

Artículo Original

Adherence to the 2016 PAHO Clinical Practice Guideline on Dengue in a Hospital in Northern Peru, 2022-2023.

Adherencia a la Guía de Práctica Clínica de la OPS 2016 sobre Dengue en un hospital del norte de Perú, 2022-2023.

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Authorship statement: Authorship statement: Writing–original draft: FELJ, SC, LMMV. Writing–review & editing: FELJ, SC, LMMV. Supervision: LMMV, LMBH, MPDG. Final approval of the manuscript: all authors. Funding: This study was funded with the author's own resources and did not receive external funding from public or private institutions.

Conflict of interest disclosure: Sofia Cavalcanti Ramírez and Franco León Jiménez are members of the Hospital Research Committee. The authors have declared that no competing interests exist: Nataly BF. Mendoza-Farro, Adriana Montoya Reategui, Joel Emmanuel Inga-Chero, Moisés Barranzuela-Herrera, Karim Dioses Diaz and Luz M. Moyano.

financing: This study was self-funded by the authors and received no external funding from public or private institutions to the Hospital authorities for the permissions provided for data access.

Artificial Intelligence Use Declaration: During the preparation of this manuscript, Luz M. Moyano (LMMV) used Claude AI Pro (Anthropic), Perplexity AI Pro, Open Evidence, Medsearch, and Scopus AI for the following purposes: integrating clinical history data, reducing word redundancy, improving spelling and grammar, enhancing paragraph clarity, conducting real and updated scientific evidence searches, structuring the discussion section, and confirming references. After using these tools/technologies, the authors reviewed and edited the content as needed and assumed full responsibility for the last version of the publication.

Received: 20-06-2026.

Accepted: 28-06-2026.

Published: 30-06-2026.

DOI: <http://doi.org/10.57188/ricsa.2026.013>



ABSTRACT

Objective: Effective dengue management enhances the chances of survival. The level of adherence to the suggestions in northern Peru is uncertain. The primary aim of the study was to assess adherence to the 2016 PAHO guideline on dengue in a hospital located in northern Peru during the period from 2022 to 2023. **Material and methods:** The study performed a cross-sectional design and exploratory analysis, reviewing 140 medical records. Fifty-four percent were from 2023; 66.43% were from women; 38.57% came from a first level healthcare center; 77.14 % had diagnosis of dengue with warning signs and 20.71% had severe dengue; 18.44% died. **Results:** We found at least one error in the classification of severity and/or treatment in non-hospital healthcare facilities (95 %), triage (90.23%), and uviclin/observation (58.93%). Errors in classification and inadequate hydration in the first level healthcare centers, triage, and uviclin/observation were: 40.68%/60.0%, 31.06%/76.6%, and 15.32%/44.14 %, respectively. Persistent errors were inadequate hydration in triage (76.69%) and urinary flow in the center (81.67 %). In a bivariate analysis, mortality was associated with age 18 years or older ($p = 0.047$), having a case from 2023 ($p = 0.008$), and having severe dengue ($p < 0.001$). In the multivariate analysis, only severe dengue (PR: 28.13, 95% CI :9.32-84.86 $p < 0.001$), and age 18 years or older (PR:2.97, 95%CI:1.19-7.43 $p = 0.020$), were associated with mortality. **Conclusions:** We found a high frequency of misclassification and management errors in these three scenarios, but they were not associated with higher mortality.

Palabras clave: Dengue, Adherence, Clinical Practice Guidelines, Mortality. (Source: MeSH-NLM)

RESUMEN

Objetivo. El manejo adecuado del dengue mejora las probabilidades de supervivencia. Sin embargo, se desconoce el nivel de adherencia a las recomendaciones vigentes en el norte del Perú. El objetivo principal de este estudio fue evaluar la adherencia a la guía de dengue de la Organización Panamericana de la Salud (OPS) de 2016 en un hospital del norte del Perú durante el período 2022-2023. **Material y métodos:** Se realizó un estudio de diseño transversal y análisis exploratorio mediante la revisión de 140 historias clínicas. El 54 % correspondió al año 2023; el 66,43 % fueron mujeres; el 38,57 % provenía de establecimientos de salud del primer nivel de atención; el 77,14 % tenía diagnóstico de dengue con signos de alarma y el 20,71 % de dengue grave; el 18,44 % falleció. **Resultados:** Se encontró al menos un error en la clasificación de la gravedad y/o en el tratamiento en los establecimientos de salud no hospitalarios (95 %), en triaje (90,23 %) y en la unidad clínica/observación (58,93 %). Los errores en la clasificación y la hidratación inadecuada en los establecimientos del primer nivel de atención, triaje y unidad clínica/observación fueron de 40,68 %/60,0 %, 31,06 %/76,69 % y 15,32 %/44,14 %, respectivamente. Los errores persistentes más frecuentes fueron la hidratación inadecuada en triaje (76,69 %) y el monitoreo inadecuado del flujo urinario en hospitalización (81,67 %). En el análisis bivariado, la mortalidad se asoció con tener 18 años o más ($p = 0,047$), corresponder al año 2023 ($p = 0,008$) y presentar dengue grave ($p < 0,001$). En el análisis multivariado, únicamente el dengue grave (RP: 28,13; IC 95 %: 9,32-84,86; $p < 0,001$) y la edad igual o mayor de 18 años (RP: 2,97; IC 95 %: 1,19-7,43; $p = 0,020$) se asociaron con la mortalidad. **Conclusiones:** Se encontró una alta frecuencia de errores en la clasificación y el manejo de los pacientes en los tres escenarios evaluados; sin embargo, estos errores no se asociaron con una mayor mortalidad.

