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IMPROVING COMMUNITIES EPIDEMIOLOGICAL SURVEILLANCE SYSTEM IN PARAGUAY THROUGH INFORMATION AND COMMUNICATION TECHNOLOGIES

Pedro Galvan[1-2-4], Virgilio Cane[1], Margarita Samudio[1], Agueda Cabello[2], Margarita Cabral[1], Xavier Basogain[3], Ronald Rivas[1], Enrique Hilario [3]

[1]Departamento de Ingeniería Biomédica e Imágenes. Instituto de Investigaciones en Ciencias de la Salud (IICS-UNA). Universidad Nacional de Asunción - Paraguay
[2]Ministerio de Salud Pública y Bienestar Social(MSPBS). Asunción - Paraguay
[3]Universidad del Pais Vasco (UPV/EHU). Bilbao - España
[4]Programa de Máster en Ingeniería Biomédica. Facultad Politécnica (FP-UNA). Universidad Nacional de Asunción – Paraguay
ibiomedica@iics.una.py

ABSTRACT

*The developed and Implemented **BONIS** system is a surveillance system based on Information and Communication Technologies (ICTs) that has been developed to support the National Epidemiological Surveillance System in Paraguay by promoting community involvement in syndromic surveillance. It has been implemented in a primary health care unit named Center for Mutual Aid Association Health for All, (CAMSAT in Spanish), located in a marginal zone of Asuncion on the banks of the Paraguay River and it is monitored by the National Centre for Health Surveillance (DGVS) of the Ministry of Public Health (MSPBS). BONIS system allows also that geographically isolated communities such as the Paraguayan Chaco can be integrated without delays into the National Epidemiological Surveillance System. The aim of this study is to report preliminary results and experiences after implementation of this new strategy through ICT to improve the community epidemiological surveillance system in Paraguay.*

Keywords: Community Epidemiological Surveillance, e-Health, Syndromic Surveillance System, BONIS System, ICT, Paraguay.

INTRODUCTION

Disease surveillance ought to be an important component of any modern program of public health in any country (1). A disease surveillance system requires an adequate input of information in the shortest period of time to analyze trends and to diagnose epidemics outbreaks for a quick response and effective control. Sometimes the information may not be complete but usually there is enough quantity of qualified information to make decisions with real preventive and control impacts. The daily and weekly mobilization of data is essential for this purpose which allows analysis and real-time response (2,3).

The health surveillance system in Paraguay is mainly of epidemiological characteristics focused on infectious diseases, which are also subject to national and international surveillance, with the health services at different levels as the starting point. In presence of a suspected case subject of surveillance, health workers (both are technical and professional)

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report, verify, dismiss, or intervene in the control of the event (4).

The application of standard protocols of first line by the health workers allows confirming or dismissing the reported case. If necessary, samples for laboratory are obtained and eventually prevention and control measurement in the family and the community are made. Nowadays, surveillance in Paraguay is mainly conducted from an institutional perspective with a limited presence of the community. This is because on the one hand the traditional monitoring systems have failed to articulate the community with the institutional health system, and on the other hand the community adopted a passive attitude waiting for an intervention of the health authorities that, moreover, had little interest in the community involvement.

To optimize the surveillance, it is necessary to develop strategies that increase the capacity and the involvement of the community to identify health problems if possible in real time. Especially because population is in fact the first beneficiary. In this sense, a community epidemiological surveillance system will allow us an early identification of the presence of some diseases such as *Dengue* fever, which is a insect (mosquito) transmitted disease mainly associated with communities because it depends on social and educational development as well as cultural and environmental patterns (Kourí, 2006). As date of the importance of this disease, comment that *Dengue* fever has caused several epidemics in Paraguay since 1998, reaching to 122.000 confirmed and suspected cases so far in the epidemic that occurred this year 2013 with 72 confirmed death (DGVS report July 4, 2013), in comparison to 2011: 46.028 cases and 2012: 35.237 cases. The participation of the community in the surveillance of *Dengue* fever will also help to prevent the worsening and possible death of the patient by notifying the Ministry of Health for a prompt intervention (5).

