



International Society for  
Research on Internet Interventions

## New ICTs based tools for the prevention and treatment of depression

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*ptimi*  
for a smiling life! 😊


(Online Predictive Tools for Intervention in  
Mental Illness)



Preventing depression

labpsitec

Information Society  
Technologies



## Context

- According to WHO, **mental health problems** are one of the main reasons for **disability** worldwide.
- Currently – around **60% of people** with mental health problems **do not have access** to **professional treatment**
- In 2030 **depression** will be the most important reason for disability in the world.
- In Europe, **Mental Health costs** correspond to **one third of the total costs** dedicated to Health.

**Prevention of depression is one of the 5 central focus points in the European Pact for Mental Health and well being.**



### It is necessary...

- To develop new strategies to **help those affected**.
- To develop better tools for **identification of subjects at risk**.
- To design **effective prevention programs**.



**Within the framework of the *OPTIMI* project we have designed ICTs based tools for early detection, prevention and treatment of depression**

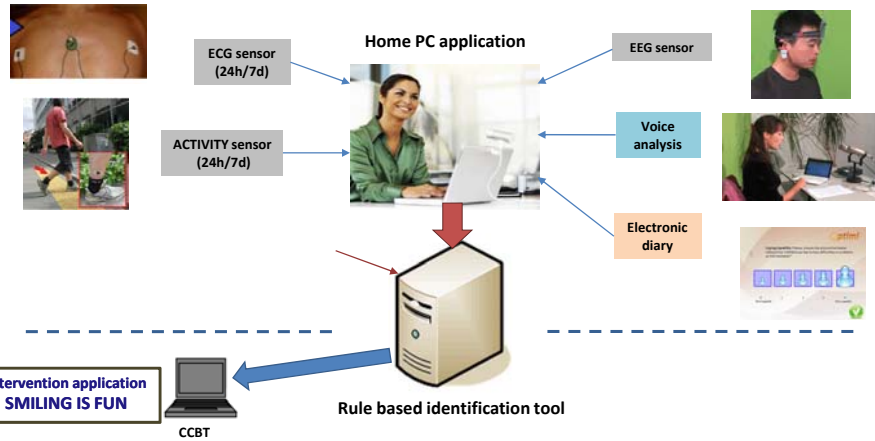


The aim of this work is to describe the OPTIMI project, its main goals, and its clinical rationale.

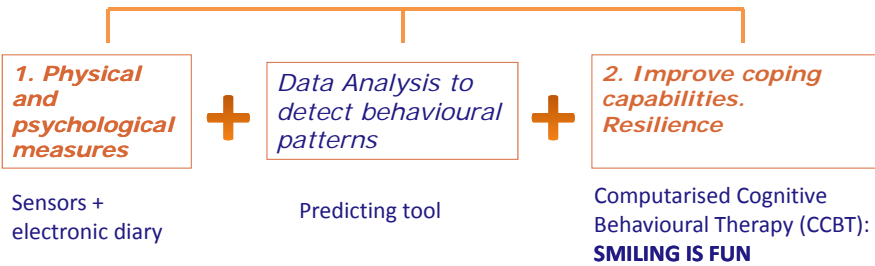
**OPTIMI is based on the hypothesis that people under high stress and with poor coping behavior have more probabilities to develop depression.**



The OPTIMI project hypothesizes that automated measures of stress and coping could provide effective predictors of depression and guide cost-effective preventative interventions.



# OPTIMI TOOLS





## 1. Physical and psychological measures

### ECG sensor

- Heart Rate and Heart Rate Variability
- Sleep Quality



### ACTIVITY sensor

- Activity level
- Type of activity.



### EEG sensor

- EEG signal processing

### SPEECH

- Voice Analysis

### ELECTRONIC DIARY

- Participants self assessment











## 2. Improve coping capabilities. Resilience

- **SMILIN IS FUN:** An internet-delivered, multimedia, interactive, CCBT self-applied program for ED.
- It is based on classical techniques, as education and **behavioural activation** (Ekers, Richards, McMillan, Bland & Gilbod, 2011).
- It also includes other psychological strategies to improve **positive mood** (Algoe & Fredrickson, 2011; Catalino & Fredrickson, 2011; McMahan & Renken, 2011; Wood, Froh & Geraghty, 2011).