Keywords: Dengue, Adherencia, guía de practica clinica, mortalidad (Fuente: DeCS-BIREME)

INTRODUCTION

In the Americas, in 2023, there were 4'563, 485 cases of dengue, 7,653 cases of severe dengue (0.16%) and 2,339 deaths (0.05% mortality). After Brazil, Peru had the second highest number of cases (274,277 cases), with 441 deaths (0.16%), which is 3.2 times the average for the Americas (1).

Peru recorded a total of 13,010 cases and 8 fatalities up until epidemiological week 5. Among these instances, the city of Piura in the northern region reported 2,153 cases. (2).

Although this virus's mortality is less than 1%, complications and deficiencies in early management can increase it. The key factors for

improving prognosis are early syndromic diagnosis, patient individualization, monitoring, and adequate hydration. (3).

In 2016, the Pan American Health Organization (PAHO) developed the Guidelines for patient care in the Region of the Americas 2nd edition, based on available evidence from cohort studies and expert opinions. in which they emphasize the correct initial management according to risk factors and symptomatology for adequate triage and treatment, according to the widely recognized classification: Dengue without warning signs (DWWS), Dengue with warning signs (DWS) and Severe Dengue (SD) (4). Within the Peruvian

contingency plan of the Ministry of Health (MINSA) against Dengue, in October 2023, a National

Directive was issued ensuring a budget of 107,585,222 PEN for the program 017 Metaxenic and zoonotic diseases, of which more than 16,000,000 PEN were assigned to the MINSA and more than 91,000,000 PEN to the Regional Governments, aimed to strengthen the skills and competencies of healthcare professionals in the management and approach of this problem and to develop research in this pathology. Likewise, this regulation exposed the deficit in adherence to the Clinical Practice Guidance (CPG) recommendations and the lack of research and exploration of the problems related to it (5). On the other hand, in our country, in March 2024, the Technical Health Standard No. 211-MINSA/DGIESP-2024 was implemented, with clear specifications on prevention and treatment at diverse levels of care (6). This allowed us to adopt an anticipatory and prospective attitude in the evaluation of the patient. To implement a guide, it is necessary to educate in all areas of care and train all healthcare personnel through validated educational interventions with theoretical and practical content. In other words, it is necessary to train and measure to know how we are, where we are going, what we need to improve and how we will do it. Adherence to recommendations can provide better clinical outcomes (8).

There is evidence that the knowledge, attitudes, and practices in the comprehensive management of this endemic disease are far from ideal. In the 2022 outbreak, studies on patients hospitalized for DWS and SD in a Level II-2 hospital of the Ministry of Health of Piura found delays in reference time, prolonged time in triage and frequent errors in severity classification, hydration, and monitoring (9). In Colombia, a review of 43 medical records for the characterization of adherence to the 2010 PAHO CPG, found that the overall adherence level was 67.4% and the items with the lowest compliance were: evaluation capillary refill, search for hemorrhages in the skin and mucous membranes, evaluation of warning signs and examination of the central nervous system (10). In another Colombian study in pediatric patients, it was found that 77.18% were correctly classified and 28.9% received adequate hydration management (11).

Since Piura is the city with the most cases of dengue reported in the period 2023–2024 and deficiencies have been evident in 2022, this study aims: a) to describe the most frequent errors in the classification of the severity and management of admitted dengue cases to a public hospital in the city of Piura in the years 2022–2023 and b) to explore their association with the severity and mortality of dengue.

MATERIAL AND METHODS

Design. This is a cross-sectional descriptive study with exploratory analytical analysis.

Study site. The region of Piura (2,127,000 inhabitants) is the second department with the largest population in Peru (12). The Ministry of Health of Peru rates the Hospital study's site, as Level II-2. (13) In 2023, it had Emergency Room Triage (20 beds), Pediatric Emergency Services (12 beds), Obstetrics and Gynecology Emergency Services (10 beds), Medicine Emergency (20 beds), and Surgery Emergency (14 beds); two Dengue Monitoring Units named Uviclin (Uviclin 1: [12 beds] and Uviclin 2: [40 beds]); an Intensive Care Unit (pediatrics, intermediate care, and general: [32 beds]); Internal Medicine Hospitalization (50 beds); Surgery (40 beds); Obstetrics and Gynecology Hospitalization (14 beds); and Pediatrics (13 beds). Up until the last patient's description, the hospital had a total of 277 beds available. The hospital has handwritten registration and information management does not have electronic medical records for hospitalization.

