

Clinical simulation in dengue education: from recognizing warning signs to decision-making

Simulación clínica en la educación sobre el dengue: desde el reconocimiento de las señales de alerta hasta la toma de decisiones

Simulação clínica no ensino da dengue: do reconhecimento dos sinais de alarme à tomada de decisão

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***Corresponding author:**nailaa.oliveira@gmail.com**Submission:** 09-07-2026**Approval:** 10-12-2026**Abstract**

This report describes the experience of developing and implementing clinical simulation scenarios focused on dengue for medical students, with an emphasis on assessment, classification, clinical reasoning, and decision-making. It is a descriptive account of an experience within a medical degree program in the interior of the state of São Paulo. The preparatory phase took place between February and June 2026, involving 11 sessions and 210 students. The scenarios were developed based on scientific literature and the Brazilian Ministry of Health's recommendations for the diagnosis and clinical management of dengue. Two scenarios featuring a standardized patient were created, set in a Primary Health Care Unit and an Emergency Care Unit, to reflect different levels of care complexity. Each scenario included learning objectives, case progression, clinical cues, expected actions, required resources, briefing, and debriefing. The educational effectiveness of the intervention was not within the scope of this report. The process resulted in the creation of structured scenarios grounded in current clinical guidelines, which are suitable for use in medical education, though their effectiveness remains to be evaluated in future studies.

Descriptors: Simulation Training; Patient Simulation; Dengue; Medical Education; Primary Health Care.

Resumen

El objetivo fue describir la experiencia de construcción y desarrollo de escenarios de simulación clínica sobre el dengue para estudiantes de Medicina, con énfasis en la evaluación, clasificación, razonamiento clínico y toma de decisiones. Se trata de un relato de experiencia de carácter descriptivo, desarrollado en un programa de Medicina en el interior del estado de São Paulo. La etapa preparatoria tuvo lugar entre febrero y junio de 2026, con 11 encuentros y 210 estudiantes. La construcción de los escenarios se fundamentó en la literatura científica y en las recomendaciones del Ministerio de Salud para el diagnóstico y manejo clínico del dengue. Se elaboraron dos escenarios con paciente estandarizado, ambientados en una Unidad Básica de Salud y una Unidad de Atención de Urgencias, abarcando diferentes niveles de complejidad asistencial. Los escenarios incluyeron objetivos de aprendizaje, evolución de los casos, pistas clínicas, acciones esperadas, recursos materiales, briefing y debriefing. La efectividad educativa no formó parte del alcance de este relato. La experiencia permitió construir escenarios estructurados y basados en las recomendaciones vigentes, aptos para su uso en la formación médica, cuya efectividad deberá evaluarse en estudios posteriores.

Descriptores: Entrenamiento Mediante Simulación; Simulación de Pacientes; Dengue; Educación Médica; Atención Primaria de Salud.

Resumo

Objetivou-se descrever a experiência de construção e desenvolvimento de cenários de simulação clínica sobre dengue para estudantes de Medicina, com ênfase na avaliação, classificação, raciocínio clínico e tomada de decisão. Relato de experiência, de natureza descritiva, desenvolvido em curso de Medicina do interior do estado de São Paulo. A etapa preparatória ocorreu entre fevereiro e junho de 2026, com 11 encontros e 210 estudantes. A construção dos cenários fundamentou-se em literatura científica e nas recomendações do Ministério da Saúde para diagnóstico e manejo clínico da dengue. Foram construídos dois cenários com paciente padronizado, ambientados em Unidade Básica de Saúde e Unidade de Pronto Atendimento, contemplando diferentes níveis de complexidade assistencial. Os cenários incluíram objetivos de aprendizagem, evolução dos casos, pistas clínicas, ações esperadas, recursos materiais, briefing e debriefing. A efetividade educacional não integrou o escopo do relato. A experiência possibilitou construir cenários estruturados e fundamentados nas recomendações vigentes, passíveis de utilização na formação médica, cuja efetividade deverá ser avaliada em estudos posteriores.

Descritores: Treinamento por Simulação; Simulação de Paciente; Dengue; Educação Médica; Atenção Primária à Saúde.