## Treatment modules

- 8 modules oriented to help learning different psychological techniques.
- *M1. Motivation for change* 
- *M2. Understanding emotional problems* 
- *M3. Learning to move on* 
- *M4. Learning to be flexible* 
- *M5. Learning to enjoy* 
- *M6. Learning to live* 
- *M7. Living and learning* 
- *M8. From now on, what else...?* 

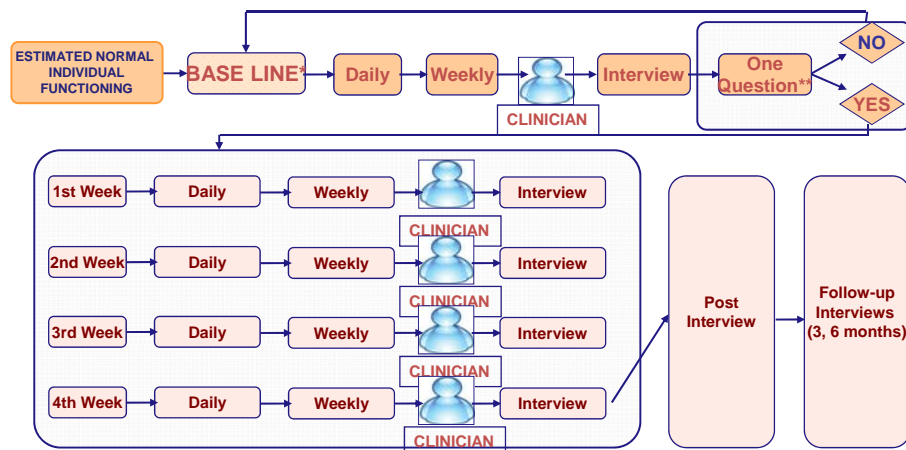


- **CALIBRATION TRIALS:** Some **cognitive, behavioural,** and **physiological sensors** (EEG, ECG and accelerometer) and *Voice Analysis*.
  - These automated measurements were complemented with **electronic diaries** and participants were **regularly assessed by a psychologist**.
- **INTERVENTION TRIAL:** Furthermore, we have developed an **internet-delivered self-applied program** (*Smiling is Fun*).
  - It includes a CBT protocol with the possibility of using the sensors.



## Calibration trial objectives

- The main goal of the calibration trial was to **develop and validate algorithms to assess risk factors for depression**, which include **poor coping** ability and **high stress**, based on data from the OPTIMI measurement systems.
- N= 34 participants tested the technology:
  - **Unemployed men** → subjects in high risk of depression because of their situation calibrated the prediction system:
    - They used the **OPTIMI sensor** based system and also accepted to have **weekly interviews** by clinicians to determine a **GOLD standard** evolution for their mental condition.



\*\* One question: "To what extend was this week a usual week for you?"(considering mood, stress, coping and general activity)



## Conclusions of the calibration trial

- OPTIMI has allowed to make considerable progress in the development of low-cost, wearable sensors for ECG, EEG, physical activity, and self-report measures.
- However, the results showed that predictions based on input from all of the OPTIMI sensors were no more accurate than predictions based on the self-report.
- In sum, the OPTIMI calibration trial did not demonstrate the effectiveness of the sensors for predicting depression.
- These results could be attributed to a combination of factors:
  - Low sample size
  - Gender effect: only male in Spain; only women in China
  - Low variability in depression scores
  - Difficulties in aggregating and matching data collected at different sampling rates
  - Some technical problems with sensors caused loss of data



## Intervention Trial Objectives

- Examine the effectiveness of the CCBT program ***“Smiling is Fun”***.
- Examine the added value provided by the sensors.



