Application for Hospital Screening of Suspected Patients with Zika, Dengue, or Chikungunya

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***Abstract*—Zika virus is a global public health emergency, and countries that have outbreaks of zika, dengue, and chikungunya, all carried by the mosquito vector (*Aedes Aegypti*) needed to be alert to their environment and population. This paper presents a proposal for screening system carried out in Brazilian health units, using a mobile application that works in conjunction with a web application, being able to obtain greater profit and effectiveness in the accomplishment of a possible final diagnosis, due to the large number of cases of diseases transmitted by vector *Aedes Aegypti*. These diseases affect a large part of Brazilian population in several regions, which nowadays live a triple epidemic of *arboviruses*, but reports like these are also presented in many other countries. The tools presented in this research aim to reduce the time of care in the main health units, through screening suspected patients. These factors together propose facilitating both patient's life and health units' proceedings. The research presents information both from a technical and theoretical point of view, of the three types of diseases caused by the mosquito, necessary for using the proposed system.**

***Index Terms*—health, hospital screening, Zika, environment, mobile application**

I. Introduction

Aedes Aegypti mosquito (*diptera: culicidae*) is originating in Africa, where there are wild and domestic populations. Originally described in Egypt, which gave him this name, he has accompanied the man in his permanent migration. He was recognized as transmitter of the yellow fever in 1881, by Carlos J. Finlay. In 1906, Brancroft published the first evidence that mosquito was also the vector of Dengue, a fact later confirmed by Agramonte in 1906, and by Simmons in 1931 [1]. This vector was probably introduced in the Americas aboard ships coming from Europe, which crossed the Atlantic during first explorations and European colonization of the New World. The first records of his identification in Brazilian lands were of 1898, by Lutz, and in 1899, by Ribas [1].

With increasing advancement of technology in its various areas of action, one that certainly deserves attention in Brazil is health area, which is one of highest priorities. With this in mind, research group observed need of developing application for mobile devices in order to reduce time of hospital screening in relation to patients suspected of Zika, Dengue, or Chikungunya.

This research aimed to facilitate diagnosis of suspected patients with Zika, Dengue, or Chikungunya. Through the development of a mobile application and web application [2]-[4], the system proposes a solution for hospital sectors, researches the main diseases transmitted by this vector and carries out data collection related to monitoring the cases; Discusses Brazilian screening system currently used in health units; Reports the main causes that lead overcrowding in health units; Proposes development of a mobile application that works together with a web application in respect of goals of optimizing hospital screening system of patients suspected of Zika, Dengue, or Chikungunya.

The research was based on statistical data from Brazilian Health Ministry, epidemiological bulletins, charts, maps, tables and others. Through the analysis of these data, it was possible observe increasing of diseases incidence transmitted by *Aedes Aegypti* in several parts of Brazil, bringing back suspected epidemic. These diseases also occur in other regions of the planet, such as Colombia [5], French Polynesia [6], India [6] and USA [7], among others.

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II. Etiology of Aedes Aegypti

Mosquito's life cycle described in Fig. 1, presents rapid development, taking about 10 days to reach the adult stage after hatching of the egg [8]. The phase of greatest resistance is that of the egg, since it is resistant to desiccation for periods ranging from 6 months to 1 year. Each female copulates once and stores the male's sperm in structures called spermathecae. In the mating phase, in which females need blood to ensure development of eggs, transmission of the disease occurs. The interval between blood supply and oviposition varies from two to three days [8].

Unlike many species of mosquitoes, a female of the mosquito *Aedes Aegypti* spreads its eggs in several breeding grounds, from the same house or not. The eggs are deposited in containers with water, but outside the liquid medium, near the water line, being adhered to the inner wall of the containers.