Introduction

Arboviruses, diseases caused by viruses transmitted by arthropods such as mosquitoes, have become one of the major challenges facing global public health. In Brazil, the situation is exacerbated by the widespread circulation of dengue virus (DENV), Zika virus (ZIKV), and chikungunya virus (CHIKV), with recurrent epidemics that overburden healthcare systems, affect epidemiological surveillance, and impose a substantial burden of morbidity and mortality on the population¹. The cocirculation of these viral agents in urban environments, combined with the lack of specific antiviral therapies, limited vaccination coverage, and ineffective control of the *Aedes aegypti* vector, increases the complexity of diagnosis and clinical management^{2,3}.

In addition to environmental and epidemiological factors, unplanned urban growth and inadequate basic infrastructure, including sanitation and drainage systems, contribute significantly to vector proliferation. Studies indicate that peripheral urban areas characterized by socioeconomic and environmental vulnerabilities have the highest rates of arboviral infections³. Despite the relevance of this issue, public policy instruments lack integrated approaches that effectively incorporate basic sanitation as a strategy to address these diseases².

In this context, the training of healthcare professionals becomes a central component of the healthcare response to arboviruses. However, the literature highlights gaps in technical training for the early recognition and appropriate clinical management of these conditions^{1,3}. Concurrently, international recommendations increasingly advocate the adoption of active learning methodologies in health education, particularly high-fidelity clinical simulation as a promising tool for acquiring cognitive, psychomotor, and interpersonal competencies^{4,5}.

Simulation provides a safe, controlled, and realistic environment for training students and professionals, fostering the development of essential clinical skills, such as clinical judgment, decision-making, and effective communication, without exposing actual patients to risk^{4,6}. Studies demonstrate that well-structured and validated simulation scenarios improve technical and behavioral performance, promote critical reflection on clinical practice, and increase participants' self-confidence^{7,8}.

Developing an effective scenario requires rigorous educational planning, including the definition of learning objectives, available resources, the required level of fidelity, and the target audience's profile. Methodological guidelines must also be followed to ensure content validity, realism in the approach, and effective measurement of educational outcomes⁵. In this regard, previous experiences demonstrate that validation by expert judges and pilot testing with students are crucial steps in ensuring the quality of simulation as an educational strategy^{6,8}.

Although the use of clinical simulation is well documented in areas such as sepsis, postpartum hemorrhage, and colostomy care, few scenarios specifically address arboviruses^{6,7}. This gap represents an opportunity for innovation in medical and nursing education, contributing to the practical training of healthcare teams in

managing highly prevalent infectious diseases with a substantial social impact.

Accordingly, this project proposes the development and validation of a clinical simulation scenario on arboviruses, focusing on the identification and management of suspected cases of dengue, Zika, and chikungunya. The proposal aims to integrate clinical and epidemiological knowledge with practical healthcare skills, promoting a meaningful, reflective learning experience grounded in the realities of the Brazilian healthcare system.

Methodology

This is a descriptive experience report on the implementation of clinical simulation as a teaching and learning strategy in medical education⁹⁻¹¹.

The experience was conducted within the Primary Health Care (PHC) and Clinical Skills module, with an emphasis on the management of severe dengue, in an undergraduate medical program at a higher education institution located in the interior of the state of São Paulo, Brazil. The activities involved students enrolled in the fifth semester (third year) of the program.

The pre-simulation phase was conducted between February and June 2026 and comprised 11 sessions aimed at developing and refining the knowledge and skills required to participate in the simulated scenario. During this phase, topics included dengue classification, clinical management and treatment, development of clinical reasoning framework, and identification and interpretation of warning signs and indicators of disease severity. Theoretical activities were delivered through interactive lectures across four groups, comprising a total of 210 students, in accordance with the previously established academic schedule. These activities preceded the simulation experience and aimed to provide the theoretical and practical foundations for clinical reasoning and decision-making in response to the situations presented in the simulation scenario.