## Inclusion and exclusion criteria

- **Inclusion criteria:**
  - unemployed male
  - 18–65 years old
  - had to be willing to participate in the study
  - able to use a computer and having an Internet connection at home
- **Exclusion criteria:**
  - proneness to skin allergies that might be exacerbated by wearing stick-on sensors
  - personal history of depression/psychosis (acute BDI II  $\geq$  19)
  - history of depression/psychosis in any first-degree relative
  - heart conditions, epilepsy, daily intake of recreational drugs, sleep medication, and regular intake of any medication for heart conditions or that might interfere with cardiovascular function.
  - smokers



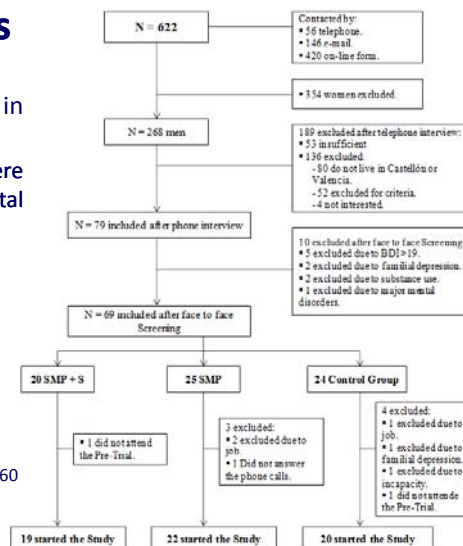
## Chart flow of participants

662 candidates applied to participate in the trial.

69 met the inclusion criteria and were randomly assigned to three experimental conditions.

### Finally 61 started the Study:

- Mean age: 31.25 (SD= 9.55).
- Mean duration of unemployment: 18.84 months (SD=12.40).
- Beck depression inventory (BDI-II): mean pre-assessment score of 5.03 (SD = 5.13)
- Perceived stress scale ( PSS ) : mean score 4.48 (SD = 2.62).
- OPTIMI Screening Questionnaire (OSQ): mean score of 7.60 (SD = 1.33).

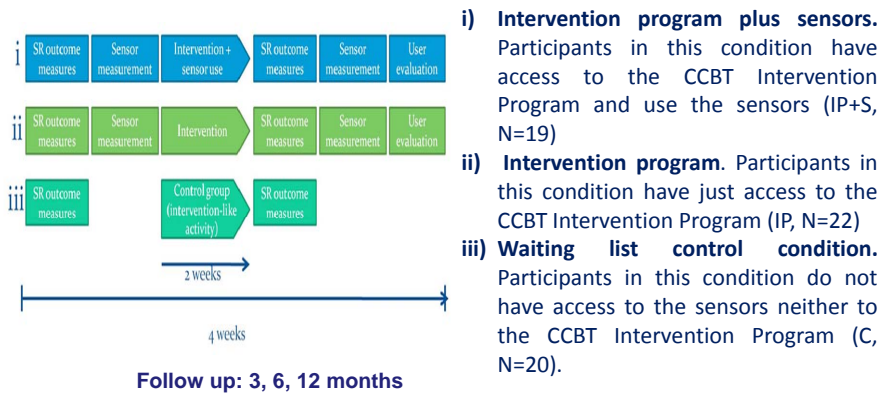






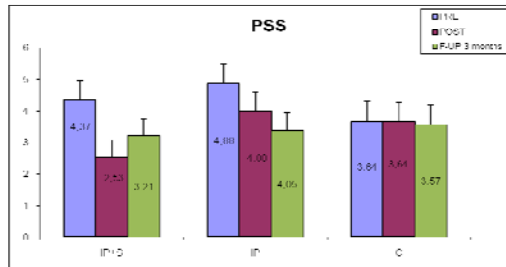
## Design

- Participants were randomly assigned to one of three conditions:



## Results

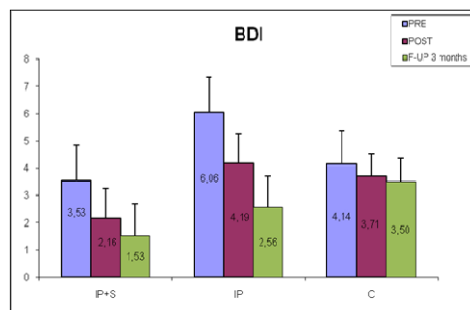
## Stress (PSS)



- Group ( $F(2, 46) = .537, p = .588$ ).
- Time ( $F(2, 92) = 5.746, p = .004$ )\*
- GxT approach significance ( $F(4, 92) = 2.144, p = .082$ ).
- **IP+S group**: significant pre-post  $p = .004$  (large effect size), tendency to significant pre-follow up decrease  $p = .051$ . (medium effect size)
- **IP group**: tendency to significant pre-follow up decrease  $p = .053$  (medium effect size)
- **C group**: no significant decreases

**Intervention groups** → scores in perceived stress decreased (significantly in IP+S group).  
**Control group** → scores are stable over time.