The information and communication technologies (ICTs) offer an alternative development for an issue that concerns all of us in the health field and thus the term telemedicine (tele monitoring or tele vigilance in this study) was born, which is an integration of medical science with the development of telecommunications (6). Syndromic surveillance has been widely adopted as a real-time monitoring tool for timely response to disease outbreaks which is used by public health authorities to detect and monitor unusual disease activity in the population by extracting nonspecific clinical data from information systems in clinical settings (7).

The National University of Asunción, together with the Ministry of Health under the technical support of the University of the Basque Country has developed a community epidemiological surveillance system for fever syndromes called *BONIS* System. The system is based on ICTs and it is designed to promote the role of the community in the syndromic surveillance. The aim of this study is to report preliminary results and experiences after implementation of this new strategy through ICT to improve the community epidemiological surveillance system in Paraguay.

MATERIAL AND METHODS

The *BONIS* system was implemented in May 2010 in a primary health care unit or Family Health Unit (USF in Spanish), named Mutual Aid Centre and Health for All (*CAMSAT*), in the capital city of Paraguay, Asuncion. It is monitored by the National Centre for Health Surveillance (DGVS) of the Ministry of Public Health (MSPBS).

The Community *CAMSAT* has an area of 55 hectares and it is characterized by constant flooding and migration of the peoples living there. The *CAMSAT*-Family Health Unit (USF) attends to the 50% of the families living in this area, approximately 1.500 families (Figure 1).

Fuente: DGEEC. Censo Nacional de Población y Viviendas, 2002.

Figure 1: Location of the densely populated Community *CAMSAT*, located on the banks of the Paraguay River (Source: Censo Nacional de Población y Viviendas, DGEEC 2002)

The Organization *CAMSAT* is recognized as a social interlocutor of the community with the authorities.

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This organization includes among other services education and prevention programs in health. They also have a community radio and a dining area for children. It is the ideal structure for the feasibility assessment and implementation of this community surveillance project.

The *CAMSAT*-USF consists of a health team that includes physicians, nurses, vaccinators, an obstetrician and ten community agents (health workers) who attend on a daily basis the health needs of the community. Each of the 10 community agents is responsible for the family (average 4 people) health care through monthly one home visit. The expected productivity for each community agent consists of 150 families visited during the monthly 20 working days.

Prior to the implementation of the *BONIS* system, a telephone survey of households in the *CAMSAT* area by interviewers with extensive experience was conducted. For this purpose a web-based questionnaire was developed. The functioning schemes of the *BONIS* system including flows of information and communications infrastructures are summarized in Figure 2.

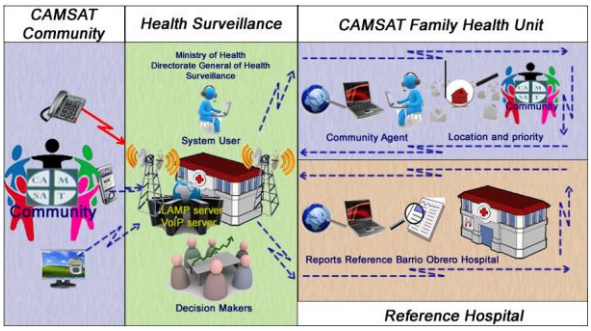

Figure 2: Functioning schemes of the *BONIS* system

The flow of information start once the phone call is made by someone from the *CAMSAT* Community. After this first step the phone call will be processed, stored, and a community agent report generated at the Health Surveillance System. The community agents check these reports (*CAMSAT* Family Health Unit) and prioritize the home visits to the community. The reference hospital gets this real-time information and can foresee admissions in case of a severe case or an epidemic. The Health Surveillance Centre (DGVS) at the Ministry of Health is responsible for the coordination, monitoring and supervision of the notification process, patient registration and follow up. The implemented network (internet) enables connectivity between the different actors for the deployment of software-phone service for communication without any cost.

