**Data Collection 3 - Parameters and variables used in the simulation model**

Table 2. Sensitivity and Specificity for Extravasation Detection

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Author** | **Type of study** | **Comparison** | **Observation** | **Sensitivity (%)** | **Specificity (%)** | **PPV (%)** | **NPV (%)** |
| (Balasubramanian et al. 2006) | Prospective | Clinical evidence, X-rays  Hemoconcentration  Hypoproteinemia | Pleural effusion or ascites | 91,42 | 53,33 | 69,56 | 84,21 |
| (Motla et al. 2011) | Retrospective | Clinical evidence and dengue seropositivity | Vesicular wall thickening >3 mm | 92 | 38 | Not reported | Not reported |
| (Pornpimon et al. 2011) | Prospective | Hemoconcentration |  | 86,6 | 95,1 | 92,2 | 91,3 |
| (Bharath Kumar Reddy et al. 2013) | Prospective | Hemoconcentration | Hepatomegaly- Ascites | 42,4 -62,1 | 54,4-68,9 | 6,8-69,4 | 28,9-99,8 |
| (Michels et al. 2013) | Prospective | POCUS vs. conventional ultrasound by radiologist  Clinical evidence,  Hemoconcentration  Hypoproteinemia | Vesicular wall thickening >3 mm | Not reported | Not reported | 21 | 91 |
| (Khurram et al. 2016) | Retrospective | Hemoconcentration | Pleural effusion, ascites and vesicular wall thickening >3 mm. | 93,48 | 100 | 100 | 97,42 |
| (Parmar et al. 2017) | Prospective | Clinical evidence and dengue seropositivity | Hepatomegaly, splenomegaly, retroperitoneal ascites, gallbladder wall thickening >3 mm | 58,0 (47,0- 68,0) | 84,0 (73,0 - 92,0) | 83,0 (72,0- 91,0) | 59,0 (48,0- 69,0) |
| (Nainggolan, L., Wiguna, C., Hasan, I., & Dewiasty 2018) | Prospective | WHO criteria for severe dengue fever | Vesicular wall thickening >3 mm | 65 | 70 | Not reported | Not reported |
| (Herath et al. 2019) | Prospective | Clinical evidence  Hemoconcentration |  | 44 (32-58%) | 93 (85-97%) | 79 (64-89%) | 72 (67-76%) |
| (Quiroz-Moreno R, Méndez GF 2006) | Prospective | Clinical evidence | Vesicular wall thickening >3 mm | 87 | 48 | 90 | 40 |
| (Sehgal A, Gupta S, Tyagi V, Bahl S, Singh SK 2002) | Prospective | Clinical evidence and dengue seropositivity | Gallbladder wall edema | 80 | 58 | Not reported | Not reported |
| (Setiawan et al. 1995) | Prospective | Clinical evidence | Vesicular wall thickening >3 mm | 93,8 | 91,7% | Not reported | Not reported |
| (Srikiatkhachorn et al. 2007). | Prospective | Clinical evidence, X-rays  Hemoconcentration | Vesicular wall thickening >2 mm | 62 | 92 | 54 | 94 |
| (Low et al. 2018) | Systematic review - Cohort studies | Severe Dengue and non-severe Dengue according to WHO criteria. | Vesicular wall thickening >3 mm | 24,2-100 | 13,2-98,7 | Not reported | Not reported |

Source: Own elaboration Based on (Dewan et al. 2021).