Population and study sample. The study population was the medical records of patients with DWS and SD, hospitalized in at least one of the services.

Selection criteria. The records of patients with or without referral from another health care facilities

and followed until their permanence in observation and/or Uviclin and/or ICU were considered. We included stories with confirmation of a case of dengue with warning signs or severe dengue, by the hospital's epidemiology office Medical records from 2022 and epidemiological weeks 18-25 of 2023 (peak of the outbreak). The records of patients with or without referral from another health care facilities and followed until their permanence in observation and/or Uviclin and/or ICU were considered. Sampling was by convenience according to the availability of the medical records. With a population of 939 records, confidence level of 97%, design effect of 1 and frequency of non-registration/no data available for mean arterial pressure in Triage of 11.3% (9) (previous study from 2022), the calculated sample size was 158 stories.

Information from medical records and definitions. SCR, AMR (Infectious diseases physicians) and FLJ (internal medicine physician) developed a checklist to describe adherence to the application of the Guidelines for the care of patients in the region of the Americas - Second edition of the Pan American Health Organization (4) and the Technical Health Standard for the Comprehensive Care of Patients with Dengue in Peru, 2024 (6). With both the relevance of the initial diagnosis, severity classification, hydration (bolus and infusion) and monitoring from the health

centers/posts until passing through the hospital were evaluated. Dengue (DENV) was defined as WHO: "Dengue (break-bone fever) is a viral infection that spreads from mosquitoes to people.

It is more common in tropical and subtropical climates. Most people who get dengue will not have symptoms. But for those who do, the most common symptoms are high fever, headache, body aches, nausea, and rash. Most will get better in 1-2 weeks. Some people develop severe dengue and need care in a hospital "(3).

The algorithms followed were:

A. Dengue case algorithm with warning signs:

1. Start hydration with crystalloid solution (Hartman or 0.9% saline solution): 10cc/kg to pass in one hour, up to 3 loads; If there is no clinical improvement change to the severe dengue algorithm.
2. Gradual reduction of hydration to 5-7 ml/kg/h for 2-4 hours and hourly monitoring.
3. Reevaluation of the patient. If clinical improvement is evident and urine output is ≥ 1 ml/kg/h, reduction of hydration to 3-5 ml/kg/h for 2-4 hours and hourly monitoring.
4. Reevaluation. If clinical improvement is evident and urine output is ≥ 1 ml/kg/h, reduce hydration to 2-4 ml/kg/h and continue for 24-48 hours and hourly monitoring.

B. Severe Dengue Case Algorithm:

1. Immediate bolus administration of crystalloid solution (Hartman or 0.9% normal saline) 20 ml/kg in 15 to 30 minutes.
2. Reevaluation. If signs of shock disappear, decrease hydration to 10 ml/kg/h for 1-2 hours and hourly monitoring.
3. Reevaluation. If the evolution is satisfactory, decrease hydration to 5-7 ml/kg/h for 4-6 hours and hourly monitoring.
4. Reevaluation. If the evolution is satisfactory, reduction of hydration to 3-5 ml/kg/h for 2-4 hours and hourly monitoring.
5. If evolution is satisfactory, reduce fluids to 2-4 ml/kg/h for 24-48 hours.

In addition, the following were measured: Presence of the referral form from the healthcare center (presence and adequate completion), time elapsed from the reference from the health center to arrival at the hospital, and times spent in each service.

Two aspects were determined: 1. Appropriate initial diagnosis and 2. Appropriate management. Each researcher was assigned a defined number of records. They were previously trained by SCR and AMR.

Adequate initial diagnosis was defined if the diagnosis that appeared on the reference, triage and observation/Uviclin sheet coincided with the investigator's opinion: DWWS, DWS, SD.

Adequate management was defined if the indications in the evolution or monitoring sheets coincided with the researcher's evaluation in relation to parenteral fluid therapy, the frequency of monitoring vital functions (mean arterial pressure, diuresis) and the indication for blood products (all should be met).

For the evaluation of diagnosis and management of Dengue, confirmed and probable cases of dengue were included, as well as those ruled out since the outbreak scenario and the concept of case management were considered. If the written information was not found in clinical history, it would be considered indeterminate.

Statistical Analysis. Descriptive analysis with absolute and relative frequencies for categorical variables and measures of median and interquartile range (IQR) for numerical variables were estimated. The association between severity and mortality and adequate initial diagnosis and appropriate management was explored. Chi 2 and Fisher's test were used for categorical tests and Wilcoxon/Student's t test for numerical tests according to normality. A multivariable analysis was performed between mortality and diagnostic classification, sociodemographic and appropriate management classification with $p < 0.1$ in the bivariate. Prevalence ratios were calculated through generalized linear models using the link log function and the binomial family with robust variance. For the statistical analysis we used StataCorp. 2023. Stata Statistical Software: Release 18. College Station, TX: StataCorp LLC.