Generation of information:

People of the community make a phone call to notify a syndromic case (fever with symptoms of *Dengue* fever or *influenza*) to the system. Thereafter the phone calls are recorded in the *BONIS* system and monitored by the community health agents on a daily basis (Figure 3). They perform then a planing of home visits and follow ups of these patients in the next 24 hours. At the same time, epidemiologists from the Surveillance Centre (DGVS) monitor the phone calls and follow ups through the system (Figure 2). The developed *BONIS* system has the ability to record, classify and prioritize automatically through the Interactive Voice Response (IVR), the suspected cases of syndromic fever. It has been programmed in a Hypertext Preprocessor (PHP) language with script Asterisk Gateway Interface (AGI) to improve the functionality of the telephone private branch exchange Asterisk, in a way that during the user call to report a possible case of fever, the system feeds a database through the manager module based on a web application developed in PHP (8).

The system, to which the community access through a telephone (mobile or not), automatically answer asking several questions on signs and symptoms such as fever, pain, shortness of breath, diarrhea and vomiting. The caller has to answer these questions pressing the 0 and 1 key to report the symptoms. It has also a database of identity cards associated with the person`s address and capable of registration by a voice message for the user not voluntary registered and included in the system, in order to locate the person who called to the system (Figure 3).

The basic questionnaire for IVR has been elaborated in both official languages of Paraguay Spanish and *Guaraní*. For testing the system, 300 phone calls were carried out. The *BONIS* system software has a web graphical interface with different tabs including among others the registered calls, registry of patients and patient follow ups. Also, the system has a set of alerts and graphic symptom trends in order to help the health staff, in particular epidemiologists of the Surveillance Centre (DGVS) for the syndromic surveillance.

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Figure 3: *BONIS* software application and a Community Agent monitoring the registered calls.

User training and dissemination of the system to the community:

All casual contacts with the community were used to disseminate information related to this new community epidemiologic surveillance system and to sociality its use. Moreover, because each of the community agents makes monthly home visits to 150 families, it was used to explain the system and how to use the phone for notification of syndromic fever such as *Dengue*. The community also has a community radio which was used to spread information about the system in several radio programs on a daily basis. The ten steps to use the system were included together the figure of a cell phone in a calendar (Figure 4), considering that this is a very important element of use for Paraguayan families, especially for the low-income population. For the distribution and reinforcement of the information, we again turned to the community agents. Other works to this effect were sending messages to cell phones by using the voluntary registered phone directory developed through home surveys. The final dissemination activity was directed to school children. This time was used to provide information about the system and recommendations on how to prevent the *Dengue* disease.

As an additional support, a portal website www.vigisalud.gov.py was developed and made available for general information of public access, a service of on-line notification and follow ups of syndromic fever cases and health reports for authorized staff subscribers only.

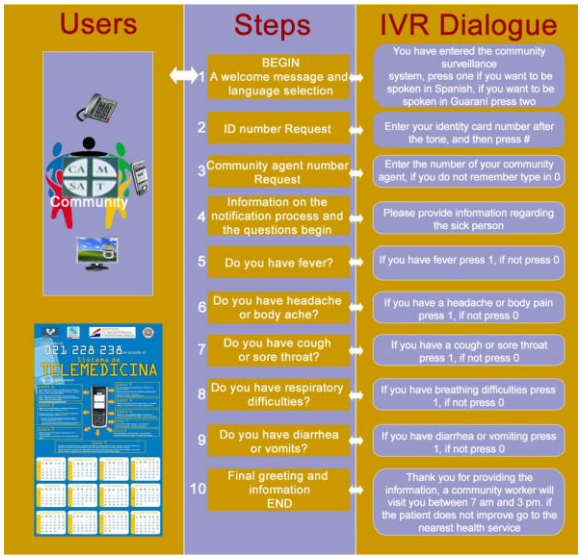

Figure 4: The ten steps of the Interactive Voice Response (IVR) and Calendar in Spanish

