Effectiveness of the implementation of a web solution in the evaluation of emergency obstetric hemorragy (red key)

Elfer Arenas-Alarcón[1], Luis Cabrera-Diaz[2], José Sulla-Torres[3], Jannet Escobedo-Vargas[4]

[1]Escuela Profesional de Ingeniería de Sistemas, Facultad de Ciencias e Ingenierías Físicas y Formales, Universidad Católica de Santa María.
elfer@fotovoltaicosperu.com
[2]Escuela Profesional de Ingeniería de Sistemas, Facultad de Ciencias e Ingenierías Físicas y Formales, Universidad Católica de Santa María. andrec393@gmail.com
[3]Escuela Profesional de Ingeniería de Sistemas, Facultad de Ciencias e Ingenierías Físicas y Formales, Universidad Católica de Santa María. jsullato@ucsm.edu.pe
[4]Facultad de Obstetricia y Puericultura, Universidad Católica de Santa María.
jescobed@ucsm.edu.pe (Corresponding author).

Abstract. Aim: Allow online training, evaluation and feedback of Obstetrics students in emergency care: obstetric haemorrhage (red key). Material and methods: an analysis of the current state of the teaching of emergency obstetric haemorrhage was performed in students of the VIII Semester of the Faculty of Obstetrics and Childcare of the Universidad Católica de Santa María, the basic requirements, functionalities and deliverables were based in the SCRUM methodology. A web server, a "Somee" database management system, SqlServer and Visual Studio application development environment were required. The database model was designed based on the emergency learning requirements identifying all the entities, standardization techniques of the tables originated from the entities were applied; necessary information was collected for the records in the tables; The user interfaces were designed, a first level identification page was developed that controls access to the system and differentiation of functions according to the type of user, followed by a search tool that provides the user with a list of obstetric emergencies with keywords. Finally, an evaluation module was developed to analyze student performance. To provide the functionality required to the application, a set of routines were developed that included querying and updating at runtime the information shown in the interface, consulting and downloading external files in PDF format. Conclusion: The GEO web application provided the feedback of knowledge to the Obstetrics student after its use and evidenced in the results an improvement in the qualification ($p < 0.05$). The use of the GEO Web application as developed information technology, complements the teaching that is currently practiced in the classrooms, promoting the improvement of the quality of teaching through the integration of a new self-learning model.

Keywords: Emergency. Hemorrhage, Obstetric, Web Application, Submit, Visual Studio, SqlServer.

1 Introduction

According to the World Health Organization (WHO), "complications of pregnancy, childbirth and the puerperium are the first cause of disability, disease and death in reproductive age" [1]. The WHO report indicates that dealing with the situation described above is not complicated, if simple measures are taken, such as the application of accessible, affordable services and quality and trained professional staff in the mother and child area. Several studies show that there is no adequate emergency obstetric care (COE) and that this is mostly due to the absence of properly trained obstetric personnel [2,3].
description of the problem
Scientific evidence allows obstetric professionals to perform essential obstetric functions and procedures, it is a cost-benefit strategy to improve maternal and child health. However, it happens that cases of obstetric emergencies happen very sporadically, so that specialized obstetric personnel are not in constant practice of the unique procedures established to apply in these scenarios [4].
Within the emergency entities of obstetric hemorrhage, postpartum hemorrhage (PPH) that is commonly defined as a blood loss of 500 ml or more within 24 hours after delivery, while severe PPH is defined as a loss of blood of 1000 ml or more within the same time frame. PPH affects approximately 2% of all women in labor: it is associated not only with almost a quarter of all maternal deaths worldwide, but also the leading cause of maternal mortality in most countries Low income PPH is a significant factor that contributes to severe maternal morbidity and long-term disability, as well as a number of other serious maternal diseases generally associated with considerable blood loss, including shock and organ dysfunction [5].
Attention of Obstetric Emergencies in Real Scenarios. At national and regional level there is a health system by levels of care in order to attend EMERGENCIES in this case OBSTETRIC; In Arequipa there are Hospitals level II and level III that receive the references of peripheral establishments such as Health Center level I-4 that attend normal deliveries and in case of any complications refer to the hospitals; and Health Centers and Posts that attend 12 hours that attend normal obstetric conditions that, in any event, are also referred to CS level I-4 or Hospitals [6].
In the Arequipa region, 80% of normal (eutocic) births are attended by obstetric professionals with the appropriate capabilities to provide obstetric care under normal conditions and to be able to identify or detect the presence of any pathology to be able to refer timely [6].