The planning and development of the clinical simulation scenario were conducted systematically, encompassing the definition of primary and secondary learning objectives; the allocation of time for environmental setup, briefing, scenario implementation, and debriefing; the selection of equipment and consumable materials; the organization of the simulation environment; the description of the clinical case; the definition of the expected sequence of actions; the development of a checklist of student actions; and the programming of commands and responses for the high-fidelity mannequin (Charts 1 and 2). Following its development, the simulation scenario was evaluated for content and technical aspects by a professional holding a doctoral degree in Public Health and expertise in arboviruses (Figure 1). This stage aimed to assess the scenario's suitability for the subject matter and proposed educational objectives, as well as to verify the consistency of the clinical information and technical aspects involved in the simulated activity. Before the scenario was implemented, a briefing was conducted to orient students regarding the activity's procedures, the organization of the simulated environment, and the conditions required for their participation. The



students then participated in the previously structured clinical scenario, applying the knowledge and skills acquired during the preparatory phase to assess the clinical situation, recognize clinical signs, and make decisions.

Following the scenario, a debriefing session was conducted, structured into the stages of description/reaction, analysis/understanding, and synthesis/evaluation. This session provided an opportunity

to reflect on the actions performed during the simulation experience, enabling discussion of student performance and aspects related to clinical reasoning, decision-making, communication, and teamwork. Regarding ethical considerations, student anonymity and the confidentiality of institutional information were preserved. No details that could identify the participants or the higher education institution where the experience took place were disclosed.

Figure 1. Stages of preparation and development of simulation scenarios. Araras, São Paulo, Brazil, 2026

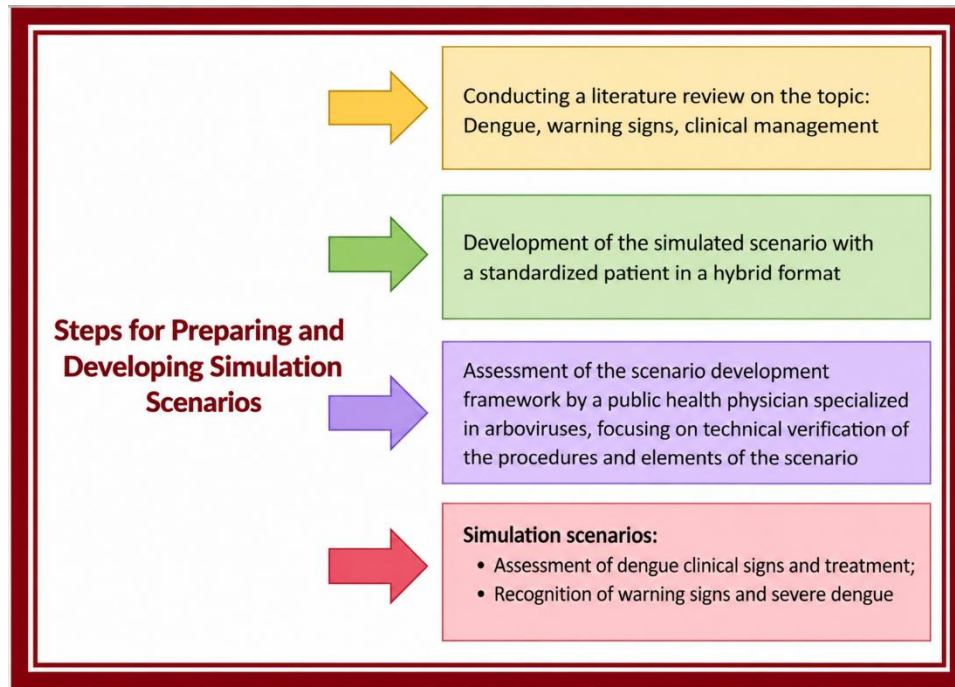


Figure 1 presents a flowchart illustrating the methodological steps adopted to develop clinical simulation scenarios on dengue, organized sequentially and intended for fifth- and sixth-semester medical students. To support the development of the scenarios, searches were conducted in national and international databases to identify evidence related to the clinical management of dengue. The content and clinical management procedures incorporated into the scenarios were based on the recommendations of the

Brazilian Ministry of Health, as established in the manual Dengue: Diagnosis and Clinical Management: Adults and Children, 6th edition¹². Based on this reference, the scenarios were developed to foster and enhance skills related to clinical assessment, dengue classification, therapeutic management, identification of warning signs and indicators of disease severity, and early recognition of severe dengue cases.

