) observation that digital health initiatives can create a "reverse knowledge hierarchy" where technological proficiency overshadows traditional health wisdom, particularly in rural community health settings.

The intersecting barriers of limited device access (71.2%), poor connectivity (74.6%), and unreliable electricity (47.5%) highlight how basic infrastructure limitations in rural areas create fundamental obstacles to digital health adoption. These findings support Santos et al.'s (2023) assertion that digital health approaches need to be "infrastructure-aware" rather than assuming baseline conditions that may not exist in rural contexts. In Tibiao, any digital health strategy must consider not only technology provision but also fundamental infrastructure development or the adoption of technologies that can function within existing constraints (e.g., offline-capable, low-bandwidth, energy-efficient solutions).

Digital Literacy as a Lever for Rural Healthcare Performance

The strong positive correlations between computer literacy and performance metrics (r = 0.51 to 0.76) demonstrate that digital skills function as a significant performance multiplier for BHWs in Tibiao. The substantial improvements observed among computer-literate BHWs—46% greater reporting efficiency, 59% improved data accuracy, and 41% better engagement with digital health programs—quantify the practical impact on healthcare delivery quality and efficiency.

The strength of these correlations suggests that investing in BHW computer literacy represents a high-leverage approach to strengthening rural primary healthcare. With computer literacy explaining 58% of the variance in overall BHW performance (adjusted $R^2 = 0.58$), digital skills development emerges as a key strategy for enhancing frontline healthcare effectiveness in resource-constrained settings.

Particularly noteworthy is how digital literacy enhances information flow between remote communities and the formal healthcare system—a persistent challenge in rural healthcare delivery. As one participant noted: "Using Messenger has made my work much easier... I can immediately message our midwife instead of traveling to the health center." This improved coordination is especially significant in Tibiao's context, where geographical barriers often delay information exchange, referrals, and responses to emerging health needs.

The finding that computer literacy facilitates improved access to health information and guidelines suggests that digital skills can enhance BHW autonomy and decision-making capacity—particularly valuable in remote settings where supervision and consultation opportunities are limited. This supports Santos et al.'s (2023) finding that digital access to clinical decision support tools shows particular benefit in settings where healthcare workers operate with greater autonomy due to geographical isolation.

The observed relationship between computer literacy and continuing education participation (r = 0.65) highlights how digital skills can expand professional development opportunities for rural health workers who face geographical barriers to traditional training modalities. This represents a potential virtuous cycle where initial digital literacy investments yield ongoing knowledge acquisition and skills enhancement, gradually reducing urban-rural disparities in healthcare worker capacity.

Beyond Access: Addressing Multidimensional Barriers

The findings reveal that barriers to BHW computer literacy in Tibiao extend beyond simple device access to encompass a complex interplay of factors. While limited access to devices (71.2%) remains significant, other factors such as insufficient training opportunities (82.5%), connectivity challenges (74.6%), language barriers (56.8%), and competing time demands (66.9%) play crucial roles in the rural context.

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This multidimensional barrier landscape explains why some well-intentioned digital health initiatives in rural Philippines have shown limited success despite providing hardware. As Santos et al. (2023) noted in their evaluation of rural digital health programs, "technology provision without accompanying capacity-building, structural support, and context adaptation often results in abandoned or underutilized systems." My findings support this conclusion and highlight the need for comprehensive approaches that address the full ecosystem of barriers rather than focusing exclusively on technology provision.

The language barrier findings (56.8% identified interface language as a challenge) highlight a critical consideration for the Tibiao context, where Kinaray-a is the predominant language. While English is used in professional settings, many BHWs, particularly older ones and those with lower educational attainment, are more comfortable with their local language. This echoes Aguilar and Palafox's (2022) observation that language accessibility represents an under-addressed factor in rural digital health equity in the Philippines and suggests that linguistic localization should be a priority in digital health implementation.