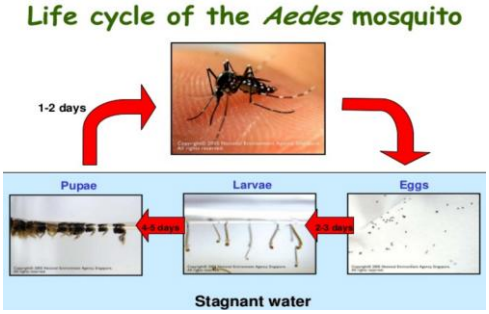

Figure 1. Life cycle of the *Aedes* mosquito.

Period for embryonic development lasts, under favorable conditions, from two to three days. When they come in contact with water, eggs hatch giving rise to larvae, which are highly mobile and feed on organic debris, bacteria, fungi and protozoa in water. Duration of pupal phase under favorable conditions is, on average, two days. The pupae do not feed, they only breathe, being endowed with good mobility. Man has a direct relationship with his environment, which is a determinant of health and disease process. Within context, the importance of caring for environment is inserted, in order to avoid diseases as serious as those presented in this research. WHO's public health emergency committee declared that the spread of the virus was an emergency of public health concern, triggering funding into research, vector control, and efforts to stop pregnant women becoming infected [6].

A. Dengue Virus

Evidences on epidemics attributed to Dengue registered before the period of development of the virus isolation techniques leaves doubts as to whether all had as etiological agent the Dengue virus and whether they were caused by one or more serotype or by the same strain [9]. According to [8] there have been reports of dengue epidemics in Brazil since 1846 occurring in São Paulo and Rio de Janeiro, but the first citations in scientific literature date back to 1916 in São Paulo City, and in Niterói City in 1923. In 1928, a French ship with suspected cases was in Salvador, Bahia, but there was no circulation of the virus in the population of that capital [10].

The main form of disease transmission is through the bite of mosquito *Aedes Aegypti*. There are records of vertical transmission (from pregnant to baby) and blood transfusion. There are four different serotypes of Dengue virus: DEN-1, DEN-2, DEN-3 and DEN-4 [11]. Dengue infection can be asymptomatic, mild or cause serious illness, leading to death. Typically, the first manifestation of Dengue is high fever (39 °to 40 °C), abrupt onset, usually lasting from 2 to 7 days, accompanied by headache, body aches and pains, prostration, weakness, pain behind the eyes, rash and itchy skin. Weight loss, nausea and vomiting are common [11]. In initial febrile phase of the disease may be difficult to differentiate it. Severe form of the disease is accompanied by intense and continuous abdominal pain, persistent vomiting, mucosal bleeding, among other symptoms [11].

There is no specific treatment for Dengue, the type of treatment performed is only done to relieve the symptoms. When the symptoms begin to appear, it is essential that the person seek nearest health service, for correct orientation regarding necessary measures to be taken. It is important to note that the person should not take medicines on their own without a doctor's advice.

B. Chikungunya Virus

Reference [12] defines Chikungunya (CHIKV) as an RNA virus of Togaviridae family of the genus Alphavirus, first described in 1950 in the region that today corresponds to Tanzania during an outbreak initially attributed to Dengue virus. After first descriptions, two distinct transmission patterns were described: one wild and periurban in Africa (*Aedes ssp*) and another urban in Asia (A. Aegypti). In addition, three different genotypes circulating in regions of the planet (Central Africa, South and East - ECSA, West Africa - WA and Asia) have been reported. Until then, few serious clinical cases and no deaths had been associated with infections with this virus [10]. From 2005, small mutations in the E1 protein of the viral envelope in the ECSA variant allowed better viral adaptation to a new cosmopolitan vector (*Aedes albopictus*). This contributed to disease great expansion to the Indian Ocean and, later, Asia and Europe. Also in 2005, virus arrived in Reunion Islands after an outbreak in Kenya. In this epidemic that reached about 40% of population, many serious cases were documented and confirmed laboratory, with lethality estimated in 1 / 1,000 cases.