Maternal health continues to be one of the priority public health issues at the international and national levels. The events related to pregnancy, childbirth and the puerperium are considered as preventable deaths, which must be measured meticulously, because they have sub registration and problems in the quality of the diagnosis, so the possibilities of addressing mortality in pregnancy, childbirth and puerperium using other data sources and not only death certificates, are very relevant [7].

The reason for maternal death in Peru for 2015 was 68 x 100,000 live births. According to estimates of the maternal mortality ratio (1990 to 2015) made by WHO,

UNICEF, UNFPA, the World Bank and the United Nations Population Division, Peru reached an RMM of 68 maternal deaths per 100,000 born alive, for the year 2015; Therefore, our country is considered to have made progress towards improving maternal health and achieving the MDG [4]. In 2015, 443 cases of maternal death were reported in Peru, 63% directly during the puerperium, 63% and 9% birth, with obstetric hemorrhage being the first direct cause of maternal death [8].

MATERNAL MORTALITY due to direct causes (pregnancy, childbirth and the puerperium) is still average in the Arequipa Region (15 maternal deaths x 100,000 nv in 2015), that is, they have died from obstetric hemorrhage, pregnancy-induced hypertension and obstetric sepsis such as First causes, all preventable but that, because they were not treated properly or too late, ended in maternal death [6]. To reduce maternal mortality, there must be health services that offer quality essential obstetric care and that these are used by pregnant women either in simple alerts or for emergencies, which is where more misfortunes occur [9,10].

The Faculty of Obstetrics and Childcare (FOP) of the Catholic University of Santa María-Arequipa was created in 1977 and since then (38 years ago) has been training professionals whose profile is aimed at training professionals in obstetrics and childcare of high academic level , scientific and humanistic, identified with the country's health problems with a focus on Family and Community Health at different levels of care, especially the most vulnerable mother-child group and throughout the process of Women's Sexual and Reproductive Health , Family and Community (FOP Mission 2015) [11].

Throughout the operation of the Faculty, there are 2 subjects related to the teaching of Obstetric Emergencies the Pathological Obstetrics I and Pathological Obstetrics II courses by gynecological obstetricians, the theoretical classes of these Courses of 2 hours per week and the practical classes of 2 hours per week in clinical fields Hospitals Level II and III of the Ministry of Health. The theoretical evaluation is through the application of several instruments such as written tests, seminars, exhibitions. The practical classes are evaluated in the clinical fields with real patients in the application of standardized care protocols through the International Jhpiego Guidelines of the John Hopkins University (EU) [12] and the Ministry of Health (Care Standards) [13] [14]. In 2000 the Jhpiego Corporation donated to the FOP Anatomical models for teaching in Reproductive Health that is used by teachers and students in the different subjects of the specialty.

It has been observed on several occasions and as stated by graduates of the FOP, that the training in Pathological Obstetrics was limited by access to patients with some risk that limits professional practice but that there may be emergency cases that must be resolved is that new ways of approaching the teaching of these topics are required. To date there is NO teaching based on the use of computer technologies of these subjects which could be a very valuable instrument in the field to promote and deepen the forms of action in scenarios that could arise.

Competency-based training was introduced at MINSA 8 years ago, covering evidence-based practices for normal delivery as well as COE. For skills-based training, skill modeling, the use of standard protocols and evidence-based practices are essential, particularly for the initial management of obstetric emergencies are essential to ensure the survival of a woman. Current evidence-based practices,

including the practice of clinical skills in anatomical models, followed by the practice of initial competencies under supervision, first, and then independently at training sites. The courses focus attention on the specific knowledge, skills and attitudes necessary to conduct normal deliveries and perform COE functions in a standardized manner, as well as the skills for interpersonal communication [12].

Main problem

For the aforementioned, there is a problem that goes beyond the preparation of the professional and is that there is no automated, visual and interactive solution at your fingertips, to guide you in these emergency scenarios, which must be solved in a matter of minutes because of the high risk of damage to the patient or the fetus and in the worst case the risk of losing one's life. There is a gap in terms of having a positive and permanent feedback on learning achieved in cases of emergency obstetric hemorrhage and that is not really applicable daily, but only when the obstetric emergency arises.