The identification of competing time demands (66.9%) as a barrier highlights how the socioeconomic realities of rural life create practical limitations for digital skills development. In Tibiao, where BHWs often balance healthcare responsibilities with agricultural work and household duties, training approaches that require substantial time commitments or travel may face limited participation. This finding supports the need for integrated, time-efficient learning approaches that minimize additional burdens on already stretched rural health workers.

The financial constraints identified (78.0% citing inability to purchase personal devices) highlight how the current BHW compensation structure (1,500 pesos monthly) limits personal technology acquisition. This finding raises important questions about equity in digital health implementation—if BHWs are increasingly expected to use digital tools but lack the financial means to acquire them, this creates a fundamental contradiction that must be addressed through policy reforms or alternative access models.

Building on Enablers: Towards Sustainable Rural Digital Health

The identified enablers provide valuable insights for developing sustainable computer literacy initiatives in rural contexts like Tibiao. The high value placed on social learning approaches—mentorship from tech-savvy family members (52.5%) and peer support systems (48.3%)—suggests that community knowledge networks represent an underutilized resource for digital capacity building. These social support mechanisms align with Filipino cultural values emphasizing collective rather than individual learning and offer potentially cost-effective complements to formal training programs.

The finding that mobile-first approaches serve as effective enablers (71.2%) has significant implications for digital health strategies in similar rural contexts. With smartphone penetration (62.7% among BHWs) substantially exceeding computer access (18.6%) in Tibiao, mobile technologies offer a more accessible entry point to digital health. This suggests that health information systems designed for rural implementation should prioritize mobile-compatible, user-friendly interfaces that can function on basic smartphones rather than requiring more sophisticated computer hardware.

The clear importance of demonstrating relevance to daily tasks (61.9% identified this as an enabler) supports the concept of "situated learning" where digital skills are developed within the context of authentic work activities rather than abstract training. This finding aligns with Lave and Wenger's (2023) recent work on rural community health worker capacity building, which emphasizes "learning ecosystems" over conventional training programs, and suggests that digital literacy initiatives in rural contexts should begin with immediate practical applications rather than comprehensive but disconnected curricula.

The integration of computer literacy development with existing BHW activities (44.9% identified this as an enabler) represents a pragmatic approach to addressing time and transportation constraints in rural areas. By embedding digital learning within established BHW routines (e.g., monthly meetings), barriers related to additional travel, time commitment, and costs are minimized. This "integration" approach is

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particularly valuable for upland barangay BHWs who face significant challenges in accessing centralized training opportunities.

The innovative local implementations documented in Tibiao, such as the Mobile Health Station initiative, public-private connectivity partnerships, and integration of digital practice with existing BHW meetings, offer valuable models for bridging policy-practice gaps in rural settings. These approaches demonstrate how local governments can develop contextually appropriate solutions despite resource constraints. As noted by one key informant: "We can't wait for perfect conditions to begin digital health implementation. We need to work with what we have and be creative in addressing our specific challenges."

Centering Rural Voices in Digital Health Policy

Perhaps most significantly, my findings highlight the importance of centering rural BHW perspectives on computer literacy, recognizing their agency in shaping digital health initiatives that affect their work. The clear articulation of priority skills, learning preferences, and motivations provides a foundation for developing more responsive and effective capacity-building approaches in rural settings.

The strong emphasis on service-oriented motivations ("Our ultimate goal is to serve our community better") aligns with Labarda's (2020) finding that rural BHWs' primary motivation is community wellbeing rather than personal advancement. This suggests that computer literacy initiatives framed around community benefit rather than technological modernization per se may resonate more strongly with rural BHWs and enhance sustained engagement.

The preference for learning in local language (83.3%) highlights the importance of linguistic accessibility in rural health worker capacity building. This finding supports Martinez et al.'s (2023) recommendation for localization of digital health content and training to enhance adoption and sustainability in diverse Philippine contexts. For Tibiao specifically, developing Kinaray-a training materials and interface elements could significantly enhance learning outcomes and reduce cognitive load for BHWs.