In Brazil circulation of the virus was first identified in 2014. Chikungunya means "those who fold" in Swahili, one of the languages of Tanzania. Refers to the curved appearance of patients who were seen in the first documented epidemic in Tanzania, located in East Africa, between 1952 and 1953 [11]. The main symptoms of Chikungunya are high-onset fever, severe pain in the joints of the feet and hands, as well as fingers, ankles and wrists. There may also be headache, muscle aches and red spots on the skin. Once infected, the person becomes immune for life [13].

Symptoms begin appearing between two and twelve days after the mosquito bite. It gets the CHIKV virus by stinging an infected person during the time it is present in the infected organism. About 30% of the cases do not present symptoms [13]. There is no vaccine or specific treatment. Its symptoms are treated with medication for fever (paracetamol) and joint pain (anti-inflammatory). Acetylsalicylic acid is not recommended because of the risk of bleeding. Absolute rest is recommended to the patient, who should drink plenty of fluids [13].

C. Zika Virus

According to [14], the widespread epidemic of Zika virus infection reported in 2015 in Brazil has become a serious public health problem due to association with increased incidence of microcephaly in newborns of mothers infected with the virus [14]. The Zika virus is spread mainly by the bite of the mosquito *Aedes Aegypti*, but can also be transmitted sexually by a man to the partner or by pregnant to her fetus. The most common symptoms of Zika's disease are rash, pruritus, joint pain, conjunctivitis, headache and fever; These symptoms are usually mild and may persist from a few days to a week. Because of problems due to intrauterine infection, especially microcephaly, pregnant women should take special precautions to avoid contamination [11].

Zika virus infection may manifest with neurological problems, congenital microcephaly, and other developmental problems in children whose mothers had infection during pregnancy. In general population, Zika may manifest with Guillain-Barre syndrome, myelitis, and meningo-encephalitis. About 80% of people infected with the Zika virus do not develop clinical manifestations. The main symptoms are headache, low fever, mild joint pains, red spots on the skin, itching and redness in the eyes [11].

Other less frequent symptoms are swelling in the body, sore throat, coughing and vomiting. In general, disease progresses are benign and symptoms disappear spontaneously after 3 to 7 days. However, joint pain may persist for about a month [11]. Severe and atypical forms are rare but, when they occur, they can progress to death, which occurred in November 2015 for the first time in history [11].

There is no specific treatment for Zika virus infection and there is no vaccine against the virus. Recommended treatment for symptomatic cases is based on using acetaminophen or dipyrone for fever control and pain management. In cases of itchy rashes, antihistamines can be considered [13]. Use of acetylsalicylic acid and other anti-inflammatory drugs is not recommended because of the increased risk of bleeding complications described in infections with other *flaviviruses*. Suspected cases should be treated as Dengue due to their higher frequency and known severity [11].

D. Microcephaly

Microcephaly is a congenital malformation, in which the child's head and brain are significantly smaller than other children of the same age. Newborn babies with suspected microcephaly undergo physical examination and measurement of the cephalic perimeter. They are submitted to neurological and imaging exams, with Transfontanel Ultrasonography being the first option indicated and tomography, when the mill is closed. Among preterm infants, those born with cephalic perimeter equal to or less than 32 centimeters are considered microcephaly, according to protocol of the Brazilian Health Ministry [11].

There is no specific treatment for microcephaly. There are support actions that can aid in the development of the baby and the child, and this follow-up is advocated by Brazilian health system whose acronym in Portuguese is SUS. To guide from prenatal care to child development with microcephaly, Brazilian Health Ministry developed a health care protocol and response to occurrences of microcephaly related to Zika virus infection. Document provides for the mobilization of managers, specialists and health professionals to promote early identification and specialized care of pregnant women and baby [11].

About 90% of microcephaly are associated with mental retardation, except in those of family origin, which may have normal cognitive development [11]. Type and severity level of sequel varies on a case-by-case basis. Treatments performed since the early years improve development and quality of life. From the reports to date, most of pregnant women whose babies developed microcephaly had Zika virus symptoms in the first trimester of pregnancy [11]. However, care not to contact the *Aedes Aegypti* mosquito is for the entire gestation period.