RESULTS

Before the implementation of the *BONIS* system, 1.394 households were surveyed showing that chronic diseases like cardiovascular diseases are the most frequent reported health problem in the community. Almost half, 46.8% of the people that reported a disease said it was arterial hypertension. It is noteworthy that 56.8% of the respondents reported that there was at least one sick person in the house at that particular moment.

Several activities were carried out to disseminate information about the system starting with a ceremony to officially launch the project with the presence of the Minister of Health where all members of the community were invited, especially social group representatives. In addition, radio programs were broadcasted through the community radio station "*Radio Tape Pyahu*" (Figure 5), which operates 12 hours a day with 32 volunteers from the community. There was the opportunity to explain the importance of reporting fever cases and the type of interventions that would be held in the community if a case was reported.

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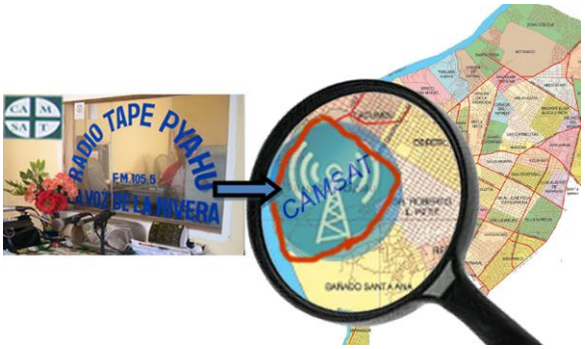

Fuente: DGEEC. Censo Nacional de Población y Viviendas, 2002.

Figure 5: Community Radio Station "*Radio Tape Pyahu*" coverage

Taking advantage of the monthly visits by the community agents, a total of 1.325 calendars were distributed to the residents of the community which explained how to use the *BONIS* system. In addition, the research team carried out 120 house to house visits to stimulate the use of the system and detect use troubles. Also were made 30 visits for technical tests and 10 training workshops for 250 children from an elementary school in the area. At the same time, 500 Short Message Service (SMS) were sent to cell phones to the target population encouraging reporting of any case of fever in the area. Finally, there were identified 10 focus groups with the community leaders to promote the *BONIS* system.

Training of the health personnel:

Several workshops were held for the training of health personnel. Ten workshops were addressed to physicians of the primary health care unit and of the reference hospital, five for epidemiologists of the Surveillance Centre (DGVS) and of the reference hospital, and two for the fieldwork team (community agents). The workshops were practical and collaborative in the use of the *BONIS* software application.

The formative material of the training plan has been performed in different ways, including dissemination of material (leaflets, posters, and interviews), technical manuals of the software applications, first step guides, video tutorials and technical publications, among others. All training materials developed are available in electronic format and accessible in a *Moodle* platform. The e-learning method will be used during the ongoing formation and training of personnel involved in the epidemiological surveillance.

Notifications by the community to the *BONIS* System:

Since the system was implemented in April 2010 until August 2011, there were 1.028 calls into the *BONIS* system. Of the 1.028 calls made to the system, 69 (7%) were from unknown not voluntary registered private phone numbers which could not be tracked by the community agents. Regarding reporting symptoms, 157 (15%) calls completed some sign and symptoms and the rest 802 calls (78%) were apparently training calls of the users in the community. About the reporting language preference, 93 % choose Spanish and 7 % Guarani. To follow up the suspected symptoms, 77% of the reported people fulfill the basic information to be tracked by the community agents and 23 % don´t completed it.

