# INTERACTIVE INFORMED CONSENT IN CLINICAL RESEARCH: DEVELOPING A MULTIMEDIA EDUCATIONAL TOOL

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***Abstract:*** *Background: Improving the informed consent process in clinical research is an ongoing concern of the regulatory authorities as well as a challenge for both the investigators and the patients involved. The latest innovations in information technology and Internet provide the opportunity to develop new methods for getting the informed consent using an online multimedia-training platform in the context of a computerized medical system. Methods: The platform development took into consideration the principle of universal accessibility for persons who have limited knowledge using a web system interface. It has been adapted to run efficiently on a tablet, taking advantage of the mobile technology. The application is structured as a list of e-learning modules and it will track in real time the progress recorded by each participant in the training process. Results: Multimedia Interactive Consent Operating System is an interactive online platform designed to inform and educate the patients about the clinical trials. It uses multimedia content, displays activity reports and integrates questionnaires for understanding assessment of the presented information, and for satisfaction assessment that will get the feedback on the presented training session. Conclusion: Using this online method, the patients have an interactive tool to get informed, the content being customized to each research protocol, giving corrective feedback on each concept, information or procedure that has been misunderstood by the patient.*

## INTRODUCTION

Clinical research has become a complex field with a highly sophisticated activity.(1-4) It implies various methods of investigation, medical procedures and technologies, as well as a continuously growing amount of information offered to participants.(5) This information is increasing in complexity and sometimes exceeding the patient's capability to read it and understand it.(6)

The informed consent (IC) documents offers a review of the clinical trial (CT): purpose and methods of research, estimated timeline of volunteer participation, benefits that can be reasonably anticipated as a result of research on the patient or on others, any risk associated with the study, maintaining confidentiality of the recorded data, investigators' responsibilities, offering free treatment in case of research related conditions, financial compensation offered to patients for the impairments or possible death resulted from these conditions, the freedom of the individual to participate and to forfeit at any point in the research without penalties or losing the benefits to which the patient was entitled to etc.(7)

Published studies report that alternative methods of obtaining IC such as multimedia systems are considered to provide substantial benefit to subjects.(8-11) Similarly, Eilenberg et al. reported high satisfaction rates on patients using interactive Web-based IC.(12)

The information disclosed to patients from the consent document do not assure the fact that they actually read it and they the have fully understood what their participation in the research involves.(13)

As Prof. Doina Banciu stated "it is unanimously recognized that sometimes there is a lack of information between research and innovation and implementation outcomes into reality".(14) Therefore, we have decided to create a tool to improve the informed consent process in clinical research.

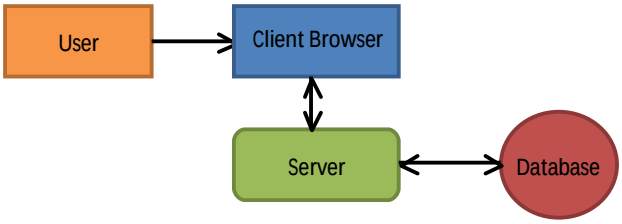
This paper will describe MICONOS, the multimedia online training platform and the impact it has on clinical research.

## METHODS

**MICONOS, an online training platform for obtaining the IC**

MICONOS (**M**ultimedia **I**nteractive **CON**sent **O**perating **S**ystem) is an interactive online information system designed to inform the patients about the clinical trials and eventually to get the IC (figure no. 1). It trains the patients regarding clinical trials procedures using web-based multimedia content such as: animations, audio & video content, MS Office presentations etc. Since the government authorities do not yet regulate its usage, it can be introduced as a supplement to the paper based IC process.

**Figure no. 1. Technical scheme of the application functioning**

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MICONOS development took into consideration the principle of universal accessibility for persons who have limited knowledge using a web system interface. It has been adapted to run efficiently on a tablet that provides simplicity when handled, ideal user friendliness and mobility. Users will be able to access the tool online at home, in the waiting room or in any other designated space within the research centre without any keyboard, mouse or other peripherals.

The application is structured as a list of e-learning modules and it will track in real time the progress recorded by each participant in the training process. The program provides the possibility to generate an IC document and IC forms, so the patient will be able to sign & date the IC.