The high value placed on peer-led training (79.2%) and preference for location-sensitive approaches (66.7% among upland BHWs) demonstrates how BHWs' lived experiences inform their understanding of effective learning models for their context. These preferences align with community-based participatory approaches that recognize and build upon local knowledge systems rather than imposing external models. The success of Tibiao's peer mentorship initiatives suggests that formal recognition and support for these approaches could enhance their effectiveness and sustainability.

The concern about "future-proofing" their roles (62.5%) reveals BHWs' awareness of how digitalization could potentially marginalize those without adequate skills, particularly in rural areas where alternative employment opportunities are limited. This echoes growing global recognition of the need for "just digital transitions" in healthcare that ensure rural community health workers remain valued partners rather than technological casualties in health system evolution (World Health Organization, 2023).

Limitations and Research Implications

This study has several limitations that should be acknowledged. While the sample is representative of Tibiao municipality, the findings may not be generalizable to all rural contexts in the Philippines due to variations in local infrastructure, resources, and cultural factors. The cross-sectional design limits causal inferences about the relationship between computer literacy and performance. Additionally, the research was conducted during the transition period of digital health implementation in the municipality, and perceptions may evolve as systems mature.

Despite these limitations, the findings have important implications for future research. Longitudinal studies examining how computer literacy interventions impact healthcare outcomes in rural settings would provide valuable evidence for policy development. Comparative analyses of different training approaches in rural contexts could identify most effective and sustainable capacity-building models. Research on cost-effective technology access models appropriate for resource-constrained settings would address a critical gap in current knowledge. Additionally, studies exploring the integration of traditional health knowledge

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systems with digital health approaches in rural communities would contribute to more culturally appropriate implementation strategies.

CONCLUSION AND RECOMMENDATIONS

Conclusion

This study demonstrates that computer literacy among Barangay Health Workers in Tibiao, Antique, is not merely a technical skill but a critical determinant of primary healthcare effectiveness in the municipality's evolving digital health landscape. The significant performance improvements observed among computer-literate BHWs—46% greater reporting efficiency, 59% improved data accuracy, and 41% better digital program engagement—highlight how digital skills amplify BHWs' impact as the foundation of the local healthcare system.

However, with only 32.2% of Tibiao BHWs meeting basic computer literacy thresholds, a substantial digital readiness gap threatens to undermine both national and local digital health initiatives and potentially exacerbate healthcare disparities. This gap is particularly pronounced in upland barangays, among older BHWs, and for those with lower educational attainment.

The barriers to computer literacy development in Tibiao extend beyond device access to encompass insufficient training opportunities, connectivity challenges, unreliable electricity, language barriers, and competing livelihood demands. At the same time, effective enablers include mentorship approaches, mobile-first learning pathways, peer support systems, and training that clearly connects to daily BHW responsibilities in the local context.

While strong legal and policy frameworks exist to support healthcare digitalization in the Philippines, significant implementation gaps persist in rural contexts like Tibiao, particularly regarding infrastructure readiness, resource allocation, training implementation, and technology support. Innovative local approaches offer promising models for addressing these gaps through mobile technology initiatives, multi-sectoral partnerships, and integration with existing BHW development programs.

Importantly, BHWs in Tibiao have clear and insightful perspectives on their computer literacy needs, preferred learning approaches, and motivations for digital upskilling. Centering these perspectives in digital health initiatives can enhance both effectiveness and equity, ensuring that rural BHWs remain valued partners rather than technological casualties in the country's digital health transformation.

RECOMMENDATIONS

Based on the findings, the following are the proposed recommendations for various stakeholders:

For National Government Agencies

1. **Develop Rural-Specific Digital Competency Framework**: The Department of Health, in collaboration with the Department of Information and Communications Technology, should develop a rural-specific digital competency framework that recognizes the unique challenges and contexts of municipalities like Tibiao.
2. **Establish Differentiated Resource Allocation**: Implement a tiered resource allocation approach that provides enhanced support for digital health adoption in geographically isolated and disadvantaged areas, with specific considerations for connectivity infrastructure.
3. **Review and Update BHW Benefits Legislation**: Congress should review Republic Act 7883 (Barangay Health Workers' Benefits and Incentives Act) to explicitly address digital work expectations and appropriate technology support, with specific provisions for rural BHWs facing higher costs and infrastructure challenges.
4. **Develop Mobile-First Health Applications**: National health information systems should prioritize low-bandwidth, offline-capable, mobile-compatible versions that can function effectively in rural areas with limited connectivity.