Against this background, a question has been raised in order to know if it is possible to develop an application based on information technologies [15], which can contribute to the performance of the Obstetrics student and consequently to their performance in the face of these situations so critics. As a result of globalization, there is currently a growing and almost widespread, convenience of having access to the Internet through any type of device and in most places where we are. This reality makes the vision of developing an efficient and complete solution for this need translate into the development of web technology [16,17,18].

In this way you have the option to carry out the implementation and put into practice the solution so that it can be used by teachers and students of Obstetrics and thus obtain the indicators that demonstrate the usefulness of the project. Currently, the necessary tools and / or support are not available, such as in hospitals or clinics where often if they are not adequately treated through the single protocol established according to Emergency Obstetric Care (COE) [12]. Similarly, the Obstetric Emergency web solution (GEO Web), serves for the evaluation and feedback of professionals specialized in Obstetrics, in order to optimize their skills and improve their performance. An influential factor in the performance of the obstetrician professional in relation to the real scenarios of obstetric emergencies is that they do not have the feedback of the information continuously, generating a gap between their knowledge acquired during their years of study and the implementation of the same.

To produce a competent professional in services, it is required that you handle modern tools such as mobile devices that are intended to simplify everyday tasks with simple processes, or the web platform, which is a tool accessible by all [12, 18 , 17]. It is necessary to readjust and strengthen some specific activities in these tasks, because there are lives involved. Nowadays, it is taking fortifications of services offered in health centers as well as project development, training, replicas and health internships. Develop a methodology with the help of technology that is orderly and systematic that guarantees reducing perinatal maternal mortality by providing comprehensive care for women and children by health personnel, this is one of the solutions being proposed.

Justification There is an urgent need to contribute through a web solution, which integrates standardized emergency care procedures.

Childcare of the UCSM, Semester Par 2015 preparing for the Internship in obstetric centers.

The GEO WEB application was created using the SCRUM methodology [19]. To carry out the project, an analysis of the basic requirements, the desired functionalities, previous information and professional interests was carried out, through meetings and deliverables based on this methodology. Scrum is an agile methodology for the development of projects that require greater speed and adaptability in their results.

Subsequently, a technology selection process was carried out in order to identify the most appropriate to the requirements of the need. The proposed solution has required a web server, a database management system and an application development environment. In this order Free server called "Somee", SqlServer and Visual Studio development environment were selected. The development of work in three major stages. First, the database model was designed based on the requirements raised by identifying all the entities and as part of the data processing it was necessary to apply the standardization techniques of the tables originated from the entities. Information needed for the records in the tables was also collected. Second, the user interfaces were designed, an identification page was developed at a first level that controls access to the system and differentiates functions according to the type of user, then a search tool that provides the user to obtain a list of obstetric emergencies with keywords. Finally, an evaluation module was developed to analyze the performance of obstetric personnel. To provide the functionality required to the application, a set of routines were developed that include querying and updating at runtime the information shown in the interface, consulting and downloading external files in PDF format.

The software engineering process [20] comprised four phases: conception, elaboration, construction and transition, this always from the point of view of a methodology called traditional, classical or predictive. To carry out this software development life cycle in which the development phases have been defined, the Logical Architecture of the System "architecture of 3 or more layers" [21] was used. This architectural style logically separates and in some cases physically, the presentation aspects of the interface layer, the application layer and the storage layer. The interface layer contains the graphical user interface that allowed users to interact with the system. This layer was implemented using JavaScript, HTML, CSS3, AJAX and all its menus. The application layer contains the logic and rules for storing data in the database layer and also for retrieving these according to the needs of the users. Finally, the storage layer saved the data required by the system [15].

To feed the content of the issues of the red key emergency obstetric haemorrhage, the manuals and teaching guides of the Ministry of Health and the Jhpiego corporation [12] [22] were taken as a reference.

Processes for the analysis of Use Cases were executed: Use Case Development, Start User Session, Start Administrator Session, User Management, Evaluation Management, Emergency Process Management, Surrender of Evaluations - See Results, Search and Review of Emergencies, Generation of Evaluation Reports.

3 Results

Prior to entering the Geo Web Platform, students were evaluated with a written test with the same parameters as the evaluation of the application, where a third of the students had a result of 10 to less than a disapproving note. And a satisfactory note only 16.2% (14 or more).

