Publishable Summary

Project objectives and main expected results

INTERSTRESS is a European-funded project helmed by Istituto Auxologico Italiano involving 11 partners from six countries. It aims to design, develop, and test an advanced ICT-based solution for the assessment, treatment, and prevention of psychological stress. It uses a new e-Health concept, “inter-reality”, in which behavior in the physical world influences the virtual world experience, and vice versa. It employs 3D shared virtual world role-playing, and bio and activity sensors, in mobile and in Internet applications. The vision for the resulting system is a personalized, immersive e-therapy in which biofeedback, simulation, and presence are key components of the therapeutic process. INTERSTRESS will provide a proof of concept and clinical validation.

The INTERSTRESS system will aim at (1) objective and quantitative assessment of symptoms using biosensors and behavioral analysis; (2) decision support for treatment planning through data fusion and detection algorithms; and (3) provision of warnings and motivating feedback to improve compliance and long-term outcome.

To reach its goals the project will use a new concept for e-health - Interreality – integrating assessment and treatment within a hybrid, closed-loop empowering experience, bridging physical and virtual worlds: (a) behavior in the physical world influences the experience in the virtual world; (b) behavior in the virtual world influences the experience in the real world. This is achieved through:

1) 3D Shared Virtual Worlds – immersive (in the health care centre) or non immersive (at home) role-playing experiences in which one or more users interact with one another within a 3D world;
2) Bio and Activity Sensors (From the Real to the Virtual World): to track the emotional/health/activity status of the user and to influence his/her experience in the virtual world (aspect, activity and access);
3) Mobile Internet Appliances (From the Virtual to the Real World): the social and individual user activity in the virtual world has a direct link with the users’ life through a mobile phone/PDA.

Project Impact

The clinical use of Interreality is based on a closed-loop concept that involves the use of technology for assessing, adjusting and/or modulating the emotional regulation of the patient, his/her coping skills and appraisal of the environment based upon a comparison of that patient’s behavioural and physiological responses with a training or performance criterion. The project will provide a proof of concept of the proposed system with validation in clinical settings guaranteed by the clinical expertise of the coordinator (HC research centre).

Psychological stress is becoming increasingly recognized as a phenomenon that has a
negative effect on a growing population in the workplace. Many EC countries have put into action laws (for example Italy's law 30.7.2010 n. 122) that provide that all employers must assign a budget to detect, consider and possibly avoid any consequences related or caused by the level of work-related stress of the employees. For this reason, after meetings and confcalls, we agreed to expand the focus of our project to reach the working population, thus widening the Interstress impact and results which will be not limited to medical and health&care environments (as declared in the DOW) but will interest, potentially, all working environments.

For this reason, a specific task of the WP8 (T8.2, Exploitation and Standardization) will contribute to the identification of possible stakeholders (patients, therapists, healthcare organizations and Human Resources departments in the industry) concerning the usefulness and attractiveness of the products and services, business models for the commercialization of these products and services and possible pricing. All this because a key objective will be also to proactively influence the activities of standard committees in the industry and in the standardization organizations (see Description of Work, page 212).

Achievements and main results so far

All the project objectives for year 1 (Y1) have been successfully and fully achieved.

Given the complexity of the Interstress rationale and the different media and delivery platforms involved, we opted to divide the activities into four main blocks, each assigned to focus groups/task forces, i.e. dedicated smaller skilled teams that deepened and shared their own core expertise thoroughly. Here's an overview of what has been done and achieved while a detailed description of the actual work and results per partner and per WP are to be found in section n. 3.

1. Requirements and scenarios (including ethics)

Istituto Auxologico Italiano, VRMI, UNIBAS worked together to define the requirements of INTERSTRESS technologies. The definition of the technical specifications focused on the following components:

- **Virtual reality scenarios:** a set of virtual environments simulating a selected number of stressful situations that are relevant to the specific target identified for the trial. The situations were selected following a careful review of the specific literature and supported by interviews and focus groups with clinical professionals and target users.

- **Shared virtual worlds:** clinical partners collaborated in the design of the shared virtual worlds, an online 3D space which will include educational contents concerning the characteristics of psychological stress and the strategies to fight it.

- **Stress management tools:** a set of specifications were provided by Istituto Auxologico Italiano and UNIBAS for the implementation of biofeedback and relaxation tools to be used both in the clinic (integrated within the virtual reality system) and at home (integrated in the mobile applications).

- **Personal Biomonitoring System (PBS):** a large amount of collaborative effort was dedicated to the design of the PBS, which aims at collecting users’ physiological, psychological and contextual data in naturalistic settings. The design resulted in the definition of the functional (and non functional) requirements for a mobile experience sampling application (jointly developed by CNR, CREATE-NET and UNIPASSAU) that can non-invasively collect a wide range of data through the wireless sensor platform developed by UDP.
- **Data Fusion and Decision Support System (DSS):** Clinical partners worked in close collaboration with CNR, CREATE-NET and CERTH to define key features of the PBS data fusion module and the DSS. The latter is a system that will be used to fuse the data collected by the PBS to: a) automatically detect and record momentary stress events; b) provide the therapist with the longitudinal assessment of stress episodes during a defined observation period; c) provide the patient with proactive feedback concerning potentially stressful situations and with appropriate tools to cope with them.

- **Patient Management System (PMS).** During the requirements’ definition phase, an important area of work concerned the design of the PMS, which is the platform used for therapist-patient communication and remote data synchronization.

All this is described in the D1.1 (including flow chart and info-design of the whole architecture and use through a video-storyboard) and D1.2 reports. Moreover, considering the delicacy of the collection, treatment and storage of the data involved in the INTERSTRESS trials UNIBAS produced a non-planned document called “Ethic Manual” that will be used as reference for all partners for the whole duration of the project.

