

## System for pressure sore prevention: a user-centered design

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### Introduction

Currently available techniques and/or protocols designed to prevent pressure sore formation in persons with spinal cord injury and wheelchair users, mainly based on the improvement of the skin/support interface and on a postural and behavioural education are not efficient. Indeed, the prevalence and incidence of pressure sore still remains very high, so that development and validation of an efficient solution to prevent pressure sore is strongly needed.

### Methods

In this study, we adopted a user-centered approach which involves the end-users as real actors in the design decision making process to design, develop and assess an embedded biofeedback system for pressure sore prevention. The results of two complementary studies we conducted are presented:

1. a participative conception study aimed at determining paraplegic persons' needs, values, requirements and preferences;

2. a usability study aimed at assessing the degree of effectiveness, efficiency and satisfaction with which they can use the embedded pressure sore prevention system.

### Results

Results of the study using participative design methodology lead us to design and prototype the following embedded device for pressure sore prevention (VIGI-SORE) (Fig. 1) which consists in:

1. putting a pressure mapping system onto the chair seat area that allows continuous and real-time acquisition of the pressure applied on the seat/skin interface;

2. detecting/identifying excessive buttock pressure concentration (localization, intensity, duration);

3. estimating the user's posture modification that would reduce this overpressure concentration through mathematical modelling and the data-processing simulation of the relationship between buttock pressure distributions and seated postures;

4. if necessary, sending this information to the user who could be (i) alerted via wrist vibratory stimulation provided by an in-house watch and (ii) informed of the localization of the excessive seated buttock pressure via a visual display (e.g., Smartphone).

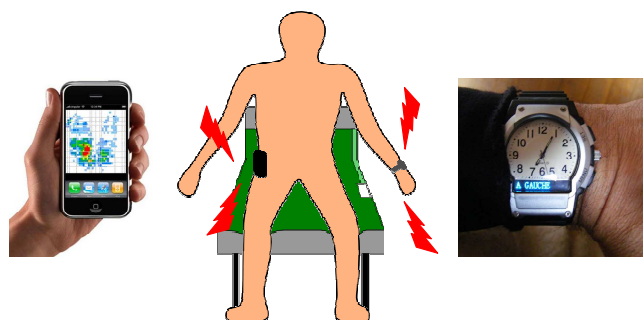


Fig. 1: Principle of functioning of VIGI-SORE system [1].

Results of the usability study showed that paraplegic persons were able to use feedback information provided by wrist vibratory stimulation and visual display to make appropriate postural changes that reduce buttock overpressures in seated posture, with ease, effectiveness, efficiency and satisfaction.

### Discussion

This study demonstrates the feasibility and the usability of the VIGISORE system for pressure sore prevention in paraplegic persons. Based on these encouraging results, this system is planned to be clinically assessed in real-life condition during a long period of time with the use of a fully wireless customizable and washable mat made of a textile able to measure and estimate in real time the internal sacral/buttock pressures [2].

### Clinical relevance

Thanks to a user-centered approach, VIGI-SORE could offer the possibility to provide a reliable and usable solution to pressure sore formation in persons with spinal cord injury and wheelchair users.

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### Conflict of Interest

None.

### References

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[2] Bucki *et al.*, Proceedings of the 14th Annual European Pressure Ulcer Meeting, 2011