Among the characteristics of MICONOS, we listed the following:

- Unitary system allowing the usage of a standardized training protocol;
- Multicenter consistency - same process is applicable in several medical centres, even if the patients training activity is conducted at the level of the medical centres in which they are enrolled;
- Multinational consistency - same process can be implemented in different countries so the patient will be trained in the preferred language;
- Data centralization - multiple medical centres will share common data. For example, the info about Sponsors initiating clinical trials (an institution or a person who assumes the responsibility of the clinical research) will be stored in a central repository.
- Traceability - any change can be tracked and this info will be accessible online by certain users.
- Security - assures data security and confidentiality complying with the laws in force and with the clinical trials regulations.

The web client interface was built using PHP, jQuery, HTML5 Design (Bootstrap 2) and HTML5 Player (Bootstrap 2 + Font Awesome) technology. The data is stored in a MySQL database. Thus, the system can be accessed online and there is no need to install it on the client machine.

For adapting the patient module to the tablet, combinations between available plugging in Bootstrap 2 framework and special adjusted plugging for facilitating a responsive design were used. The concept involves changing text and page size depending on screen resolution and device type, in order to make navigation easy and its filling to comprise the Y axis only (up-down scroll).

In terms of security, the access to the website is based on username & password. Each user is assigned to certain user groups (e.g. administrator, Sponsor, monitor, investigator, patient) so he will see only the sections that are allowed to these user groups.

## RESULTS

**System components: modules and functions**

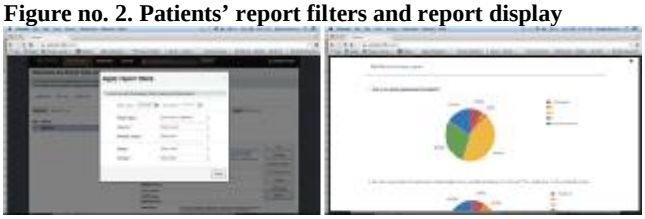
We created the following main modules:

1. The registration module - every user needs to fill out a registration form as a first step prior to using the system. Afterwards, an administrator will accept or not the registration.
2. The authentication module - every user accesses the system using a username & password or via SSO (Single Sign On).
3. The administrator module - it provides functionalities for user management, clinical trials management, presentations management and reports management.
4. The clinical trial admin module - it manages the clinical trials and the patients assigned to them.
5. The interactive training module - it trains the patients regarding a specific clinical trial.
6. The reporting module - it provides various reports on how the clinical trials are coming along.

**Reports and questionnaires**

The program can display the report on a study centre (quick statistics related to patients answers). It allows the visualization of the report related to the activity of a patient or of all the patients belonging to that study centre. Once the patients completed the training session, the system generates their activity report. This report can be accessed in real time by (investigators) clinical trial managers, the data management team and the Sponsors (see figure no. 2).

**Figure no. 2. Patients' report filters and report display**



This interactive platform provides researchers, via the patient's testing session, the acknowledgment of understanding, approval and acceptance of the clinical trial procedures. The training program integrates two types of questionnaires:

- the awareness questionnaire (understanding assessment) of the presented information,
- the satisfaction assessment questionnaire that will get the feedback on the presented training session.

Since the awareness questionnaire represents a key point in the training process, it will be detailed below.

The satisfaction of using MICONOS as a source of valid information, involved hardware and the application was assessed by using a 20 questions questionnaire and is rates (from "very low" to "very high"). There are scores for:

- content quality (from "bad" to "very good"),
- content completeness (from "incomplete" to "complete"),
- appropriate duration of the presentations (from "short enough" to "too long"),
- navigation tools usefulness, used language, and the tablet itself (from "very low" to "very high").

The following aspects were assessed: the patients' and investigators' opinion on this e-learning platform, the influence of personal discussions with the investigator during the informed consent process and the time spent compared to the time required by the printed-based consent.