E. Monitoring Cases of Zika, Dengue, and Chikungunya

As published in the epidemiological bulletin of Secretariat of Health Surveillance, a part of Brazilian Health Ministry, in 2016 1,426,005 probable cases of Dengue were registered in the country by Aug / 2016 [12]. In this period, the Southeast region recorded the highest number of probable cases (841,286 cases, 59.0%) in relation to the total of the country, followed by the Northeast (310,161 cases, 21.8%), Central West Region (163,501 cases; 11.5%), South (73,565 cases, 5.2%) and North (37,492 cases, 2.6%). 564,350 suspected cases of Dengue were discarded in the period. Analysis of incidence rate of Dengue probable cases (number of cases / 100 thousand inhabitants), according to geographic regions, shows that the Center-West and Southeast regions have the highest incidence rates: 1,058.8 cases / 100 thousand inhabitants, and 981.1 cases / 100 thousand inhabitants, respectively. Among the states are Minas Gerais (2,516.0 cases / 100 thousand inhabitants), Rio Grande do Norte (1,604.4 cases / 100 thousand inhabitants), Goiás (1,428.4 cases / 100 thousand inhabitants) and Mato Grosso do Sul (1,273.9 cases / 100 thousand inhabitants).

In 2015, 91 deaths from Chikungunya fever were confirmed in the state of Pernambuco (46 deaths), Rio Grande do Norte (19 deaths), Paraíba (7 deaths), Ceará (6 deaths), Rio de Janeiro (4 deaths), Maranhão (2 deaths), Alagoas (2 deaths), and São Paulo (1 death). The median

age of the deaths was 62 years old, varying from 0 to 98 years old. Most deaths from Chikungunya fever, confirmed until August of 2015 occurred between February and March. It should be noted that although Chikungunya fever deaths are of immediate compulsory notification (within 24 hours of knowledge of its occurrence) and mandatory investigation, this process may take weeks to months [15] [16]. Thus, 53 new confirmed deaths were identified with distributed occurrence over the first 7 months of 2016.

An autochthonous transmission of Zika virus fever has been occurred since April 2015. Was also confirmed by laboratory 3 deaths in cities S ão Lu ís (1 death), Benevides (1 death) and Serrinha (1 death). The median age of deaths from Zika fever was 20 years old. Until August 2016, 196,976 probable cases of Zika virus in the country had been registered (incidence rate of 96.3 cases / 100 thousand inhabitants), distributed in 2,277 municipalities, and 101,851 cases were confirmed.

Analysis of the incidence rate of probable cases (/ 100 thousand inhabitants) according to geographic regions, shows that the Center-West region had the highest incidence rate: 188.1 cases / 100 thousand inhabitants. Among the states are Mato Grosso (652.9 cases / 100 thousand inhabitants), Bahia (328.2 cases / 100 thousand inhabitants) and Rio de Janeiro (363.6 cases / 100 thousand inhabitants). In 2016, 3 deaths from Zika virus were confirmed in laboratory [17]: 2 in Rio de Janeiro and 1 in Esp írito Santo. It is also important to note that deaths in newborns, stillborn, abortion or fetuses resulting from Microcephaly possibly associated with the Zika virus are accompanied by the epidemiological report on Brazilian Cases Monitoring of Microcephaly.

According to [14], it is possible to observe in Brazil, the distribution of incidence rates, as well as suspected and confirmed cases of Zika virus fever, respectively, according to municipality notification. Zika fever is a notifiable disease and is present in National List of Compulsory Notification of Diseases, Injuries and Public Health Events [15], [16].

F. Vetorial Control

According to [1], the role of vector control in Public Health is to prevent infection by blocking or reducing transmission, and its main objectives are manage existing problems, such as outbreaks, epidemics, high mortality and high morbidity; Prevent epidemics or re-introduction of diseases; Reduce the environmental risk factors of transmission. Effective vector control cannot depend on a single method. On the contrary, it must have several alternatives, adequate to the local reality, that allow its execution in an integrated and selective way [1].