Ethical aspects. The Hospital Research Committee approved the study protocol. The confidentiality of the information was maintained, and the databases were worked without identifiers. We delivered a final report to the hospital's general management and shared the results with the authorities and the hospital's dengue team.

RESULTS

The Minister of Health's Epidemiology Surveillance System (ESS) reported 208 cases of DENV in 2022; between weeks 18 and 25, in 2023, they reported 731 cases, for a total of 939. We evaluated 141 medical records. For the mortality analysis, only 140 cases were considered since the final outcome was not found in one.

General characteristics of these cases. Sixty-six percent of the medical records were from women, almost 67/141 (47.51%) were previously in a healthcare center or other hospital; 31.20% had between 1-4 hours of delay in their referral, 56.73% were between 1-4 hours in triage, 76.60% had dengue with alarm signs, and 32% were in Uviclin and deceases 18.44% (see table 1).

Table 1. General characteristics of the total number of services (n=141)

Characteristics	N	%
Year		
2022	65	46.43
2023	75	53.57
Sex		
Women	93	66.43
Man	47	33.57
Age (m/iqr)	27.5	17 – 49.5
HSPI level		
First level	54	38.57
Second level	86	61.43
Hours of delay in reference		
< 1 hour	1	1.85
1-2 hours	23	42.59
2-4 hours	21	38.89
> 4 hours	9	16.67
Severity		
No warning signs	3	2.14
With warning signs	108	77.14
Serious	29	20.71
Sick days (m/iqr)	5	4-Jun
Days of Hospitalization (m/iqr)	4	2-Jun
Final condition		
Alive	114	81.43
Deceased	26	18.57

HSPI: Health Service Provider Institution; m= median, iqr= interquartile range; ICU: Intensive care unit

When considering the classification of severity or treatment, at healthcare facilities outside of the study site, triage and Uviclin/observation, there were a frequency of at least one error in 91.5%, 88.5% and 52.6%, respectively (see table 2). To explore the association between sociodemographic features, hospital care variables and severity/mortality, voluntary withdrawals were considered alive until discharge and the observation of “missing data” was eliminated for the final outcome (n =140).

When comparing the presence of at least one error in the healthcare center, triage and observation/Uviclin, no difference was found in mortality: p= 0.486, p= 0.281, p= 0.85 (see table 3). In the exploratory multivariate analysis, only severe dengue (PR: 28.13, 95% [CI , 9.32-84.86] p<0.001), and age 18 years or older (PR:2.97, 95%[CI, 1.19-7.43] p: 0.020), were associated with mortality. Neither the presence of at least one error in the center (p= 0.486), triage (p=0.281), and observation/uviclin (p=0.853), was associated with mortality) (see table 4).

Table 2. Frequency of errors in diagnosis and treatment of Dengue by service (n=141), 2022-2023 period

	Healthcare center/Hospital (n=60)		Triage* (n=134)		Observation** (n=114)	
	N	%	N	%	N	%
Classification error						
†						
Correct diagnosis	35	59.32%	91	68.94%	94	84.68%
Incorrect diagnosis	24	40.68%	41	31.06%	17	15.32%
Hydration						
Adequate	24	40.00%	31	23.31%	62	55.86%
Not suitable	36	60.00%	102	76.69%	49	44.14%
Urinary flow measurement						
Adequate	11	18.33%	61	46.21%	94	84.68%
Not suitable	49	81.67%	71	53.79%	17	15.32%
MAP control						
It was recorded	41	68.33%	88	66.17%	98	88.29%
It was not recorded	19	31.67%	45	33.83%	13	11.71%
At least one mistake						
No	3	5.00%	13	9.77%	46	41.07%
Yes	57	95.00%	120	90.23%	66	58.93%

MAP: mean arterial pressure; *: Triage: medicine, pediatrics and gynecology; **: medicine, pediatrics and gynecology; only Uviclin has patients exclusively from this area.

Table 03. Factors associated with dengue mortality in Piura (N=140)