Chart 1. Guide for the Arbovirus Simulation Scenario. Araras, São Paulo, Brazil, 2026

Planning: assessment of the requirements for scenario development: literature review, definition of the target audience, establishment of objectives; development of the clinical situation; preparation of the content, facilitator, and setting; and planning of the materials and resources required to conduct the activity.
Learning Objectives: Primary Identify the most prevalent arboviruses in Brazil Implement preventive interventions in response to classic signs and symptoms Identify warning signs and severity criteria Secondary Reflect on the social, environmental, and epidemiological impact of arboviruses Practice teamwork and shared decision-making
Simulation Structure and Format: high-fidelity clinical simulation with a simulated patient
Materials and Resources: Nursing consultation room with a debriefing room

Hand sanitizer bottle
 Stethoscope
 Sphygmomanometer
 Examination table
 Thermometer
 Venipuncture equipment
 Normal saline solution
 Simulated printouts of complete blood count, serological tests, NS1 antigen test, RT-PCR, urinalysis, serum albumin and transaminases;
 abdominal ultrasound
 Emergency Department history-taking and physical examination form
 Notification form

Case Description:

You, a medical student, are assigned to provide care to patient B.M.A.

B.M.A., a 53-year-old woman, presented to the Emergency Department (ED) with persistent hypotension associated with fever, nausea, vomiting, and severe abdominal pain for three days. During history-taking, she reported a previous history of epilepsy (on continuous treatment with Depakene 500 mg and lamotrigine 100 mg, both every 12 hours), surgery for achalasia correction, and hospitalization for severe dengue in 2021. She denied respiratory and urinary symptoms. No dengue serological testing had been performed up to that point.

On admission, aggressive fluid resuscitation with 0.9% normal saline was initiated, with transient improvement in hypotension. Dengue serology was requested and the case was reported. Initial laboratory tests showed thrombocytopenia (99,000/ μ L), leukopenia (1,400/ μ L), and markedly elevated transaminases (AST: 155 U/L; ALT: 177 U/L). Physical examination revealed a Glasgow Coma Scale score of 15; the abdomen was soft and non-tender, with no signs of peritonitis; Blumberg, Murphy, and Giordano signs were negative. After fluid resuscitation, hypotension recurred, and an Internal Medicine consultation was requested; the team recommended an abdominal CT scan and admission to the Intensive Care Unit (ICU).

In the ICU, the patient was classified as having Group C dengue, progressing to Group D. Her blood pressure was 89/45 mmHg and mean arterial pressure (MAP) was 60 mmHg despite 4 L of fluid replacement. Echocardiography showed a small pericardial effusion, and CT revealed no relevant abnormalities. Vasoactive medication was initiated (norepinephrine at 5 mL/h); she maintained spontaneous ventilation and had a positive fluid balance of 3,710 mL/24 h, with ++/4+ edema in the limbs. Point-of-care ultrasound (POCUS) showed a small right pleural effusion and moderate venous congestion on the VExUS score. The abdomen became distended, with pain on deep palpation of the right flank.

On the second day, laboratory findings worsened (platelets 67,000/ μ L; leukocytes 940/ μ L). Additional serological tests and cultures were collected. On the third day, despite partial improvement in edema and laboratory results (platelets 119,000/ μ L; leukocytes 4,310/ μ L), abdominal pain persisted, and a repeat CT scan was requested. The scan showed a small amount of free pelvic fluid, mild perivesicular fat stranding, and bilateral pleural effusions. Ultrasonography findings were consistent with suspected acalculous cholecystitis, a complication associated with the viral illness.

On the fourth day, dengue serology returned positive, confirming the diagnosis. B.M.A. was then classified as having dengue shock syndrome. Laboratory parameters progressively improved (AST: 56; ALT: 86; platelets: 139,000/ μ L), and her clinical condition stabilized. On the sixth day, edema and anemia improved (Hb: 11.2 g/dL). She remained in good general condition and was walking independently.