Integrated control or management deals with unified control planning, according to environmental conditions and population dynamics of vector. Appropriate control methods are selected and vector populations are maintained at levels that do not cause harm to health [1]. Solution for vector control should be based on the couple Science & Education [18]-[20]. In general it is in domestic environments that vectors reproduce and through education, the residents themselves could eliminate these breeding places [9].

III. Assistance and Risk Classification for Care Priority

Organizing health service network is necessary to prevent a greater number of deaths [21]. With improved care and service delivery to patients, it is possible to significantly reduce the number of deaths due to poor management in hospital environment and the lack of health education in population [19], [20]. Screening, using the risk classification based on disease severity [22], is a key procedure to improve the quality of care. Risk classification aims to reduce patient's waiting time for medical care, aiming at accelerating the diagnosis, treatment and hospitalization, when appropriate, and contributing to organization of patient`s flow in health unit and prioritization of cases according to severity [23].

Organization of health services network is a condition for coping with an epidemic [21]. The establishment of clinical protocols, reference system and counter-referral, based on the risk classification [22], makes possible timely and quality care to the patient and is a condition to avoid occurrence of deaths. Preferred entry point for care of the person with suspected Dengue is primary care. However, all health services must accept the cases, classify the risk, attend and, if necessary, refer to the service compatible with the patient's complexity / need, taking responsibility for their transfer [23]. Given the epidemiological scenario presented every year in Brazil, with an increasing number of serious cases in adults and especially in children under 15, it becomes necessary to qualify and organize services at all levels. For this, it is recommended using guidelines for risk classification, services organization and strategies for coping with a dengue epidemic [23]. Therefore, patient care is based on risk classification and not on arrival order at health service. For risk classification of patients with suspected Dengue, national humanization policy criteria and the extent of disease are used. Based on this information, risk classification may be performed by a nurse or doctor, who, with technical protocol, will identify patients who need immediate treatment, considering risk potential, suffering degree and problem health. A professional must evaluate, guide, route, collect and record data in the most detailed way possible in technical protocol. This data subsidizes a doctor regarding the diagnosis, extension and treatment of a Dengue suspected patient [23].

Performing screening through risk classification is termed Manchester Protocol, or Manchester Triage System (MTS). According to [22] and [25] MTS has five categories or levels. Each category is assigned a maximum acceptable number, color, name and target time until the first medical care, as follows: level 1: emergent, red, immediate; Level 2: very urgent, orange: 10 minutes; Level 3: urgent, yellow: 60 minutes; Level 4: not very urgent - green: 120 minutes; Level 5: non-urgent - blue: 240 minutes. Some states and municipalities use other criteria

for risk classification, which can be maintained and respected, as long as they have technical rationale.

It is important to highlight implementation of risk classification as a way to help services organization, streamlining care and avoiding deaths [23]. It happens in relation to patient's signs and symptoms.

IV. Overcrowding of Health Basic Units and Patient Information Integrity

A hospital aims to provide population with a full medical care, both curative and preventive. However, a systematic organization of a Health Basic Unit (HBU) is of fundamental importance. Both a good hospital structure and qualified professionals in their functions should be required, as it is through working together that they obtain significant results in accomplishment of several types of diagnoses. However not always in the hospital is possible having appropriate care. Consequence of this reality is transfigured in image of overcrowded hospitals, patients in corridors, lack of beds and generalized chaos in service that, for majority of population, should be the main care provider [24]. Reality that reinforces still more popular imaginary that lack hospitals in the country able to meet population demands [21].

Other economic factors that play an important role in hospital overcrowding include increasing institutional costs resulting from doctors' remuneration, technological advancement, and pharmaceuticals associated with lower reimbursement by insurers as well as state and federal agencies [24]. There is also a delay and difficulty in getting patient's personal data, along with illness history, and information on allergies, use of medications, pressure problems, and others. An example of this problem is when patient needs to go to a hospital that he/has never attended before and therefore does not have data of last hospital that attended him/her. With this, doctor does not have access to data and there is no way to get quickly and completely information. It is possible to present factors that contribute to overcrowding of health units, making a relation between demand for efficiency and increasing expectations.