Variables	Freq.	%	Alive		Deceased		p
			Freq.	%	Freq.	%	
Sex							
Women	93	66.43	78	83.87	15	16.13	0.296
Man	47	33.57	36	76.6	11	23.4	
Age group							
Under 18	38	27.14	35	92.11	3	7.89	0.047
18 or older	102	72.86	79	77.45	23	22.55	
Year of illness							
2022	65	46.43	59	90.77	6	9.23	0.008
2023	75	53.57	55	73.33	20	26.67	
HSPI level							
First level	54	38.57	46	85.19	8	14.81	0.365
Second level	86	61.43	68	79.07	18	20.93	
At least 01 error in Healthcare center							
No mistake	3	2.14	3	100	0	0	0.486 *
at least one mistake	57	40.71	49	85.96	8	14.04	
At least 01 error in triage							
No mistake	13	9.29	12	92.31	1	7.69	0.281
at least one mistake	120	85.71	96	80	24	20	
At least 01 error in observation							
No mistake	46	32.86	37	80.43	9	19.57	0.854
at least one mistake	66	47.14	54	81.82	12	18.18	
Dengue severity							
Non Severe Dengue	111	79.29	108	97.3	3	2.7	<0,001
Severe Dengue	29	20.71	6	20.69	23	79.31	

p of chi2; * p Fisher's test; HSPI: Health Service Provider Institution

Table 04. Factors associated with dengue mortality in Piura (N=140)

Variables	Bivariate		p	Multivariate		p
	PR	IC95%		PRa	IC95%	
Sex						
Women		Ref.	0.293			
Man	1.45	0,72 - 2,91				
Age group						
Under 18		Ref.	0.072		Ref.	0.02
18 or older	2.86	0,91 - 8,97		2.97	1,19 - 7,43	
Year of illness						
2022		Ref.	0.014			
2023	2.89	1,24 - 6,76				
HSPI level						
First level		Ref.	0.373		Ref.	0.109
Second level	1.41	0,66 - 3,02		0.65	0,38 - 1,10	
At least 01 error in triage						
No mistake		Ref.	0.329		Ref.	0.13
at least one mistake	2.6	0,38 - 17,68		1.75	0,85 - 3,60	
At least 01 error in observation						
No mistake		Ref.	0.853			
at least one mistake	0.93	0,43 - 2,02				
Dengue severity						
Non severe Dengue		Ref.	<0,001		Ref.	<0,001
Severe Dengue	29.34	9,46 - 90,98		28.13	9,32 - 84,86	

PR GLM link log and family binomial; PRa GLM link log and family poisson, adjusted by age group, HSPI level, at least one mistake in triage and dengue severity

DISCUSSION

The study's results indicate a high frequency of diagnostic and initial management errors in the pre-hospital and hospital phases. In both triage and the healthcare center, 9/10 treated patients experienced at least one error or omission during the process; in observation/Uviclin, this error occurred in 5/10 patients. Similarly, in the healthcare center (4/10) and in triage (3/10), patients were incorrectly classified based on their severity, which improved under observation. Only 2/10 patients in triage and 4/10 patients in the healthcare center, respectively, received adequate hydration.

The results may show bias in healthcare staff documentation because they may not have enough time to record every detail. Another possibility is a lack of standardized formats set up by the new National Technical Standard (5). This reality is often evident in scenarios of patient overload, epidemics, and care provided by front-line personnel with limited experience. A recent example was the COVID-19 pandemic, which made this type of inconvenience clear (14). On the other hand, a lack of adherence to the CPG recommendations is common not only in our country but in other realities and infectious pathologies such as COVID-19 (15).

Evidence suggests that the region has conducted training. Experts conducted four training sessions between 2023 and 2024: the first for 150 primary care health professionals (16), and the second for personnel with similar characteristics in the Morropon-Huancabamba Health Sub-Region (17). The Regional Directorate of Health Piura trained more than 1,200 nurses from the Ministry of Health (MINSA), Social Security (Essalud), Police Forces Health Facilities (Sanidad), and other healthcare establishments in a 12-hour workshop course in October 2023 (18, 19). However, it is crucial for any strategy to not only provide training for the personnel in charge but also to measure the baseline (knowledge, attitudes, and practices) (8) (10) and determine the impact afterwards. In this scenario, quasi-experimental studies are an attractive model and an especially useful tool (20).

In an 18-month study in India by Balkrishnan et al., in patients with DWS, pre- and post-intervention measurements were carried out, determining that the educational program had an impact on improving the admission and classification criteria, monitoring of vital signs, correct use of bolus fluids, fluid therapy in titration, hematocrit monitoring, platelet transfusion when indicated, and discharge criteria. Also, mortality decreased from 7.1% to zero. The median hospital stays decreased by one day (21). An attractive possibility is to describe the before and after evaluations conducted on doctors in Piura in 2023 (19). Qualitative research is another unexplored scenario that is potentially helpful in exploring the perceptions, attitudes, and

limitations of human resources. Quantitative measurement of adherence to a guideline is insufficient to explore these scenarios (22).

The Peruvian Health Ministry Directorate for the Prevention and Control of Metaxenic and Zoonotic Diseases developed a strategy to measure adherence to the National Technical Standard's recommendations (5). According to their findings, in Peru, adherence was 70.5% (249 evaluations), with 51.27% in treatment and 73.76% in diagnosis. After reviewing 33 records, global adherence was 68.22% in Piura, 73.74% in diagnosis, and 49.19% in treatment, ranking ninth out of 13 regions (23).