Table 1. Writing assessment of Emergency Obstetric Hemorrhage

Writing assessment	No. Of students	Percentage
Less than 11	8	32.4
11-13	13	51.4
14-15	4	13.5
16-20	1	2.7
Total	**26**	**100.0**

After registering and entering the system where through the applications they studied and resolved clinical cases of the emergency, they entered the online evaluation where the majority of students had a satisfactory evaluation 14 to more: 57.7%.

Table 2. GEO Web evaluation of Emergency Obstetric Hemorrhage

GEO Web evaluation	No. Of students	Percentage
Less than 11	7	26.9
11-13	4	15.4
14-15	6	23.1
16-20	9	34.6
Total	**26**	**100.0**

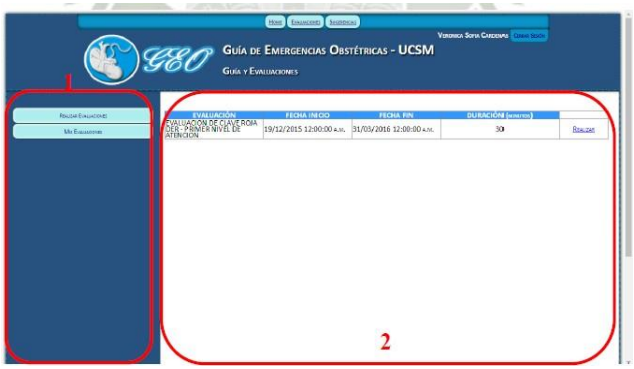

Fig 2. Visual Interface for the Geo Web Evaluations

Figure 3 shows the evaluation through the application GEO Web improved the performance in the evaluations being the results in the platform superior to the written

evaluation that had the same parameters as that of the platform, these being significant differences. ($p < 0.05$).

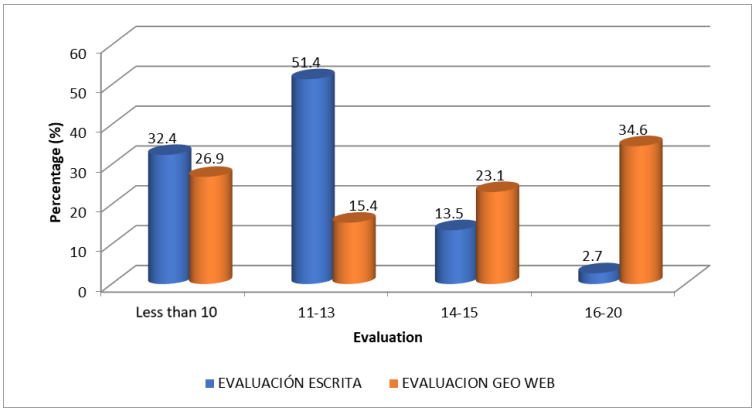

Fig. 3. Results comparison of written assessment and Geo Web evaluation.

4 Discussion

Given the need for a system that uses information and communication technologies, in December 2015, the official launch of Geo Web v 1.0 was carried out, with the concurrence of students, authorities of the Faculty of Obstetrics and Childcare, and the Teacher in charge of implementing the content of the GEO Web for emergency obstetric haemorrhage in the facilities of the Santa María Catholic University, with the aim of publicizing the correct way to use and interact with each of the application modules web, it is worth mentioning, that the use of the evaluation module was highlighted as it would be the fundamental piece to measure both their knowledge and the added value generated by the system.
Post-Production Scenario, once the system was presented, there was a considerable time interval for student training using the emergency care guide module obstetric hemorrhage (red key) [12,22]. In this way it was useful both for users to improve their knowledge and for the system to have real access records in order to keep more sought emergency controls and frequency of access to the system by users.
At the same time, the results of the evaluation rendered were obtained, which are compared with the results of the written evaluation developed prior to the use of the application, with the objective of determining whether the use of the interactive Geo Web system with a friendly interface, emergency search engine and classified information and standardized.