V. Application for Hospital Screening of Suspected Patients with Zika, Dengue, or Chikungunya

This research project aimed to facilitate diagnosis of Brazilian people suspected with Zika, Dengue, and Chikungunya, proposing a solution for hospital units in improving infected persons care. Proposed solution was based on easily accessible technologies, where system executes a type of data processing informed by users, these being redirected from a hybrid mobile application [26], directly to a site located in health units. The completion of this data is done through a free mobile application [27] developed using Laravel framework and Phonegap tool [28], and Bootstrap tool [29], [30]. Through this application, users can fill out a questionnaire describing the most striking symptoms of their physical and emotional state. After completing the questionnaire, an alert is displayed on screen informing a possible case of Zika, Dengue, or Chikungunya. It is also presented, a message recommends user going to a health unit and inform his registration number for verification.

This registration number refers to patient's history, containing all his symptoms previously filled in the application. Registration number is unique, and it is presented on screen to user after completing questionnaire. Through the website available, free of charge, health units will be able to check users' history through a field of fill referring to this code.

Meeting user needs occurs through provision of unique data, such as registration number. This data will be analyzed by system through validation criteria, and after confirming veracity of information, will be stored in database. Mobile application was developed in a hybrid way, it is an executable application on more than one mobile platform (Android, iOS, Windows Phone, BlackBerry) [26], [31], [32].

A. Typology - Hospital Screening

The type of screening used in hospitals uses risk classification, which aims to prioritize the patients with greater risk of life. This type of classification is fundamental for patient entry and exit organization, as it seeks to improve health unit services in order to accelerate care and diagnosis process. Fig. 2 illustrates a basic queue model used in hospitals, involving patients with customer service system through priority rule.

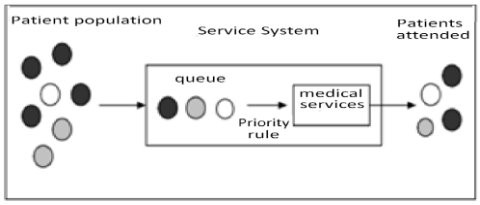

Figure 2. Basic elements of queue models

B. Typology - Screening after System Implementation

Through a "selection process" - where patient will be prioritized if she/he is conforms to validation of priority rule - it is possible significantly reduce overcrowding in hospitals and health facilities [24]. This prioritized patient selection process may be fundamental for a more accurate diagnosis, saving time and reducing stress in hospital environment involved.

According to Figure 3, it can be observed that, after system implementation, the patient population has reduced considerably due to the risk classification rule. This resulted in a shorter waiting list and a considerable number of patients attended.

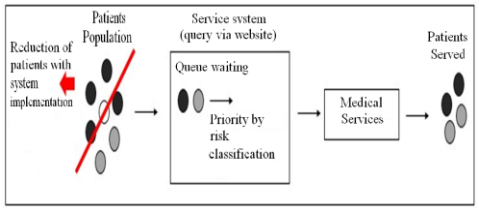

Figure 3. Screening with system implementation

C. Expected Benefits from System Implementation

Main beneficial factor in system implementation in health units is agility of care and reduction in patient's waiting time. Figure 4 compares benefits between agility and time, both in hospital environment satisfaction and patient satisfaction.

	HEALTH UNITS	PATIENTS
AGILITY	Improved service, higher employee satisfaction	High quality service, reduced waiting time
TIME	Attend more patients in a shorter period of time	Due to rapidity of care, patient has a longer recovery time

Figure 4. System implementation benefits.