These figures are more encouraging; however, the evaluation of compliance should focus on the correct completion of forms and sociodemographic data rather than clinical aspects. We believe that our results can provide input for metaxenic strategies and other managers looking to improve training, infrastructure, and political commitment to addressing dengue. In the case of the Peruvian Social Security Health System (ESSALUD), 42 clinical records as of March 2024 from cities Piura, Lambayeque, La Libertad, Ancash, and Ica, were audited. It was found that the frequencies of notification to epidemiology surveillance, recording of the date of onset of symptoms, observation/hospitalization, parenteral hydration, recording of vital functions, and request for at least one blood count were 62%, 83%, 83%, 76%, 71%, and 91%, respectively (24). The National Health Ministry Health System made similar observations.

Even in patients with DWS, the high mortality rate of 18% is striking. Other probable causes include related comorbidities (which were not measured in this study) and limitations in diagnosis and case management. In a recent systematic review of our country, out of 17 publications between 1993 and 2023, including 10 regions of Peru and 2310 patients, mortality was 1.73% (25). The significant variation in mortality could potentially be attributed to our study's bias, as we exclusively included patients from Piura, our non-random sampling method, and the severity of our patients (20.7% of those who had severe dengue). However, in the exploratory multivariable analysis, the presence of at least one error in the hospital and in the health center, was not ultimately associated with mortality. This could be attributed to biases in the sample size (140/158) and sample design (consecutive), as well as the challenges of applying a retrospective checklist, which, despite training, may have measurement biases. Only dengue severity and age over 18 years, were associated with higher mortality.

There has been serious criticism of the efficiency of the reference and counter-reference systems in Peru. The referral process took more than 2 hours for more than 60% of patients (26). According to

the regional government, the hospital where the study took place has approved the formation of a counter-referral team, but its implementation is still under development (27). Meanwhile, over 30% stayed in triage for over four hours. Understaffing and insufficient areas of attention are possible explanations. The current National Technical Standard mandates that in DWS, medical care should begin in less than 30 minutes, with immediate intravenous hydration; in SD, immediate attention is needed (5). This study has found many challenges in implementing these measures.

Regarding the observation/Uviclin area's findings (55% of "at least one error"), we could attribute these findings to time constraints, patient overload, burnout, unnecessary form filling (National Insurance/discharge procedures), and possibly a lack of organization. This area requires monitoring with practical protocols. It is also imperative to verify the proper operation of equipment and supplies.

Theoretically, hospitalized first-level health care facilities (I-3 and I-4) can handle dengue diagnosis and alarm signs by providing an immediate response based on hydration and vital sign monitoring (blood pressure, heart rate, respiratory rate, temperature, oxygen saturation, water and electrolyte balance, etc.), which forms the foundation of effective dengue management. These facilities typically have a basic laboratory that works between 12 and 24 hours for monitoring with a complete blood count, although dengue management is still clinical in the Americas, according to the WHO (28). Again, human resource training (3, 4), as well as a lack of clear and socialized processes, could explain this reality.

One of the study's limitations was that it did not meet the required sample size (n = 159 medical

records). Some of the reasons for this were the inability to find the clinical history, incomplete data in the follow-up, and a lack of digitization of data and processes. However, the limitations prevented a random sampling process. Likewise, the 2023 cases were limited to weeks 18-25 (the peak of the outbreak). However, we believe that these results can serve to support any effort in the implementation of the electronic health record to improve information management (29)(30). The Ministry of Health and the regional governments still have unresolved issues.

We firmly believe that there are various actions that the Government in alliance with universities, should apply to improve the processes of care for Dengue cases:

1. Improvement of information systems, which implies improving the infrastructure and interoperability of the systems that results in adequate registration of data and an improvement in health management.
2. Clarification and socialization of care processes in institutions and in reference and counter-reference processes between institutions.
3. Training through action-participation methodologies to achieve the involvement of administrative and clinical actors, evaluating the system's response before and after the interventions.
4. Commitment of the universities of the Piura region from undergraduate, postgraduate and specialization to generate joint work with the strategies of the Ministry of Health in the care of patients with dengue

In conclusion, we found a high frequency of errors in the diagnosis of severity and in the treatment of patients with DWS and SD in the pre-hospital and hospital phases, but the sample size was insufficient to determine whether this finding had an impact on mortality.