## Depression (BDI-II)

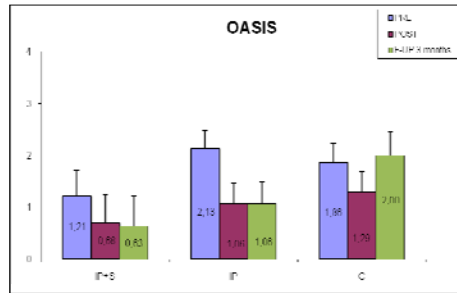


- Group ( $F(2, 46) = 1.397, p = .258$ ) and T x G ( $F(4, 92) = 1.317, p = .270$ ), were non-significant.
- Time was significant ( $F(2, 92) = 8.664, p = .000$ ).
- **IP+S group**: significant pre-post  $p = .020$  (small effect size), and significant pre-follow up  $p = .008$ , (medium effect size)
- **IP group**: significant pre follow up  $p = .011$  (large effect size)
- **C group**: no change

**Intervention groups** → significant decreases of depressive symptoms from pre to follow up. Mood improves more than in the control group.  
**Control group** → no change.



## Anxiety (OASIS)



Group ( $F(2, 46) = 1.700, p = .194$ , and TxG ( $F(4, 92) = .732, p = .572$ ) were not significant.

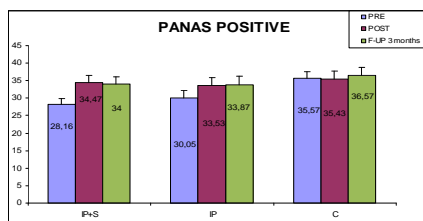
Time ( $F(2,92) = 2.980, p = .056$ ), a trend to significance.

- IP group: a trend  $p = .058$  (medium effect size)
- IP+S and C group non significant.
- C group: increases

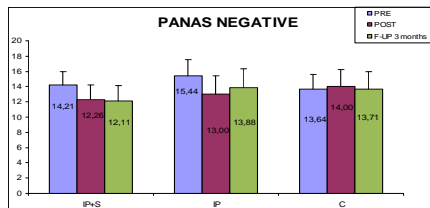
The results for **anxiety** were inconclusive although a visual inspection of the data suggests a benefit for the intervention groups.



## Positive and negative affect (PANAS)



Time was significant ( $F(2, 92) = 9.476, p = .001$ )



Time was significant ( $F(2, 92) = 5.274, p = .007$ )

**Intervention groups** → positive affect increases significantly from pre to follow-up, and significantly more than the control group.

IP+S: from pre to post ( $t(18) = -4.025, p = .001$ , Cohen's  $d = -.68$ , large effect size), and from pre to follow up ( $t(18) = -3.804, p = .008$ , Cohen's  $d = -.68$ , large effect size).

IP : from pre to follow up ( $t(15) = -2.384, p = .031$ , Cohen's  $d = -.47$ , medium effect size).

C: no change

**Intervention groups** → negative effect decreases significantly  
In the control group it increases.

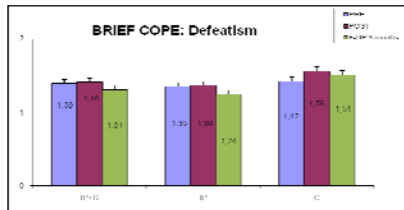
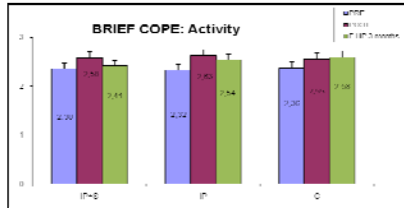
IP+S: from pre to post ( $t(18) = 2.707, p = .014$ , Cohen's  $d = .56$ , medium effect size) and from pre to follow up ( $t(18) = 2.797, p = .012$ , Cohen's  $d = .61$ , large effect size).

IP : from pre to post ( $t(18) = 3.674, p = .002$ , Cohen's  $d = .64$ , large effect size).