On the ninth day, she was discharged from the ICU and transferred to the general ward. On the tenth day, she was hemodynamically stable, with a platelet count of 374,000/ μ L and resolution of clinical signs and was discharged from the hospital.

The scenario should be stopped when the proposed activity is completed or when the 15-minute time limit is reached.

Briefing: before the scenario begins, present the case, the environment, and the resources available for care.

Debriefing¹³⁻¹⁵

Duration: 25 minutes

How do you feel after completing the simulated activity? What were your impressions of the care provided?

What stood out to you most during the care provided? Explain.

Identify positive aspects of the simulated activity.

Identify areas for improvement. What would you do differently, and why?

What did you learn from this simulated activity?

What skills were developed during this activity?

How many warning signs were identified, and what actions should the physician take in response to the problem presented?

Which additional tests should be requested during care? Why?

What therapeutic plan is proposed for this patient?

What are the criteria for hospital discharge?¹⁶

Assessment: the scenario will be evaluated through a group discussion at the end of the scenario.

Chart 2. Guide for the Dengue Simulation Scenario in a Primary Health Care Unit (UBS). Araras, São Paulo, Brazil, 2026

Simulation Team Members:

Facilitator: will provide key information to guide clinical reasoning and, consequently, the participant's care of the patient; will lead the debriefing to encourage reflection on the student's/participant's care experience during the simulation scenario.



Technical Support: a staff member from the Simulation Laboratory will be responsible for operating the audio and video equipment and the simulator software, if applicable.

Simulated Patient: B.M.A. (female, 53 years old)

Target Audience: Medical students

Educational Activities:

Active learning: participants who will take part in the scenario

Passive learning: participants observing the scenario

Both groups will participate in the post-scenario discussion (debriefing)

Objectives:

General:

- Provide care to a patient presenting with dengue warning signs.

Specific:

- Conduct a comprehensive medical history and physical examination focused on dengue warning signs.
- Establish an initial treatment plan (intravenous hydration and referral to an emergency care unit (UPA) or hospital).
- Request laboratory tests and interpret simulated results (complete blood count, transaminases, serology, NS1 antigen, RT-PCR).
- Assess social vulnerabilities and apply a compassionate, interprofessional approach.

Simulation structure and format: High-fidelity simulation with a standardized patient in an urgent care unit (UPA) setting.

Problem-solving:

- Obtain the patient's history (medical record available in the scenario);
- Demonstrate cultural competence (an attribute derived from Primary Health Care [PHC]), which should be implicitly understood by the students.
- Have prior knowledge of arboviruses, their respective warning signs, and treatments.

Clinical Cues:

- Age, sex, chief complaint, symptom duration, symptoms, and warning signs

Social Cues:

- Socioeconomic vulnerability, exclusive reliance on the Brazilian Unified Health System (SUS), and informal employment.

Physical Examination Cues:

- Fair general condition, cold extremities, weak and thready pulse, abdominal tenderness on palpation, mild gingival bleeding, and fever.

Diagnostic Reasoning Cues:

- Sixth day of symptoms, evidence of plasma leakage, and elevated hematocrit.

Materials and Resources:

Clinical examination room with a debriefing room

Bottle of alcohol-based hand sanitizer

Stethoscope

Sphygmomanometer

Examination bed

Thermometer

Venipuncture equipment

Normal saline solution

Simulated printouts of complete blood counts, serology tests, NS1 antigen tests, RT-PCR, urinalysis, serum albumin, and transaminase results; abdominal ultrasound

Printed Multidimensional Assessment Tool for Older Adults in Primary Health Care.

Case Description:

Patient R. S. M. is a 67-year-old woman, a homemaker, residing in a dengue-endemic area in the countryside of São Paulo state, Brazil.