**Table 3. Variables present in the Conceptual Model**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Description** | **Representation in the model** | **Initial values** |
| Learning curve | It graphically represents the relationship between learning effort (e.g., time, repetitions) and learning outcomes. (Pusic et al. 2015) | LC-CUSUM and CUSUM control charts. | St was modeled as a Bernoulli distribution, (simulation in STELLA as a binomial distribution with N = 1) with 80% probability of success, being possible to adjust this parameter by the user of the simulation. |
| Patient demand | Demand for patients admitted to the emergency department with febrile syndrome and diagnosed with dengue virus disease by the attending physician. As recommended by the WHO, see Illustration *22*. | Poisson distribution of prospective cohort study data, in the units of simulation time, days.  The function used in STELLA generates a series of random numbers that conform to a Poisson distribution. | Data corresponding to the prospective cohort study, described in Chapter 5, during the months of April 2019 and March 2020.  Table 4. |
| Types of patients | Children or obese patients that may limit the acoustic window (Catán G, Villao M, and Astudillo D 2011) | Because diversity in patient types impacts the learning curve, it is represented in the model by the binomial distribution with N = 1 that generates a series of random numbers from a discrete probability distribution of the number of successes in a sequence of attempts with a given probability of success. | Bernoulli distribution, (simulation in STELLA as a binomial distribution with N = 1) with 80% probability of success |
| Ultrasound points | Refers to the anatomical location for image or video acquisition. | According to what was analyzed in chapter 5, there is greater difficulty in reaching competence in certain anatomical points, in this sense, the model represents a single learning curve that should be the one that represents the highest degree of difficulty |
| Image quality | The image quality measurement scale used in the pilot and cohort study was the one recommended by ACEP, see Table 1. Table 9. | According to what was analyzed in chapter 5, the quality of the image influences the success or failure in the interpretation of the image and therefore in the construction of the learning curve. In the model it is represented by means of the binomial distribution with N = 1 |
| Retraining | Time at which the trainee loses proficiency during the monitoring stage. | Point at which the limit *(h)* is exceeded on the CUSUM control chart | 0 |
| Proper classification of dengue | Represented by true negatives (diagnostic result with POCUS as absence of plasma leakage when it actually does not have this condition) and true positives (diagnostic result with POCUS as presence of plasma leakage when it actually has this condition). | Calculated from sensitivity and specificity values presented in the literature.  The simulation also calculates: | Sensitivity = 91.4%.  Specificity =  53,3%  PPV= 69.6 %.  NPV= 84.2%.  (Balasubramanian et al. 2006)  These values can be modified by the user.  Based on the scoping review performed by (Dewan et al. 2021) who included primary studies from 1989 to 2018 and the review performed between 2018 and 2021, the data presented in *Table 2 were* obtained. Which can serve as a reference for the user |
| Readmissions/ reconsultations | Defined as readmissions/reconsultations of patients to the emergency department for the same cause.  Although the prospective cohort study did not include information on readmissions, the simulation contemplates the possibility of the user entering this parameter. The reference was taken as the reconsultations to medical control during the follow-up time (on average 3 days). | Reconsultation rate | Cohort study information:  29% (52/178) |
| Severity of patient's condition | It refers to the therapeutic conduct followed with patients confirmed with IgM-positive dengue:  - recovered at home,  - recovered after hospitalization,  - immediately referred to another hospital of a higher level of complexity,  - recovered in another hospital | Represented by means of the corresponding rates and flows taken from the cohort study. | 0 |
| Costs | Established as fixed costs: purchase value of biomedical equipment for training and use in the emergency department, associated annual maintenance and training courses.  Variable costs: costs of supplies needed for ultrasound, cost of retraining and income from the provision of ultrasound procedures. | Reference values of the Colombian market.  Values established in the Tariff Manual established under decree 2423 of December 31, 1996, updated to 2021. | Values updated to the current legal minimum wage 2021 of Colombia. |
| Labor | Refers to the number of emergency department physicians to be trained. | Number of emergency department physicians to be trained. | 3  Considering that this is a 24-hour service, this value can be modified by the user. |
| Time of attention | Calculated as the reference time for performing POCUS- Dengue, FAST and gynecological emergency ultrasounds | Probability distribution according to the behavior of the cohort study times and reference values. | POCUS-Dengue Test Time: Normal Distribution (24 min; 3.7 min)  FAST test time:  UNIFORM Random distribution (10 min -15, min)  Examination time Gynecological emergencies:  UNIFORM Random distribution (20 min -25, min) |
| Patient demand for gynecological emergencies | Demand of patients admitted to the emergency department with diagnoses associated with abdominal trauma. | Poisson distribution of the case study data, in units of simulation time, days.  The function used in STELLA generates a series of random numbers that conform to a Poisson distribution. | Data corresponding to the case study during the months of April 2019 and March 2020.  Table 4. |
| Emergency trauma patient demand (FAST) | Demand of patients admitted to the emergency department with a diagnosis associated with gynecological emergencies. |

Source: Own elaboration

Table 4. Demand for patients with suspected Dengue, trauma and gynecological emergencies.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Year** | **Month** | **Number of patients suspected of having dengue fever** | **Number of patients with diagnosis associated with trauma** | **Number of patients with a diagnosis associated with gynecological emergencies** |
| 2019 | April | 1 | 101 | 20 |
| May | 7 | 75 | 15 |
| June | 10 | 114 | 14 |
| July | 3 | 86 | 26 |
| August | 1 | 102 | 24 |
| September | 2 | 69 | 14 |
| October | 1 | 93 | 10 |
| November | 3 | 68 | 15 |
| December | 17 | 93 | 19 |
| 2020 | January | 37 | 82 | 20 |
| February | 75 | 66 | 15 |
| March | 21 | 74 | 12 |
| **Total** | | 178 | 1023 | 204 |

Source: Own elaboration, based on case study.