Both the mobile application and website are freely available and easily accessible tools, thus facilitating receipt and exchange of information between users and health units. Purpose of a navigation map is to express main paths of user interface through the system [33]. These are primary paths through the system screens and not necessarily all possible paths. The goal is serving as a roadmap to the system user interface. Fig. 5 shows navigation map flowchart for mobile application [33].

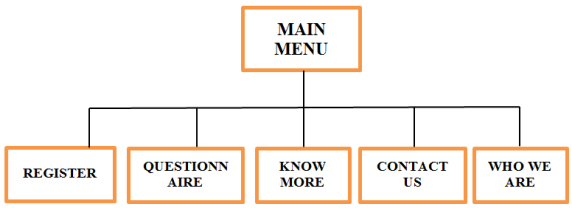

Figure 5. Mobile application navigation map flowchart.

Just as in navigation map for mobile application, the web-oriented navigation map also aims to express main paths of user interface [3], [33], [34]. These can be imagined as flowcharts, which allow us to see distribution of the site, know the exact number of pages, and how these pages are integrated with each other. For this application a navigation map on web application was constructed. Fig. 6 shows the main home page.

Navigation pages are presented in different shapes and objects. In addition to its internal links, various forms of navigation were created between content contained in it. Its function is basically to allow navigation from one page to another. After screen for user registration, showed in Fig. 7, an alert is displayed on screen informing that user has been registered successfully. A screen is prepared for conducting the questionnaire regarding user most striking symptoms.

After completing the questionnaire, an alert is displayed on screen informing a possible case of Zika, Dengue, or Chikungunya. It is also presented, a message recommending user who goes to a health unit and inform his Brazilian Identification Number whose acronym in Portuguese is CPF, from "*Cadastro de Pessoa F ísica*". Afterwards a register screen is presented to provide basic information about three types of disease transmitted by *Aedes Aegypti* mosquito and a page about other information of mobile application.

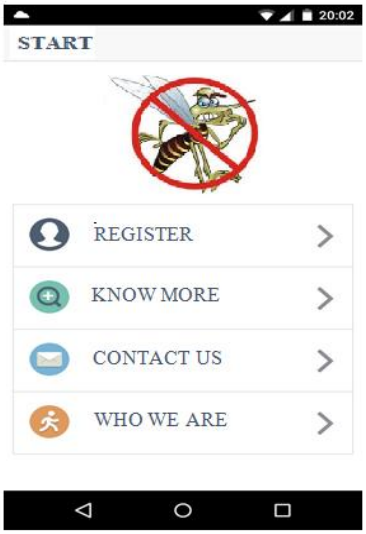

Figure 6. obile app home page.

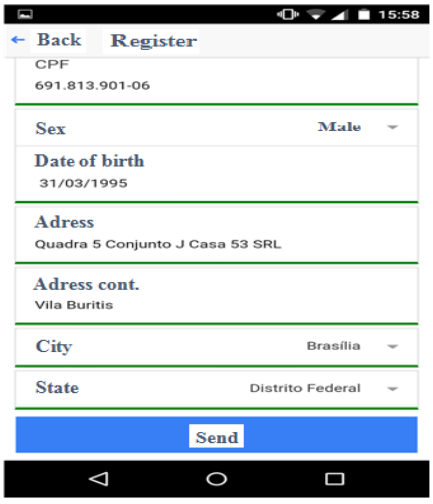

Figure 7. Register screen.

A screen for exchanging information between developers and users of application is presented by email or by phone, a page about application's developers, containing some information and social network profiles associated with then and a homepage about its developers. As for mobile application, web browsing homepages have the same functionality [31], [32].

Homepages with web application features are: server registration homepage, which contains a registration form; homepage for server login, which contains a login form; homepage to change data; homepage to check patient data. Some functionalities of this software follow: when searching by registration number, user data and disease history are displayed. A screen shows data from patients infected with a specific disease or outbreaks of *Aedes*

Aegypti mosquito, and has a search field, a button to export the table to spreadsheet, and action buttons with alert about advanced searches on data screen.