She presents to the primary health care unit (UBS) with a 4-day history of retro-orbital pain and myalgia. She reports fever (38.5°C) during the first 2 days but has been afebrile for the past 48 hours. She reports mild dizziness upon standing, without syncope. She denies abdominal pain, persistent vomiting, bleeding, rash, or pruritus. She has taken paracetamol 500 mg every 8 hours, without significant improvement. She reports that two nearby neighbors experienced similar symptoms during the previous week.

Medical history: denies comorbidities (diabetes mellitus/arterial hypertension), allergies, and use of acetylsalicylic acid (ASA)/nonsteroidal anti-inflammatory drugs (NSAIDs). Yellow fever vaccination is up to date.

Initial physical examination: BP 110/70 mmHg, HR 92 bpm, RR 18 breaths/min, temperature 36.9°C, SpO₂ 98%, dyspnea on mild exertion, severe headache (10/10), poor appetite, moist mucous membranes, no jaundice, no rash, and a soft, non-tender abdomen.

You are the physician at the primary health care unit (UBS) responsible for the initial assessment.

The scenario should be stopped when the student determines the management plan (additional tests, risk classification, referral, or guidance) or after 15 minutes.

Briefing: Before the scenario begins, present the case, the environment, and the resources available for patient care.



Debriefing:

Structured debriefing. Duration: 30 minutes.

How do you feel after completing the simulation activity? What are your perceptions of the care provided?

What stood out to you most about the care provided? Explain your answer.

Identify positive aspects of the simulation activity.

Identify areas for improvement. What would you do differently, and why?

What did you learn from this simulation activity?

What skills were developed during this activity?

How many warning signs were identified, and what actions should the physician take in response to the presenting problem?

Which additional tests should be requested during the assessment? Why?

What management plan is proposed for this patient?

What are the criteria for hospital discharge?

Chart 2 describes the development, organization, planning, and implementation of the simulation scenario in a primary healthcare unit.

Experience Report

The educational experience was developed with medical students through a planned sequence of theoretical and practical activities aimed at exposing them to clinical situations related to the care of patients with suspected dengue at different levels of healthcare. Initially, preparatory sessions were held to address the epidemiological and clinical aspects of the disease, case classification, warning signs and indicators of severity, therapeutic management, and criteria for determining appropriate clinical management. This phase preceded the simulation and provided the theoretical foundation necessary for students to participate in the proposed scenarios.

Following the preparatory phase, the experience was conducted through two clinical simulation scenarios involving standardized patients, structured within distinct healthcare settings and featuring progressively increasing clinical complexity. The first scenario was set in a Primary Health Care Unit (Unidade Básica de Saúde, UBS) and involved a 67-year-old female patient presenting with an acute febrile illness and an epidemiological context consistent with dengue. During the activity, students were required to perform a clinical assessment, investigate relevant information from the patient's medical history, recognize manifestations consistent with the disease, classify the case, and establish appropriate management according to Primary Health Care guidelines. The second scenario took place in an Emergency Care Unit (Unidade de Pronto Atendimento, UPA) and involved a 53-year-old female patient whose clinical condition had progressed to include warning signs, hemodynamic instability, and laboratory abnormalities. The progression of the case required students to identify signs indicating greater severity, integrate clinical and laboratory findings, and determine the initial management measures appropriate to the situation. Thus, the experience sought to reproduce a clinical situation requiring timely recognition of clinical deterioration, prioritization of interventions, and decision-making.

Before each scenario began, a briefing was conducted to provide students with guidance on the simulation

procedures, the organization of the environment, and the implementation of the activity. This stage enabled participants to become familiar with the simulated context and the resources available for providing care.

During the scenarios, previously structured scripts were used, specifying the sequence of case progression, the expected actions of participants, and the standardized responses of the simulated patient. These scripts helped organize the progression of the clinical situations and ensure greater consistency in the implementation of the experience across different student groups.

At the end of each scenario, a debriefing session was conducted to provide an opportunity for reflection on the experience. During this session, the decisions made throughout the simulation were reviewed, allowing discussion of clinical reasoning, identification of warning signs and indicators of severity, proposed management measures, communication, and student performance in response to the situations presented. In the UPA scenario, the debriefing was structured according to the PEARLS model, while the NLN/JSF model was used as a reference for scenario design¹⁷.