C: no change



## BRIEF COPE: Activity and Defeatism



- Group ( $F(2, 46) = .079, p = .925$ ), or time x group ( $F(2, 92) = .520, p = .721$ ) were not significant.
- Time ( $F(2,92) = 6.109, p = .003$ ) was significant.
- **IP group:** significant change  $p=.023$  (medium effect size),
- **No change for IP+S and C groups**
- Time ( $F(2,92) = 5.984, p = .004$ ) and time x group ( $F(2, 92) = 2.503, p = .048$ ) were significant.
- The effect of group ( $F(2, 46) = 3.048, p = .057$ ) was close to significance.
- **IP group:**  $p=.023$  (medium effect size)
- **IP+S group:** close to significance  $p=.073$  (medium effect size)
- **C group:** defeatism increased almost significantly,  $p = .066$  (medium effect size)



## Depression – Effect Sizes for Smiling is Fun

### POST TRIAL

- Smiling is Fun=**0.59** (Medium)
- Sensors=**0.48** (Medium)
- Control group=0.13 (less than small)

### 3 MONTS FOLLOW UP

- Smiling is Fun= **0.83** (Large)
- Sensors=**0.77** (Medium)
- Control group=0.14 (less than small)

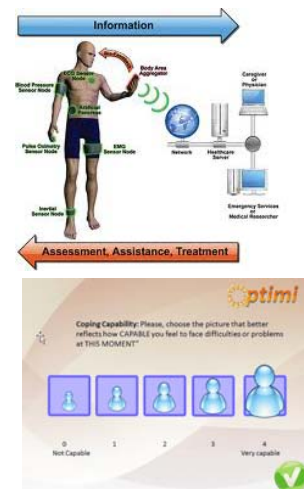


# Conclusions



## Calibration Trials

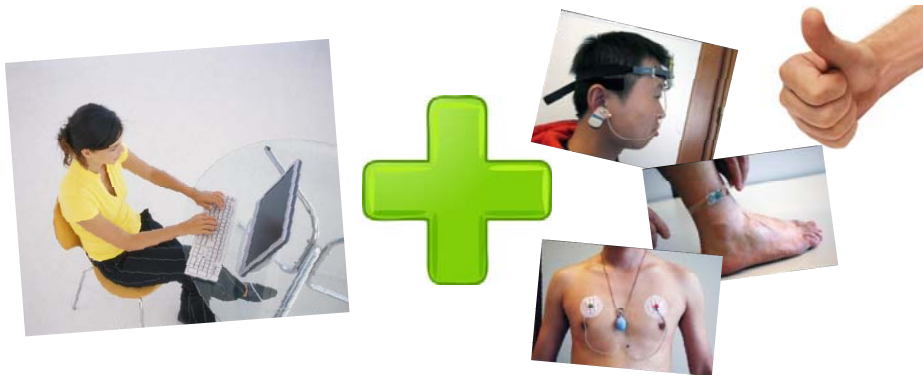
- We tested whether the use of sensors could be useful to predict depression, but this objective was not achieved.
- The self report diary predicted it better.



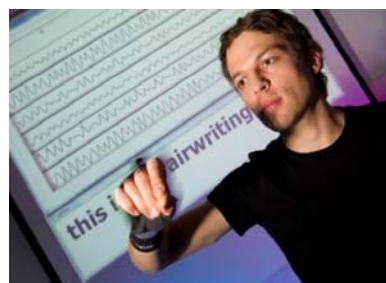


## Intervention Trials

- This is the first study that uses a CCBT program plus sensors.
- “Smiling is Fun” was effective with and without sensors and it was very well accepted by the participants.



- **The program had positive effects in both intervention groups**, with medium-large effect sizes.
- In some cases, the improvements were larger for the sensors group than for the group which did not use the sensors (although no significant differences were found between both intervention groups).
- The **sensors were highly valued** and using them did not worsen nor deteriorate CCBT results.
- **This can be considered a first indication of the possibility of using sensors.**





- The participants were healthy volunteers with no psychological problems.
  - We should highlight that, despite their long-term unemployment situation, their score on BDI was very low. 5.27 (SD = 4.91).
- We are waiting for the results at 6 months follow-up.



- **We do not know if the results would have been different:**
  - **in case of using just one sensor**
  - or if the participant or the clinician **could have decided which one to choose.**
- Also, significant **technical improvements in the sensors** are required.





- In any case, the present findings open the door to the use of CCBT plus sensors.

**Thank you very much for your  
attention**

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