REFERENCES

1. Pan American Health Organization. PLISA: Health Information Platform for the Americas [Internet]. Washington (DC): PAHO; [cited 2024 Feb 12]. Available from: <https://opendata.paho.org/en>
2. Peru. Ministerio de Salud. Centro Nacional de Epidemiología, Prevención y Control de Enfermedades. Sala situacional de dengue [Internet]. Lima: MINSA; [cited 2024 Feb 12]. Available from: <https://www.dge.gob.pe/sala-situacional-dengue/diaria/>
3. World Health Organization. Dengue and severe dengue [Internet]. Geneva: WHO; [cited 2022 Aug 17]. Available from: <https://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue>
4. Pan American Health Organization. Dengue: guidelines for patient care in the Region of the Americas. 2nd ed. Washington (DC): PAHO; 2016. Available from: <https://iris.paho.org/items/499a0290-7f8d-4bc8-865e-94e75eee06d5>
5. Peru. Ministerio de Salud. Resolución Ministerial N.º 082-2024-MINSA: Plan de prevención y control del dengue 2024 [Internet]. Lima: MINSA; 2024 [cited 2024 Mar 26]. Available from: <https://cdn.www.gob.pe/uploads/document/file/5813240/5156456-resolucion-ministerial-n-082-2024.pdf>
6. Peru. Ministerio de Salud. Resolución Ministerial N.º 175-2024/MINSA: Norma Técnica de Salud para la atención integral de pacientes con dengue en el Perú [Internet]. Lima: MINSA; 2024 [cited 2024 Mar 10]. Available from:

- <https://cdn.www.gob.pe/uploads/document/file/6007546/5323501-rm-175-2024-minsa-y-nts-211-dgiesp.pdf>
7. Koonisetty KS, Aghamohammadi N, Urmi T, Yavaşoglu Sİ, Rahman MS, Nandy R, et al. Assessment of knowledge, attitudes, and practices regarding dengue among physicians: a web-based cross-sectional survey. *Behav Sci (Basel)*. 2021;11(8):105. doi:10.3390/bs11080105
 8. Laoprasopwattana K, Khantee P, Saelim K, Geater A. Mortality rates of severe dengue viral infection before and after implementation of a revised guideline for severe dengue. *Pediatr Infect Dis J*. 2022;41(3):211-216. doi:10.1097/INF.0000000000003411
 9. León-Jiménez FE, Inga-Chero JE, Mendoza-Farro NBF, Montoya-Reátegui A, Dioses-Díaz K, Cavalcanti-Ramírez S, et al. Características y errores más frecuentes en el diagnóstico y tratamiento del dengue en un hospital del norte peruano, 2022. *An Fac Med (Lima)*. 2023;84(2):210-212. doi:10.15381/anales.v84i2.25494
 10. Rodríguez J, Lastre G, Camargo J, Fuentes G, Bermejo J, Nieto V. Adherencia de los pacientes a la guía de práctica clínica del dengue (GPC_Dengue) en una clínica de Barranquilla (Atl, Col). *Cienc Innov Salud*. 2015;3(2):23-30.
 11. Valderrama Ardila M, Velasco M, Molina López A, Perea Ayala M, Noguera Quiñones D, Rodríguez Arenas D, et al. Evaluation of the management of pediatric patients diagnosed with dengue in a medium-complexity children's clinic, according to the new WHO guideline. *Rev Colomb Salud Libre*. 2011;9:33-44.
 12. Peru. Ministerio de Salud. Estadística poblacional [Internet]. Lima: MINSA; [cited 2024 Apr 18]. Available from: https://www.minsa.gob.pe/reunis/data/poblacion_estimada.asp
 13. Hospital de la Amistad Perú-Corea Santa Rosa II-2 [Internet]. Piura: Gobierno del Perú; [cited 2022 Sep 23]. Available from: <https://www.gob.pe/hsantarosa>
 14. Lake EA, Demissie BW, Gebeyehu NA, Wassie AY, Gelaw KA, Azeze GA. Knowledge, attitude and practice towards COVID-19 among health professionals in Ethiopia: a systematic review and meta-analysis. *PLoS One*. 2021;16(2):e0247204. doi:10.1371/journal.pone.0247204
 15. Carrera-Acosta L, Salvador-Salvador S, Torre-Maraví GE. Evaluación de la adherencia de guías de práctica clínica en el Seguro Social del Perú. *Rev Cuerpo Med HNAAA*. 2021;14(4):430-431. doi:10.35434/rmhnaaa.2021.144.1355
 16. Dirección Regional de Salud Piura. Capacitan al personal de salud para fortalecer las intervenciones sanitarias contra el dengue [Internet]. Piura: Gobierno del Perú; 2023 [cited 2024 May 30]. Available from: [https://www.gob.pe/institucion/regionpiura-diresa/noticias/752982-capacitan-al-](https://www.gob.pe/institucion/regionpiura-diresa/noticias/752982-capacitan-al-personal-de-salud-para-fortalecer-las-intervenciones-sanitarias-contra-el-dengue)
 - [personal-de-salud-para-fortalecer-las-intervenciones-sanitarias-contra-el-dengue](https://www.gob.pe/institucion/regionpiura-diresa/noticias/752982-capacitan-al-personal-de-salud-para-fortalecer-las-intervenciones-sanitarias-contra-el-dengue)
 17. Dirección Subregional de Salud Morropón Huancabamba. Fortalecen capacidades de personal de salud para una mejor atención de pacientes con dengue en el Alto Piura [Internet]. Piura: Gobierno del Perú; 2023. Available from: <https://www.gob.pe/institucion/regionpiura-dsrmh/noticias/768037-fortalecen-capacidades-de-personal-de-salud-para-una-mejor-atencion-de-pacientes-con-dengue-en-el-alto-piura>
 18. Peru. Ministerio de Salud. Piura: médicos son capacitados para atender a pacientes afectados por dengue [Internet]. Lima: MINSA; 2024 [cited 2024 Mar 26]. Available from: <https://www.gob.pe/institucion/minsa/noticias/843478-piura-medicos-son-capacitados-para-atender-a-pacientes-afectados-por-dengue>
 19. Dirección Regional de Salud Piura. Más de 1,200 enfermeras son capacitadas para enfrentar al dengue en la región Piura [Internet]. Piura: Gobierno del Perú; 2024 [cited 2024 Mar 26]. Available from: <https://www.gob.pe/institucion/regionpiura-diresa/noticias/900660-mil-200-enfermeras-son-capacitadas-para-enfrentar-al-dengue-en-la-region-piura>
 20. Fondo de las Naciones Unidas para la Infancia. Síntesis metodológica n.º 8: evaluación de impacto [Internet]. Florencia: UNICEF Office of Research-Innocenti; [cited 2023 Jun 6]. Available from: <https://www.unicef-irc.org/publications/pdf/MB8ES.pdf>
 21. Balkrishnan P, Panda PK, Pandey RM, Biswas A, Aggarwal P, Vikram NK, et al. Compliance of WHO guideline on dengue management among Indian patients: an interventional quality improvement study. *J Assoc Physicians India*. 2019;67(4):30-34. PMID:31299835.
 22. Wharton-Smith A, Green J, Loh EC, Gorrie A, Omar SFS, Bacchus L, et al. Using clinical practice guidelines to manage dengue: a qualitative study in a Malaysian hospital. *BMC Infect Dis*. 2019;19(1):45. doi:10.1186/s12879-019-3680-5
 23. Peru. Ministerio de Salud. Dirección de Prevención y Control de Enfermedades Metaxénicas y Zoonosis. Evaluación de adherencia a normas técnicas de salud [Internet]. Lima: MINSA; [cited 2024 Apr 15]. Available from: <https://lookerstudio.google.com/u/0/reporting/695d47ab-cb34-48ee-b1dc-471925689515/page/xpKkD>
 24. Instituto de Evaluación de Tecnologías en Salud e Investigación. Evaluación de adherencia a la Guía de Práctica Clínica para la atención de casos de dengue en el Perú en EsSalud, al 12/03/2024 [Internet]. Lima: EsSalud; 2024 [cited 2024 Apr 15]. Available from: <https://ietsi.essalud.gob.pe/wp-content/uploads/2024/03/Reporte.pdf>