In relation to the 157 reported signs and symptoms of epidemiological interest for this study, the *BONIS* system have registered for the questions 157 calls for fever, 147 for headache and / or body ache, 138 for cough and / or sore throat, 135 for respiratory distress and 131 for vomiting and diarrhea. Table 1 show how each questions of sign and symptoms were responded with "YES" or "NO".

Table 1: Distribution of "YES" or "NO" response to sign and symptoms questions (n = 157 calls)

Sign and Symptoms Questions	Response YES	Response NO	Total n
Fever	91	66	157
Headache and / or body ache	86	61	147
Cough and / or sore throat	77	61	138
Respiratory distress	51	84	135
Vomiting and diarrhea	26	105	131

Regarding the response to the sign and symptoms questionnaire, 42% (66/157) of the callers reported not to have the symptom of interest (fever), but the 58% (91/157) reported fever as suspected. The association of the symptom of interest (fever) with the other sign and symptoms is showed at Table 2. The combination of registered symptoms fever with fever plus headache and/or body ache is 66% (159/240) and corresponds to the *Dengue* fever symptoms.

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Table 2: Association of Fever with other Sign and Symptoms registered at *BONIS* System

Association of Fever with other symptoms	Registered cases
Fever alone	91
Fever + Ache	68
Fever + Ache + Cough	44
Fever+Ache+Cough+Respiratory distress	25
Fever+Ache+Cough+Respiratory distress + Vomiting	12

Field research of suspected symptoms and Patient Registry:

As starting point for the 10 community agents field research of suspected symptoms was used the 1028 at the *BONIS* system registered calls. Such field research was made according to a *Dengue* fever diagnose protocol in order to confirm or discard each suspected symptoms of interest for the community, which was prioritize through the *BONIS* system. The community agents prioritize homes to visit where fever symptoms were reported. During the home visits, patient symptoms were verified and registered into the system. In 52 (33%) of the 157 reported suspected cases of fever and 58 (40%) of the 147 suspected headache/body ache were confirmed after the field research.

According to the Table 3, 129 (43%) of the 304 (fever + headache = 157+147) suspected cases were confirmed through the community agents during home visits.

Table 3: Confirmed Symptoms during home visits (n = 129)

Symptoms	Confirmed	Discard
Fever	52 (40%)	13 (10%)
Headache and / or body ache	58 (45%)	6 (5%)

From the 129 confirmed fever and headache / body ache cases reported at the *BONIS* system as clinical suspected *Dengue* disease through the community agents, 68 (52%) persons were derived to the Familiar Health Unit (USF) CAMSAT for physician and laboratory confirmation. After a laboratory diagnosis were confirmed 56 people (43%) to have *Dengue* and 12 people (9%) influenza, as showed at Table 4.

Table 4: Laboratory confirmed clinical suspected *Dengue* Disease (n = 129)

Clinical symptom	Confirmed (n)	%
Dengue	56	43
Influenza	12	9
Other disease	61	48
Total	129	100

Patient Follow up through the Familiar Health Unit (USF):

There were 173 follow ups through the community agents, physicians of the USF and reference hospital, corresponding to the 129 confirmed patients (see Table 3), with 1 to 5 follow-ups per patient. According to Table 5, the main type of follow up were 62 home visits by community agents, 39 cases were referred to the reference hospital, and 57 *Dengue* suspected cases were discard (closed).

A group of suspected cases (n=75) could not received a follow up, the reasons for the lack of follow ups by the community agents were primarily because the phone numbers belonged to people outside the area. Although the community agents claimed they knew all the people assigned to their area they could not identify the home address, the caller's name, or phone numbers of the affected callers reporting suspected symptoms.