2. Basic research

Several laboratory experiments involving a number of participants were carried out during Y1 with the goal of informing technology design with sound empirical data:

- Istituto Auxologico Italiano performed **three lab experiments** for the purpose of testing the project’s key assumptions. The first study, involving 115 participants, investigated the emotional responses (using physiological and psychological assessment tools) associated with the stressful situations identified from the literature on stress, using two different presentation modalities (textual or video). The second study, involving 39 participants, compared four emotional-induction procedures (virtual reality, video, audio and text) in order to understand the relative effectiveness of different media in eliciting affective responses. The third study, involving circa 200 participants, was aimed at testing the Italian adaptation of the Stress Appraisal Measure (SAM), a widely-used tool in stress research which will be applied in the clinical trials starting in Y2. The analysis and publication of data collected in these studies is in progress.

- Istituto Auxologico Italiano, CNR and UNIPASSAU performed a **pilot study with the mobile experience sampling tool** (jointly developed by CNR, CREATE-NET and UNIPASSAU) to test its efficacy in collecting psycho-physiological data in naturalistic settings. The Italian branch of the pilot trial was carried out by Istituto Auxologico Italiano and CNR and involved 7 participants who tested the mobile experience-sampling application for one week, 12 hours per day. The German branch of the pilot trial was carried out by UNIPASSAU and involved 9 participants (2 female, 7 male) who used the experience-sampling application for 2 weeks, 24 hours per day. The analysis of data is in progress.

- CNR tested a mobile application designed to induce relaxation in a **study involving 50 participants**, following an experimental protocol defined by Istituto Auxologico Italiano which included the assessment of psychological and physiological responses. The analysis of data is in progress.

- STARLAB is executing an EEG experiment (which started in Y1 and is still ongoing) to identify functional **EEG brain correlates of cognitive stress**, following an experimental protocol defined in collaboration with Istituto Auxologico Italiano.
In addition Starlab, CNR, UNIPASSAU and Istituto Auxologico worked to take a clear snapshot of the existing equipment able to meet the highest stability and trustable standard in monitoring stress-related physiological parameters. Thorough researches, contacts and tests have been carried out to identify not only existent but also possible new gizmos/equipment/sensors that may be put on the market in the next year/s and that may ease the obtrusiveness and guarantee truthfulness in data gathering.

3. Technology
The development process has successfully started and produced preliminary prototypes of the INTERSTRESS technology, some of which ahead of schedule. These include:

- the first version of the virtual reality platform to be used at the therapist’s office
- a mobile experience sampling application used to collect stress data in naturalistic settings, available for both Windows and Android mobile platforms. The mobile application includes a wireless ECG and is equipped with a tri-axis accelerometer
- the interaction design of the mobile applications used to provide stress management exercises (the mobile biofeedback tool and the mobile relaxation tool)
- a first working version of the Patient Management System

In addition, FIMI, CNR, CERTH, CREATE-NET, STARLAB, VRMMP and UDP defined the reference architecture of the INTERSTRESS system incorporating the requirements defined by clinical partners in Wp 1 and detailed in the deliverables D1.1 and D1.2. The reference architecture as well as the integration plan are described in deliverable D2.1. A selection of target mobile platforms based on a benchmarking analysis has also been performed by technical partners.

4. Dissemination
VRMI developed the site [www.interstress.eu](http://www.interstress.eu). The site is dynamic (being developed under Joomla) to ensure easy navigation and fast storage/retrieval of content. Most importantly, it is expected that the progress of the work and the interest of external observers will heavily influence the operation and features provided by the project’s website, and its dynamic construction will allow for this necessary evolution. For this reason it offers six EC languages. Although this required an increased initial effort on implementation, the payback is large when it comes to long-term exploitation of the architecture. The site has been designed to comply with EC dissemination guidelines and offers project related contents along with a quarterly newsletter, e-mail lists and RSS feeds. Moreover a number of assets by have been produced by VRMI for dissemination purposes, mainly:

- Video describing the INTERSTRESS project (streaming on the project’s website home page and available on YouTube)
- Logo
- Information sheet/flyer
- Presentation, deliverables, reports templates
- Elevator speech
- Press releases

All documents can be found uploaded in BaseCamp (http://basecamphq.com/) and displayed in the D8.1 Dissemination Plan.

Dissemination and use so far
Although not a core technical section of the INTERSTRESS project’s effort, dissemination
activities have an impact on the technical progress of work, because they promote the validation of the project’s outcome. This is why the plan of these activities has been finalized at an early stage of the project, when still lacking mature technical output (i.e., operational hardware/software system).

Dissemination and use of foreground have a high priority and we have planned appropriate measures to ensure an effective and timely dissemination of the project results to potential users both at European and international level. This policy proved rewarding because we reached a significant result: we can already mention 4 published papers related to INTERSTRESS on peer-reviewed journals (two further publications have been submitted in Spring 2010 and are under review):


INTERSTRESS project was also presented in several international conferences, which resulted in the following publications:


All these publications are listed in the project’s website [http://www.interstress.eu](http://www.interstress.eu) (under the directory “Dissemination/Resources”. The website is intended to be the primary dissemination channel for the INTERSTRESS project. It's a source of information for external parties that are interested in the work done within the INTERSTRESS consortium, containing diverse types of information that could be of potential interest to external observers as long as interesting and useful information/papers/studies the partners come along during their researches and development of activities. Further details about dissemination activities performed in Y1 are provided in the Annual Periodic Report (year 1).