The experience enabled the integration of previously addressed content with simulated situations representing different levels of healthcare complexity. The use of scenarios set in the UBS and UPA made it possible to address dengue management from the initial assessment and case classification to the recognition of manifestations indicating clinical deterioration and the need to adapt management measures to the corresponding level of care. However, it should be emphasized that the experience was not intended to measure learning gains or changes in students' clinical performance; these aspects may be investigated in subsequent evaluations.

Discussion

The findings of this study demonstrate the development of two structured and documented clinical simulation scenarios for teaching dengue management in undergraduate medical education, implemented in different levels of the healthcare network: a Primary Health Care Unit (UBS) and an Emergency Care Unit (UPA). Developing scenarios in distinct healthcare settings is a relevant feature of this educational product, as it enables the exploration of clinical situations involving different levels of complexity and decision-making demands, bringing the educational content



closer to the organization of care within the healthcare network¹⁸.

Although dengue is the central clinical condition in both scenarios, they were designed to engage different components of clinical reasoning. The scenario set in the UBS focuses on the initial assessment of an older female patient residing in an endemic area, requiring clinical evaluation, identification of epidemiological factors, recognition of disease manifestations, case classification, and determination of appropriate management according to Primary Health Care guidelines. In contrast, the UPA scenario includes warning signs, laboratory abnormalities, and hemodynamic instability, increasing the complexity of the situation and directing decision-making toward recognition of disease severity, assessment of hemodynamic status, initial management, and determination of the need for hospitalization^{18,19}.

This differentiation between scenarios facilitates the teaching of dengue management across different points in the healthcare network, representing the progression of clinical complexity and the decisions required at each level of care. Thus, the cases extend beyond diagnostic identification of the disease to incorporate clinical classification, recognition of warning signs and indicators of severity, and adaptation of management measures to the healthcare setting^{19,20}.

Another finding concerns the systematic structure of the scenarios. Both include defined learning objectives, simulation team composition, standardized patient characterization, environmental organization, clinical and social cues, physical examination findings, case progression, expected participant actions, material resources, criteria for terminating the scenario, briefing, and debriefing. This organization demonstrates alignment between educational planning and the implementation of the simulated activity, providing greater clarity regarding the steps required for its execution^{18,20}.

The inclusion of graded cues and scripts containing predetermined responses for the standardized patient is also an important component of scenario design. These elements help organize clinical progression during the activity and promote greater consistency in the presentation of information to different groups. In the UPA scenario, the inclusion of a temporally organized script further strengthens this systematic approach by specifying the expected participant actions and the simulated patient's responses throughout the scenario¹⁸⁻²⁰.

From a pedagogical perspective, the scenarios were structured to integrate the simulation experience with the principles of experiential learning. Participation in the scenario represents the concrete experience of a clinical situation, while the debriefing provides an opportunity for reflection, analysis of decisions, and integration of theoretical knowledge with situations experienced during the simulation. In the UPA scenario, the PEARLS model was adopted to structure the debriefing process into phases of reaction, analysis, and summary, supporting a systematic approach to reflection following the experience.

The use of the NLN/JSF model¹⁷ and the PEARLS debriefing model²¹ in the UPA scenario also contributed to organizing the different components of the simulation, including objectives, participants, facilitators, educational practices, simulation design, and expected outcomes. However, it is important to distinguish the inclusion of these components in activity planning from their potential effects on learning. The structural alignment of a scenario with a simulation framework is a characteristic of the educational product developed, but does not constitute evidence of knowledge acquisition or the development of skills or competencies among students.

Another relevant finding was the incorporation of social aspects into clinical cases. In addition to elements related to physical assessment and diagnostic reasoning, the scenarios addressed socioeconomic vulnerability, dependence on the Brazilian Unified Health System (Sistema Único de Saúde, SUS), informal employment, and cultural competence. These components broaden the approach beyond strictly biomedical aspects and incorporate elements related to patients' social contexts and living conditions into the decision-making process. This feature is particularly relevant in Primary Health Care, where understanding the territory and the vulnerabilities of the population constitutes an important dimension of care.