25. Ledesma Negreiros GC, Rodríguez Vásquez S, Valencia Hipólito JV. Características clínicas y situación epidemiológica del dengue en Perú: una revisión sistemática. *Rev Cuerpo Med HNAAA*. 2024;17(1). doi:10.35434/rmhnaaa.2024.171.2409
26. Llanos-Zavalaga LF, Orellana-Vásquez AT, Aguado-Taquire HF. Evaluación inicial del sistema de referencia y contrarreferencia ambulatoria en la DIRIS Lima Norte, desde los centros materno infantiles. *Rev Med Hered*. 2021;32(2):91-102. doi:10.20453/rmh.v32i2.3982
27. Gobierno Regional de Piura. Dirección Regional de Salud Piura. Hospital de la Amistad Perú-Corea Santa Rosa II-2. Resolución Directoral N.º 060-2022/GOB.PIURA-DRSP-HAPCSR-II-2-DIR-UDS: conformación del equipo de referencias y contrarreferencias [Internet]. Piura: Hospital Santa Rosa; 2022 [cited 2023 Jun 6]. Available from: https://www.hsantarosa.gob.pe/PORTAL/RD_060.pdf
28. Pan American Health Organization. Declaration of Alma-Ata [Internet]. Washington (DC): PAHO; 2012 [cited 2023 May 30]. Available from: <https://www.paho.org/hq/dmdocuments/2012/Alma-Ata-1978Declaracion.pdf>
29. Sampaio VS, Lopes R, Ozahata MC, Nakaya HI, Sousa E, Araújo JD, et al. Thinking out of the box: revisiting health surveillance based on medical records. *Antimicrob Steward Healthc Epidemiol*. 2023;3(1):e185. doi:10.1017/ash.2023.451
30. Peru. Ministerio de Salud. Resolución Ministerial N.º 618-2019/MINSA: Documento técnico: Plan de implementación del Registro Nacional de Historias Clínicas Electrónicas - RENHICE [Internet]. Lima: MINSA; 2019 [cited 2025 Mar 30]. Available from: <https://www.gob.pe/institucion/minsa/normas-legales/283745-618-2019-minsa>