For advanced searches, user has a confirmation alert on data screen; Server registration screen, because if the user is an administrator, he/she can register new servers from a list present in a worksheet; Alert about the default file present on the server registration screen, which explains mandatory patterns and rules for registering from a worksheet.

Statistics screen, which has buttons for exporting graphics; Server statistics screen visible only to administrators, which has a search field and an action button; Server list screen for user registration, visible only to administrators; screen for testing user creation functionality.

Through field research some results were obtained regarding to *Aedes Aegypti* vector. This research used a questionnaire about these three diseases. All the questions described in the questionnaire were carried out with the purpose of extracting interviewee's knowledge about vector and its diseases.

In this questionnaire, simple and objective questions are presented, with only two alternatives. It is important to say that interviews recording were performed by people chosen by interviewers, regardless of their social class. After analyzing data from interview register, the following results were obtained: 100% of respondents know what Dengue is; 80% of the interviewees know how the transmission of Dengue occurs; 100% of respondents do not know that the *Aedes Aegypti* vector is the transmitter of Zika, Dengue, and Chikungunya.

Only 60% of respondents think that media and communication vehicles provide necessary support for the virus; Only 40% of interviewees think it necessary to send a health worker to their home; 80% of respondents support the idea of a virus-related software; Only 20% of those interviewed had Dengue; Only 20% of respondents believe hospitals and health units provide necessary support to patients with disease. According to data described above, graphs were generated in relation to percentage of respondents for each type of listed question. Fig. 8 and 9, present graphics related to interviews.

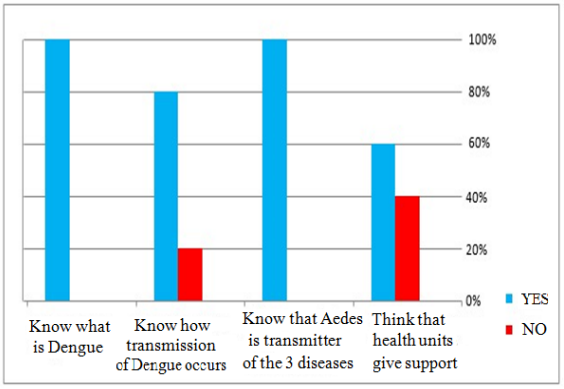

Figure 8. First interview information graphic.

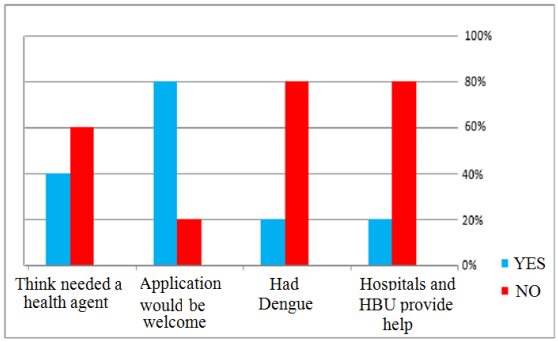

Figure 9. Second interview information graphic

VI. Conclusion and Futures Applications

This research objective was to improve screening system used in Brazilian health units. Proposes for this problem are essential for better disease control work. Statistical data were provided to confirm worrisome spread of *Aedes Aegypti* mosquito. Over the years, it has proliferated more and more, which will impact future generation. Therefore, an efficient system is needed to assist in control and treatment of vector-borne diseases, and the more tools we have to combat this mosquito, the more lives can be saved. From the observation of data it is possible to plan a management model using strategic points to prioritize places that present an epidemic.

Science has been trying as well as possible to stop mosquito proliferation, and Brazilian government has presenting several social awareness initiatives. However, citizen needs to take necessary precautions and measures to avoid vector proliferation as much as possible. Population need to be alert to their environment. A probable future application of this research could be, research group obtained a hybrid mobile system that works mobile solution in conjunction with web system. Mobile application is targeted at patients (users) and web application is targeted to health units. It is also important to talk about educational nature of this application, because when user fills their health data on the screen, he collaborates with health promotion.

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