Nowadays there are studies that are carried out in the stage of pregnancy, childbirth and postpartum by means of technology multimedia computer tools, to be able to show in a real dimension, phenomena that are usually studied theoretically by students of medicine and obstetrics [18]. The Medical Sciences Review [23], published an article about educational software for the development of practical-

professional skills in the subject of gynecology and obstetrics that is constituted by three fundamental parts that include contents of obstetrics, gynecology and self-assessment questions with your answers The designed software provides students with continuous learning and self-evaluation with a useful methodological and didactical approach to reinforce the theoretical and practical learning of the subject. Its creation responds to a real need that is satisfied with the use of this teaching medium. The GEO Web only prioritized the management of the emergency obstetric hemorrhage as a fundamental aspect that an obstetrician should know how to apply the immediate action measures. Hipolito Breijo Madera et al. [24] carried out an investigation of the technological innovation type in the Pedro Borrás Astorga University Polyclinic in Pinar del Río, from September 2005 to June 2006, deciding to prepare software to quickly show the main parameters of the Prenatal Care consultation, according to the gestation time Interesting application but that only involves care during pregnancy with the most important milestones to have quality care, the methodology used is similar to ours but the issue is obstetric but we prefer to cover the first cause of maternal death nationwide and Thus, in the future, it is possible to implement for the most important cases of obstetric emergency, such as the red code, the blue code (pregnancy-induced hypertension) and the yellow code (puerperal sepsis). The universe of this research was made up of all the students of Medical Sciences who attended the Polyclinic Library mentioned during this period.

The sample was those students (214) who used the simulator for some reason and voluntarily decided to answer the applied survey. In the realization of this medium, a 600Mhz Celerón microcomputer was used with the Windows XP operating system and the Flash 5 Macro media software, using Spanish as a language and creating a Prenatal Care (ATENPRE) consultation simulator with multimedia sequences, which a Through a series of links they lead the user to recognize the search query. Among the main results is more than 90% of acceptability, efficiency and utility, concluding that educational software (ATEN-PRE) is another tool to be used by undergraduate students in the active search for information.

Arturo Atria et al. [25] argues that the current obstetric medical field must rely on computer resources, not only oriented to the processing of information in databases or search and consultation of scientific information, but in the use of computational and computer tools that complement the actions diary. Under this context, a comprehensive software oriented to the obstetric medical environment has been developed. This software is developed for personal digital assistant (PDA: Personal Digital Assistant) of the Pocket PC type. It allows the calculation and management of information concerning gestational age, fetal and embryonic biometrics, estimation of fetal weight and national and international benchmarks, quickly, safely and effectively.

Our work has an impact on the management of obstetric emergencies, given that in our country these entities can appear at any time and place and in the preparation of undergraduate there are few opportunities to intervene in these high-risk cases that endanger the life of the mother and fetus and / or newborns, which is why the Jhpiego Corporation of Johns Hopkins University [12,26] trains, prepares and has teaching materials and manuals available to everyone that help staff to train as is the case of

the Faculty of Obstetrics of the UCSM teachers who attended the Courses and gave replicas to the rest of the staff but we see the need to also use an application such as the one created called GEO Web whose use is complementary to what Jhpiego offers.

Regarding the completeness of the system, all the information of standardized emergency processes was integrated into a tree view data structure, which for the end user becomes a category tree interface, which helps navigation effective for it. Complementing the development of the completeness of the system, a data structure was implemented, which serves as an emergency container for Red Key obstetric hemorrhage and its entire procedure segmented in care steps.

4 Conclusions

A web solution was developed, which originated in the Faculty of Obstetrics and Childcare of the Santa María Catholic University, to modernize and optimize the learning system about emergency obstetric hemorrhage care, which is hosted on a web server free (www.somee.com), which was selected based on certain criteria. The web solution is available 24/7 for the use of students who require it, as well as for the administrator. Complementing with the documentation of the project, in each of the phases annexes were developed, among which are the database, data dictionary, source code (digital) and user manuals of / administrator.

-The information provided by the system is focused on the category of emergency obstetric hemorrhage (red key), this does not mean that the system is static, since it has a process management (obstetric emergencies) that allows keeping the information updated to available to all active users. Tools and feedback were integrated into a web solution to complement the current learning system and the application of knowledge. The GEO Web application improved the performance in the evaluations, the results being better on the platform than the evaluation that had the same parameters demonstrating the efficiency of the system.
-The implementation of information technologies in the specialty of education complements the teaching practiced in classrooms today. This implementation has encouraged the improvement of teaching quality through the integration of a new distance self-learning model with the classroom model, achieving a mixed model which favors those involved in the learning process (students and teachers).

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