We were interested in learning the extent to which patients find MICONOS presentation interesting, if the format is adequate, if it generates an increase in their interest towards clinical trials, if it facilitates the understanding of the presented information, if the use of equipment does not involve problems, if the length of going through the IC procedure is perceived as long or short, if the chosen presentation changes the option to participate in clinical trials, if the used language is unknown or common and if the amount of information influences the decision making process. The investigators' opinion about MICONOS is currently under ongoing evaluation.

The Awareness Questionnaire

About the research subjects it was reported that:

a) there is a lack of their interest towards clinical trial they will attend;(15-17) they adhere to the study schedule and procedures, but they are not that interested in what a clinical trial is, what are its objectives. This lack of interest is shown by the fact that many patients ask too few questions or none, out of which most address the form, not

the gist of clinical research;

b) in current research practice, a challenge is represented by the fact that a number of patients less instructed or old, who have lost the reading exercise, find the study of the IC documents quite tiring;(18-19) even if the document is read by a physician, many times the patient's attention is lost on the way, or if the patient reads it individually, he does so superficially, skimming the text, as he would do if he read a utility contract, that has to be signed no matter what.

c) for other subjects there is a low degree of understanding and remembering or retaining the presented information;(20-22)

d) patients are not so motivated to understand. For them, what matters is the end result (healing or an improvement in their condition), even if they are aware or informed that this is not guaranteed.(23)

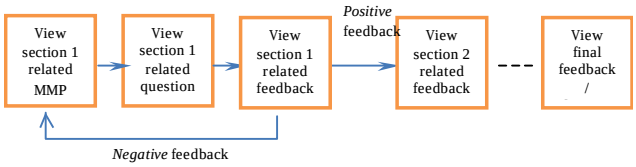
This behaviour can be interpreted as a sign of informed consent in incomplete awareness.

In order to fix this critical problem, we introduced "The Awareness Questionnaire" in the online training platform. This questionnaire will allow both the patient to be informed of the most delicate or important aspects of the clinical trial, as well as the physician to seize the poorly understood aspects in the IC document and to identify the areas where more discussions need to happen in order to achieve a more comprehensive IC.

The MICONOS online training material presented to the patient is structured in sections; each section has a multimedia content attached and an awareness questionnaire. We recommend the questions to be interposed with the sections of the informed consent document, to keep the patients' attention "awake" during the entire lecture of the document, instead of being used at the end of the presentation.

Once the patient finished visualizing a section, he will have to answer the awareness questionnaire. Depending on the given answers, the system will re-run the current section (if the provided answers were unsatisfactory) or he can move forward (if he gave correct answers to all questions). If the patient offers wrong answers, the system will provide additional explanations or the patient can contact one of the CT managers via chat or email (figure no. 3). In this way, the patient will get a better understanding of the matter. A wrong answer will be considered a notion not well explained which requires edification through a targeted explanation of the misunderstood information. The CT team will see these errors by checking the reports associated to each patient who went through the online training platform.

**Figure no. 3. The workflow diagram associated to the patients' multimedia presentation (MMP) and evaluation module**



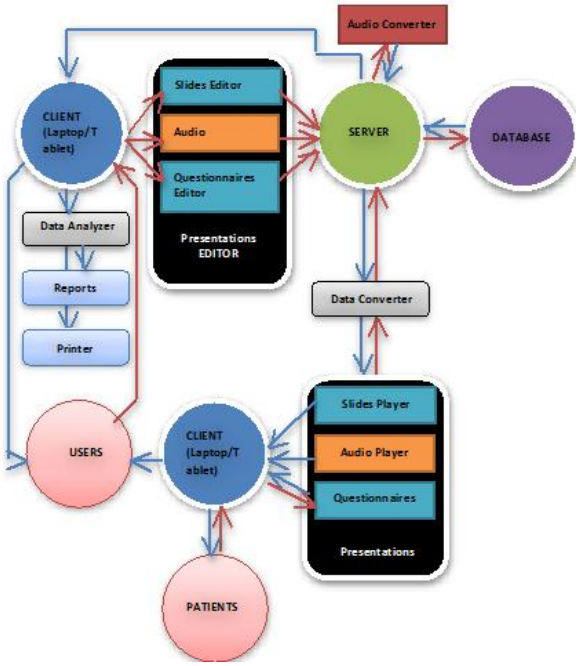

Using this awareness questionnaire, the CT team makes sure the patients have a good level of understanding of the presented notions while the patient must stay connected to the presentation.

