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FULL PROPOSAL SUBMISSION

A. COVER PAGE

1. Title

HEAD-US Mobile App: design and implementation

ID number:

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2. Abstract

More and more emerging applications are being used in the medical field. Many of them have been designed for the use of patients themselves. Care applications are also being developed to facilitate clinical decision making, to process medical information and to assist the work of the physician at the patient's bedside.

Other applications have been designed exclusively to facilitate the teaching of clinical aspects. For example, applications have been created to enhance the three-dimensional knowledge of anatomy, tools for simulations in emergency situations or programs designed to improve specific clinical skills.

On the other hand, there is a growing interest in the use of ultrasound as a tool for the assessment of musculoskeletal pathology related to hemophilia. This growing interest has led to the development of protocols for the evaluation of hemophilic joints. Among the known protocols, the Haemophilic Early Ultrasound Detection-arthritis (HEAD-US) published by Martinolli has proven to be the most appropriate for its effectiveness and reproducibility.

However, while there is a consensus on the usefulness of ultrasound in hemophiliacs, training and required equipment are not always available. Besides, the US HEAD method requires an adequate training to be applied with good results.

This project arises from the need of facilitating the teaching of US HEAD-method and assisting the clinician in using such a systematic sonographic evaluation. It will be made an application that facilitates clinicians to learn and use the HEAD-US method, assisting it's users during the application of this method of ultrasound assessment at the patient's bedside.

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C. REVIEWER COMMENTS

Among the reviewers' comments the first question that arises is the difficulty when recruiting clinicians using the application. The idea behind this project is to get clinicians to know and use the application once it has been properly publicized. To achieve this we can count on the collaboration of organizations that provide coverage to doctors who value hemophiliacs, as can be scientific societies, patient organizations or specific research centers. The idea is to organize group training sessions to show the use of the application, how to access it and solve the general problems that may arise from their use.

Although today the use of computer applications is simple, we are aware that some clinicians may have some difficulty using a mobile application such as that proposed in this study. We think group class format, small groups considering, can help to solve all technical problems in a personalized way, so it would get easier access to this application to those clinicians with greater difficulties in the use of new technologies.

The main idea when developing this application is to reduce technical barriers, related primarily to the lack of knowledge of HEAD-US method, as well as facilitating the learning curve in the sonographic evaluation of hemophilic patients for clinicians less experienced in the management of musculoskeletal ultrasound imaging. The interest in overcoming other barriers, as can be economic or organizational, also underlies the spirit for the creation of this application. Later in this document these aspects will be developed further.

The application to be carried out with this project aims to facilitate learning and application of HEAD-US method. Getting assess to obtain the degree of hemophilic arthropathy in a standardized way, with a sensitive and safe method, has enormous clinical benefits. However, since the clinical benefits that can be obtained by using this application are mainly indirect, they are extremely complex to measure. We believe that using clinical parameters to assess the effectiveness of the application created in this project is not valid, being a confounding factor rather than an appropriate valuation.

D. MAIN SECTION OF PROPOSAL

1. Overall Goal and Objectives

The main objective of this project is to develop an application for mobile devices that facilitate the learning and use of the HEAD-US method. One of the main barriers to the implementation of the HEAD-US method is the lack of training of the professionals who should perform it. We face a double training deficit, the general musculoskeletal ultrasound utilization and the use of the HEAD-US score.

We believe that there are several barriers to learn and perform HEAD-US method:

1) Technical barriers.

- Lack of knowledge about using ultrasound equipment.
- Lack of equipment needed to perform the method.
- Integration defects with information systems within healthcare organizations.
- Lack of HEAD-US method knowledge or lack of experience with its use.

2) Economic barriers.

- Related to time consume of ultrasound examination.
- Cost of ultrasound equipment.
- Cost of training of professionals.

3) Barriers individuals.

- Lack of motivation to learn the method.
- Fear of change.

The application aims to overcome the various barriers described. Both technical barriers (facilitating knowledge of the method and improving its application experience) and economic barriers (reducing training time to learn the method) and even the barriers of individuals, related to a modern teaching methodology and use of new technologies.