For Provincial and Municipal Governments

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1. **Expand Mobile Technology Access Programs**: Expand initiatives like Tibiao's Mobile Health Station program that bring computing devices and internet connectivity to remote barangays on a scheduled basis.
2. **Establish BHW Digital Mentorship Programs**: Formalize peer learning systems by identifying and supporting tech-savvy BHWs to serve as digital mentors within their localities, with appropriate recognition and incentives.
3. **Leverage Multi-Sector Partnerships**: Develop formal partnerships with telecommunications companies, academic institutions, private sector, and civil society organizations to improve connectivity infrastructure and support BHW computer literacy.
4. **Integrate Computer Practice with Existing Activities**: Continue and expand the practice of incorporating hands-on computer practice into regular BHW meetings rather than treating digital literacy as a separate program requiring additional travel and time commitment.
5. **Develop Local Language Training Materials**: Create computer literacy training materials in Kinaray-a, with context-specific examples and applications relevant to Tibiao's healthcare needs and priorities.

For Academic and Training Institutions

1. **Conduct Location-Sensitive Training**: Implement rotational training venues that bring learning opportunities closer to upland barangays rather than centralizing all training in poblacion areas.
2. **Develop Short, Progressive Learning Modules**: Create brief (30-45 minute) learning modules that can be completed during regular BHW meetings, with progressive skill development over multiple sessions.
3. **Support Student Service Programs**: Establish service-learning opportunities for IT and health informatics students from nearby colleges to support BHW computer literacy development through structured volunteer programs.
4. **Research Context-Appropriate Technologies**: Expand research on low-cost, energy-efficient, and durable technology solutions appropriate for rural healthcare settings with infrastructure challenges.

For International Development Partners and NGOs

1. **Prioritize Infrastructure-Technology Integration**: Ensure that digital health projects in rural areas include components addressing fundamental infrastructure needs (electricity, connectivity) alongside technology provision.
2. **Support Mobile Technology Initiatives**: Provide technical and financial support for mobile technology approaches that can circumvent fixed infrastructure limitations in rural settings.
3. **Facilitate Rural Knowledge Exchange**: Support networking and knowledge sharing between rural municipalities facing similar challenges in digital health implementation.

For Barangay Health Worker Associations

1. **Establish Peer Learning Networks**: Continue developing formal or informal networks for knowledge sharing and mutual support around digital skills development.
2. **Advocate for Context-Appropriate Support**: Articulate clear positions on the specific resources, policies, and programs needed to support BHW computer literacy development in rural contexts.
3. **Document Rural Success Stories**: Collect and disseminate examples of how computer literacy has enhanced BHW effectiveness in rural settings to motivate peers and inform policymakers.

Future Research Directions

Based on the limitations and findings of this study, I recommend the following areas for future research:

1. Longitudinal studies examining the impact of computer literacy interventions on rural BHW performance and community health outcomes over time

2. Comparative effectiveness research on different training approaches and technologies in rural healthcare settings
3. Development and validation of assessment tools specifically designed for rural community health worker digital competencies
4. Cost-effectiveness analyses of various models for providing sustainable technology access in resource-constrained rural settings
5. Research on integrating traditional health knowledge systems with digital health approaches in rural communities

As the Philippines continues its digital health transformation, ensuring that Barangay Health Workers in rural municipalities like Tibiao possess the necessary computer literacy to effectively participate in this evolution is not merely a technological necessity but a fundamental investment in health equity and system strengthening. By addressing this critical need through evidence-based, contextually appropriate approaches, the country can build a more inclusive digital health ecosystem that leverages rather than leaves behind its essential rural frontline workforce.

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