Table 5: Types of follow up preformed through the Familiar Health Unit (n=173)

Type of Follow up	n	%
Home visit by the community agent	62	35
Referred to the Family Health Unit	39	23
Referred to the reference hospital	10	6
Home visit by the physician	3	2
Telephone advice	2	1
Case Discard (closed) during home visit	57	33
Total	173	100

The Data Base System (IVR *BONIS*) is available for the health network services (Family Health Unit, Reference Hospital and Health Surveillance Centre)

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with restricted and coded access for the system users. There was a significant increase of suspected cases notifications to the Health Surveillance Centre (DGVS) respect to the traditional methods via Fax or weekly report since the implementation of the *BONIS* System. Thus, in 2008, *CAMSAT* USF notified to the Surveillance Authority (DGVS) only one suspected case of *Dengue* and in 2009 there were no reported cases. By contrast, between April 2010 and August 2011, 157 suspected cases were reported and after that were through the laboratory confirmed 56 cases of *Dengue* Disease and 12 cases of Influenza.

Concerning the acceptance grade of the *BONIS* System by the community, a randomized survey between system users was performed. A high level of the surveyed people, 90%, showed their awareness and acceptability of the *BONIS* system to report suspected symptoms. Also through the survey were some reasons detected why the community don't use the *BONIS* System widely, between others the quantity of questions to answer and the cost of the call to the system (approximately 20 cents US$). The surveyed people would like to have a free call (0800) to report their suspected health symptoms in order to avoid an epidemic.

DISCUSSION

The developed and implemented notification tool is a community epidemiologic surveillance system based on ICT. It incorporates web technologies and databases for patient records, home visit prioritization and an appropriate follow-up by health personnel (8). The *BONIS* system has been implemented as an innovation tool for community epidemiological surveillance according to the new public health strategy in Paraguay, where the primary health care (Familiar Health Unit), community agents and the community empowerment of their own health a vital role play (1,9,10). However, the system can work in other scenarios. The key is to have a health staff monitoring the phone calls and generating adequate information about the patient (home visit) in order to refer the patients to the appropriate health service level (physicians, primary health centre (USF), reference hospital or laboratory) to confirm and treat the disease (11).

For an efficient functioning of the health surveillance system, there must be a strong commitment on all stakeholders that include community, primary health care, reference hospital and laboratories, as well as the health surveillance authorities. At the community level, the implementation of this new tool for community epidemiological surveillance based on ICT requires a relatively longer time than the duration of this project in order to validate the system and thereafter to include it as part of the national health surveillance system. Community agents are the key in delivering information to the community and receiving it from the community. In this context the study also shows how ICT may be used to bridge the health information gap between primary care units and the community, facilitating the establishment of the first step for a community e-Health system. Furthermore, geographically isolated communities such as the Paraguayan *Chaco* may be integrated into the National Health Surveillance System without delays through the use of the *BONIS* System, which is already facilitating communication (promotion and prevention of health) among stakeholders of public health.

The use of ICT in the implementation of an active epidemiological surveillance have showed very positive results both in the management of information and awareness in the community, thanks to the prompt communication at different levels of health surveillance, health centers and the affected community. This was evident by the increase of notifications after the *BONIS* system implementation respect to the traditional method. However, many people from this community still prefer to call directly to the community agent to report their health related symptoms than to report it to the IVR system. According to their perception, they get a faster advice to their problem, since most of the problems afflicting this community are related to chronic diseases such as hypertension or diabetes, which was observed in a performed household survey. Other reasons were the extension of the IVR questionnaire and cost of the telephone call (about 20 cents US$).

One of the major finding of this study was the community cultural paradigm, which must be solved to address a community empowerment of the *BONIS* system as a tool to monitor their health. In this sense, the community has not yet recognized that the purpose of an epidemiological surveillance system is the early intervention before epidemics occur. The community must become proactive in order to eliminate the infectious disease in time (12). Therefore, many promotional and prevention interventions are still necessary in this community regarding infectious disease control such as *Dengue*, where community involvement is essential. Much can

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be done to improve the effectiveness of the community health promotion (7, 11).