The application to be developed would be designed for professional use, ie for use by physicians whose professional activity is related to hemophilia. The purpose of this application is to facilitate the teaching of HEAD-US method, benefiting from the advantages offered by new technologies and also assist the clinician to use the HEAD-US score thanks to an audiovisual guide system that ease the different items of score. Finally the application will include a self-assessment test that will allow the clinician to check his/her skill level of knowledge of the HEAD-US protocol.

Therefore the main objectives of this project are:

- 1) To facilitate the use of HEAD-US score at the patient's bedside.

- 2) Improve teaching HEAD-US method for professionals who train other professionals.
- 3) Incorporate new technologies to facilitate the learning experience for clinicians attending patients with haemophilia.

2. Current Assessment of Need for the Project

The way medicine is currently being taught is changing dramatically. In addition to classic textbooks and scientific papers, the use of other teaching methods related to new technologies is more and more common. The online repository of clinical information, the use of audiovisual content portals, including social networks, have become vehicles for the transmission of medical knowledge today.

In the current scenario of technical advances there is an increasing trend for using mobile applications to facilitate teaching of knowledge and clinical skills. This is due to the presence, almost ubiquitous, of mobile devices in the population of developed countries, and also to the great possibilities of processing and connectivity offered by these devices.

Medical colleagues from different Hematology departments nationwide (Spain) have been asked about their knowledge and skills in using ultrasound in hemophiliacs. Most of them informed on the poor knowledge of HEAD- US they currently have, and their interest for learning the method.

The general impression indicates that most Hematology departments do not know how to use ultrasound equipments in a correct way. Moreover, they have no experience with the HEAD- US method. One of the main perceived weaknesses is the lack of tools that could facilitate learning the HEAD-US method and assist the clinician on applying the score in a hemophilic patient.

3. Target Audience

The application is designed to be used by physicians involved in the management of patients with hemophilia. As it is a tool that facilitates the sonographic evaluation of the musculoskeletal system through a particular protocol (HEAD -US), it will benefit hematologists, rehabilitation physicians, radiologists, orthopedic surgeons and sport physicians.

Given the benefits of HEAD-US method in the assessment of hemophiliacs there have been numerous professionals who have tried to be trained in this method to apply it properly. We believe that this huge interest is a factor that will influence positively on the use of the application proposed in this project by different professionals. Logically the clinical utility using the HEAD-US method assisted by our application will be the main factor to consider the impact of our project on clinicians day to day.

We believe that there are 5 key points needed to achieve broad acceptance of the application:

- 1) Inform and involve clinicians who value hemophiliacs.
- 2) Keep in mind and know how to counter the difficulties that may arise for the new technologies less skilled users.
- 3) Promote collaboration at all levels and by all groups (designers, trainers and users).
- 4) Having the support and close cooperation of the centers where hemophiliacs patients are treated.
- 5) Conduct a proper training program for system use.

The application seeks to facilitate learning and employment of HEAD-US method, and so it may be thought that our main goal are the clinicians who attend hemophiliacs. Quite at contrary, the ultimate target of our application is the hemophiliac patient, who is the main beneficiary of this tool that facilitates his evaluation and clinical management, influencing therapeutic decisions taken by their doctors based upon the patient's clinical status.

4. Project Design and Methods

The project consists of two phases. A first phase it will be created the application that will assist clinicians in learning and performing the HEAD-US protocol at the patient's bedside. A second phase, in which the method HEAD-US will be taught using the application as a support tool, as well as instructing clinicians in using the application. The training will take place in a classroom format.

The training sessions will be held in a guided way, starting with the download and installation of the application on clinicians participants mobile devices. Special attention to those users with difficulties using new technologies will be provided. The use of a mobile application in the clinician's own device is in line with the BYOD (Bring your own device) philosophy, which facilitates the use of electronic tools in the workplace using technology that users employ in their day to day.

Once all clinicians have downloaded the application and are familiar with its use, theoretical training is conducted with audiovisual and human guidance. Later practical training where HEAD-US method will be applied using the application as a tool to aid in the assessment will be performed.