**The interactive multimedia presentation**

The MICONOS multimedia presentation was created as animated slideshows including all the information in the IC document. The standardized information offered to all the patients within a clinical trial is accomplished through a multimedia presentation, identical for all the patients (using the language of the specific country), except for a short introduction clip (welcome clip), specific to each research centre. In order to simplify the usage, we have created a minimalist interface having several essential buttons (see figure no. 4), user friendly, personalized by incorporating some images of the centre and of the research team. Thus, it helps patients to become familiar with the team members from this very moment. This will strengthen the bond between patient and investigator, being a tool that favours the maintenance of the subject in the program.(8) The interface communicates information using a calm, empathic voice that has the role of increasing the presentation impact. The system will choose the personalized presentation version according to the patient's gender when the patient is registered. The presentation has two versions since some information are gender-related (e.g., female patients will be informed about contraceptive precautions during the trials and pregnancy/fetus related risks), so that patients will feel more comfortable and less confused when seeing the appropriate presentation. Patients will have access to the online training system as a source of information until the CT ends. Patients will also receive a printed copy of the clinical trial information as soon as the presentation session ends. The program provides the possibility to generate an IC document, so the patient will be able to sign & date it at the end of the presentation.

**Figure no. 4. Interface of the interactive multimedia presentation**

**Figure no. 5. Multimedia presentations scheme (execution, data saving, patients interaction method)**




A multimedia presentation editor was developed for this platform, which can create a new presentation for each CT that requires informed consent (figure no. 5). By text editing, both compulsory information can be added as well as supplementary information that clarify certain terms, medical procedures. Clips that cover information on disease

management, background information on clinical trials and other relevant topics can be inserted. It allows - words management in the glossary, questionnaires and the elements of the multimedia presentation (image, sound, and movie).

The development of the module for creating presentations includes:

- Text editor, the „What you see is what you get" type
- Audio files upload
- Audio converter (if necessary)
- Additional information insertion editor (Glossary)
- A section of video links attachment and video gallery development
- Creation module of questionnaires corresponding to the presentation slides.

The player development:

- System based on slides for rendering the presentation content
- Audio rendering system according to ongoing slides
- Separate slides rendering system for patients and other types of users
- Glossary rendering system
- Video rendering system integrated through a YouTube link
- Data backup system transmitted by the patient interaction in real time
- Time metering system for browsing the presentation
- Re-composition system for questionnaire slides
- Reporting system.

## DISCUSSIONS

Researchers could use this online platform in order to obtain a better valid informed consent regarding clinical research. The efficacy of this platform has started being evaluated in several feasibility studies with participants from different research projects who suffer from various medical conditions. The acceptability of the new technology by the patients and the research teams was verified. At the same time, we have started to estimate the impact of using the new technology on research costs.

There is a request from physicians and patients to use new technologies for getting the IC in the context of increasing complexity of CTs, as well as a need to prove without doubt that subjects were informed and they understood what the voluntary participation in a clinical trial required.

Since the competent authorities (National Ethics Committees and National Medicine Agencies) have not regulated the usage of this innovative approach in obtaining the IC, the research centres have to use the program as a supplement to the standard paper based IC.

## CONCLUSIONS

We believe that the most important advantages of the e-learning platform are the high level of multi-sensorial stimulation (auditory, visual, reading and writhing) and the amount of additional explanation information it can provide to participants in clinical studies.

The statistical analysis of the item measuring subjects` satisfaction towards the different format, printed versus multimedia concludes that the audio-visual multimedia format is more appropriate to presenting information.

The correlation between the information understanding level and the way subjects perceived MICONOS proves that the higher the degree of understanding, the more interesting the presentation of IC information is.

The awareness questionnaire represents a key point in the informing process. It is an auxiliary tool integrated into the platform, that:

- will stimulate the interest of the patients to what will happen during clinical research,
- will maintain their attention to the disclosed information and
- will evaluate retention, and nonetheless, understanding of the concepts being communicated.

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