Since the cost-benefit ratio can´t be easily visualized by the caller, it is strongly recommended that the calls have to be free of charge (0800-call). The population does not realize that maintaining their health is their own responsibility, and generally identifies the Ministry of Health as responsible for public health, which was a finding during the *BONIS* system promotion at the school.

In conclusion, despite the socio-cultural paradigms to a community and health staff empowerment of the innovated health surveillance tool named *BONIS*, Paraguay has a community epidemiological notification system based on ICT, of low cost, open source, extensible, and scalable to other diseases. However, in order to address its effective implementation in the communities, a development of community-wide education programs and other health promotion activities have to be strengthened. Proactive community participation builds public support for health policies and programs, generates compliance with health regulations and support cost-effective use of human and technological resources. At least, the use of the developed ICT tool transforms the epidemiological surveillance system in a case study of e-Health in Paraguay.

REFERENCES

1. Berkelman RL, Bryan RT, Osterholm MT, LeDuc JW, Hughes JM. (1994). Infectious disease surveillance: a crumbling foundation. Science. 264: 368-370.

2. Nsubuga P, Nwanyanwu O, Nkengasong JN, Mukanga D, Trostle M. (2010). Strengthening public health surveillance and response using the health systems strengthening agenda in developing countries. *BMC Public Health*. 10 (suppl 1): S5.

3. Kebede S, Gatabazi JB, Rugimbanya P, Mukankwiro T. Perry HN, Alemu W, et al. (2011). Strengthening systems for communicable disease surveillance: creating a laboratory network in Rwanda. *Health Research Policy and Systems.* 9: 27-35.

4. DGVS (2011). Boletín Epidemiológico Semanal nº 22. Retrieved June 17, 2011 from http://www.vigisalud.gov.py/index.php?option=com_phocadownload&view=category&id=12&Itemid=140

5. Beatty ME, Beutels P, Meltzer MI, Shepard DS, Hombach J, Hutubessy R. et al. (2011). Health economics of Dengue: a systematic literature review and expert panel's Assessment. *Am. J. Trop. Med. Hyg*. 84: 473-488.

6. Westbrook JI, Braithwaite J, Gibson K, Paoloni R, Callen J, Georgiou A, et al. (2009). Use of information and communication technologies to support effective work practice innovation in the health sector: a multi-site study. BMC Health Services Res. 9: 201.

7. Chretien JP, Tomich NE, Gaydos JC, Kelley PW. (2009). Real-Time public health surveillance for emergency preparedness. *Am J Public Health*. 99: 1360-1363. Doi: 10.2105/AJPH.2008.133926.

8. Basogain X, Cane V, Galván P, Cabral M, Olabe MA, Gómez MA, et al. (2010). Epidemiological surveillance using information technologies in Paraguay. *Biomedical Instrumentation & Technology*. 2: 159-165.

9. Galvan P, Cabral MB, Cane V. *Implementation of a Telemedicine / Telehealth system at the Institute of Research in Health Sciences*. Mem. Inst. Investig. Cienc. Salud, Vol. 4 (1). Junio 2008. ISSN 1817-4620.

10. Basogain X, Olabe MA, Espinosa K, Gómez MA, Larrabe JL, Galván P, et al. (2010). Sistema de vigilancia epidemiológica comunitaria "Bonis". Estado actual y proyecciones futuras. *Mem. Inst. Investig. Cienc. Salud*. 8: 44-57.

11. Meankaew P, Kaewkungwal J, Khamsiriwatchara A, Khunthong P, Singhasivanon P, Satimai W. (2010). Application of mobile-technology for disease and treatment monitoring of malaria in the Better Border Healthcare Programme. *Malaria Journal*. 9: 237.

12. del Hoyo-Barbolla E, Kukafka R, Arredondo MT, Ortega M. (2006). A new perspective in the promotion of e-health. *Stud Health Technol Inform*. 124: 404-412. PubMed PMID: 17108554)

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