The consistency between the clinical rationale and the educational product is also demonstrated by the incorporation of content identified in the literature review conducted during project development. Dengue classification criteria, warning signs, indicators of severity, clinical management measures, and care pathways were incorporated into the simulated situations and the decisions expected of participants. Thus, continuity can be observed between the theoretical review and its application in the development of the clinical cases.

The literature used in developing the project also demonstrates that the systematic construction of simulation scenarios has been employed in different areas of health education, including postpartum hemorrhage, sepsis, and colostomy care. In this context, developing scenarios focused on dengue management expands the potential application of this strategy to a condition of considerable epidemiological relevance in Brazil. The applicability of the scenarios should be considered considering their specific characteristics. The UBS scenario focuses on initial assessment, case classification, and the determination of appropriate management and referral, whereas the UPA scenario addresses a more complex situation involving warning signs and hemodynamic compromise. Using the two scenarios together may facilitate the representation of different stages of care for patients with dengue and the responsibilities associated with the different levels of healthcare.

Despite the structural strengths identified, the findings should be interpreted considering the study's limitations. Although the initial theoretical framework addressed dengue, Zika, and Chikungunya¹⁸, the scenarios developed focused specifically on dengue, with the other arboviruses addressed primarily in relation to differential



diagnosis. Furthermore, the scenarios were designed for undergraduate medical students, requiring caution when considering their direct use with other audiences without prior adaptation.

The main limitation concerns the absence of implementation and evaluation of the scenarios with the target audience within the scope of this study. Consequently, no data was generated to assess satisfaction, knowledge acquisition or retention, skill development, clinical performance, or changes in participants' practice. The findings therefore support the development of two comprehensive, systematically structured scenarios grounded in clinical and pedagogical frameworks, but do not allow conclusions to be drawn regarding their educational effectiveness.

In this regard, subsequent stages may involve implementing the scenarios with students, evaluating the simulation experience, and investigating potential effects on clinical reasoning, recognition of warning signs and indicators of severity, decision-making, and dengue management. Assessing these outcomes may provide additional evidence regarding the applicability and educational contributions of the scenarios developed.

Final Considerations

The development of clinical simulation scenarios on dengue enabled the systematization of an educational proposal for medical training, integrating theoretical knowledge, clinical reasoning, decision-making, and aspects related to the organization of care at different levels of the healthcare system. As an outcome of this work, two structured and documented scenarios were developed, set in a Primary Health Care Unit (UBS) and an Emergency Care Unit (UPA), respectively, and addressing clinical situations with different levels of healthcare complexity.

The scenarios incorporated essential elements of clinical simulation, including learning objectives, standardized patient characterization, clinical and social

cues, case progression, expected participant actions, material resources, criteria for terminating the scenario, briefing, and debriefing. The use of current recommendations for the clinical management of dengue helped align the simulated situations with the Brazilian epidemiological and healthcare context, particularly regarding case classification, recognition of warning signs and indicators of severity, and determination of management measures appropriate to the level of care.

The use of scenarios developed for different points within the healthcare network expands the possibilities for teaching dengue management in undergraduate medical education by addressing both initial assessment and case classification in Primary Health Care and more clinically complex situations in emergency services. Incorporating aspects related to social vulnerabilities also contributed to the development of scenarios that extend beyond the strictly biomedical dimension and consider elements relevant to comprehensive care. Nevertheless, this study focused on the development and structuring of the scenarios and did not evaluate their educational effectiveness among the target audience. Therefore, the findings do not support conclusions regarding knowledge acquisition or retention, skill development, student satisfaction, or improvements in clinical performance.

In conclusion, the process undertaken enabled the development of two structured, contextualized clinical simulation scenarios grounded in clinical and pedagogical frameworks, constituting a proposal that may be used to teach dengue management in undergraduate medical education. As a subsequent step, implementation of the scenarios with the target audience and systematic evaluation are recommended to investigate their applicability and potential contributions to clinical reasoning, timely recognition of warning signs and indicators of severity, and decision-making when managing patients with suspected dengue.

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