Finally it will be fulfilled a evaluation survey where clinicians attending the training session will determine the degree of utility provided by the application and overall quality of the training received.

How far the knowledge of project members arrives, there is no computer application designed to teach a method of sonographic evaluation, as is the HEAD- US , and also assist the clinician in its application at the patient's bedside.

It has been performed a search in major biomedical databases, as well as in major mobile application stores to confirm that there is no application as it is designed in this project. Although there are other applications in health, whether aimed at patients or professionals, very few have a dual purpose , teaching and care, so marked. It is particularly interesting because it covers a specific area such as ultrasound assessment of hemophiliac patients joint pathology, and by a particular method such as HEAD- US .

Once the application is complete, it will be available for free download at the main application stores for professionals interested in using it. Thus its spread to be used for the benefit of the patient is provided.

5. Evaluation Design

The application general quality will be evaluated considering different sections, wich include the reliability, usability, and privacy. We will adapt an evaluation method used in the literature for assessing health applications in which the sum of the differents sections result in the overall quality of the app.

Another option that will evaluate the application is through the number of downloads from the store. This data may indicate, indirectly, the interest generated by the application, taking into account the number of potential end users. On the other hand, the store itself allows the evaluation of the application through a 5-star system, where 5 stars rating indicate the best possible result. This assessment may be done by users at any time and is dynamic, ie, can be modified by the user as he changes his user experience.

The evaluation of the training will be done through conducting some real case studies and a questionnaire of user satisfaction. We think that a great way to evaluate the application is through feedback that users who receive the training provide, fostering their cooperation and active participation. However, since it is necessary to quantitatively measure the effectiveness of the application, a satisfaction use´s survey for clinicians who are being trained in app´s use will be performed.

It is difficult to predict the use of the application over time. We expect that there will be a high initial demand among target users, by the very nature of the project to facilitate learning and use of the HEAD-US method. However, as clinical experience with the method increases, we think that the application will not be so much used. On the other hand, there will always be a demand for new users, taking into account clinicians who start to treat hemophiliacs or residents and medical students, for their lack of experience status.

In order to increase visibility and publicize the application between the group of interested end users, we will count on the collaboration of scientific societies that support clinicians who treat hemophiliacs, as well as scientific and patients organizations involved in the treatment of hemophiliac patients. In addition, we will

make use of social networks for medical use and is expected the result's publication in a scientific paper for wider dissemination in the medical community.

6. Detail Workplan and Deliverables Schedule

The timetable for completion of the two phases of the projects foreseen in the period between January 2017 and December 2018.

Time	Workplan
January- June 2017	In January 2017 will begin the design of the application. Initially it will be collected the best clinical scientific information available on hemophilic arthropathy, musculoskeletal assessment, anatomical notes, ultrasound equipment and use, the HEAD-US method itself and the systematic score. In this first stage all joint ultrasound images necessary for the creation of the audiovisual material for learning will also be collected. All the relevant information will be held in a suitable format to facilitate further migration to mobile application coded language. It is therefore necessary to be in direct contact with the informatics, to adapt the clinical information to the most appropriate format that facilitates it's later coding process. This stage is expected to be completed in June 2017.
June 2017- June 2018	From June 2017 to June 2018 it will be done the computer coding of all medical scientific information, both in text and audiovisual formats, to generate the mobile application in the necessary environments to be downloaded to the user's terminals. Throughout this phase there will be a continuous communication flow between informatics that develop the application and the clinical team involved in its design.
July- September 2018	In the period between July 2018 and September 2018 testing of the application by testing team will be done. At this stage all the errors that may have occurred and that may interfere with the best user experience with the application will be detected.
October- December 2018	Finally, in the period between October 2018 and December 2018 training and spread for the implementation among potential interested users will be done.

It should be noted that although this project has a completion date in December 2018, is intended by this working group perform a monitoring and tracking application usage over time. The aim would be to obtain appropriate metrics that can be analyzed in depth and lead to improvements in the user experience and facilitate the publication of long term results in terms of efficacy.

E. REFERENCES

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