

# A serious game for COPD patients to perform physiotherapeutic exercises

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## Background

COPD is a chronic, progressive lung disease for which an active lifestyle is important to slow down progression. Serious gaming, i.e. using games for other purposes than entertainment, could provide a nice alternative or addition to regular physical rehabilitation treatment.

Within the IS-ACTIVE project, the Orange Submarine game was developed. In this game, a submarine moves at a constant speed across an underwater landscape. An accelerometer is used to control the submarine. The goal of the game is to catch as many air bubbles by directing the submarine through them. During the game, feedback is given about the score, pulse rate, and oxygen saturation for motivation and a safe exercising.

The goal of this research was 1) to investigate the usability of the Orange Submarine game, and 2) to explore the changes in saturation and pulse rate in COPD patients while playing the game.

## Methods

Nineteen COPD patients participated (range: 47-72 years) performing squatting exercises, with the accelerometer attached to the patient's hip. The System Usability Scale (SUS) was used to obtain a high-level view on usability. Saturation and pulse rate were measured by the Nonin WristOx2 3150 (finger clip).

Patients first performed a measurement in rest to obtain a mean baseline score for pulse rate and saturation. To observe the change in pulse rate and saturation during game play compared to the baseline of every patient, we divided each sample point at game play by the mean baseline score of that patient. These ratios were averaged to obtain a group ratio, and plotted against time.

## Results

The mean SUS score was  $85.3 \pm 13.8$  ( $n=19$ ), which lies in the acceptable range, and corresponds to an adjective rating of 'excellent'. In a group of nine COPD patients, data of the Nonin was logged before and during game play. Pulse rate increased with 20% during game play, compared to baseline (figure 1), saturation decreased with 2% compared to baseline.

## Conclusions

The game was positively received by the patients and could provide a new fun way for performing exercises, either at home or as part of the regular treatment.

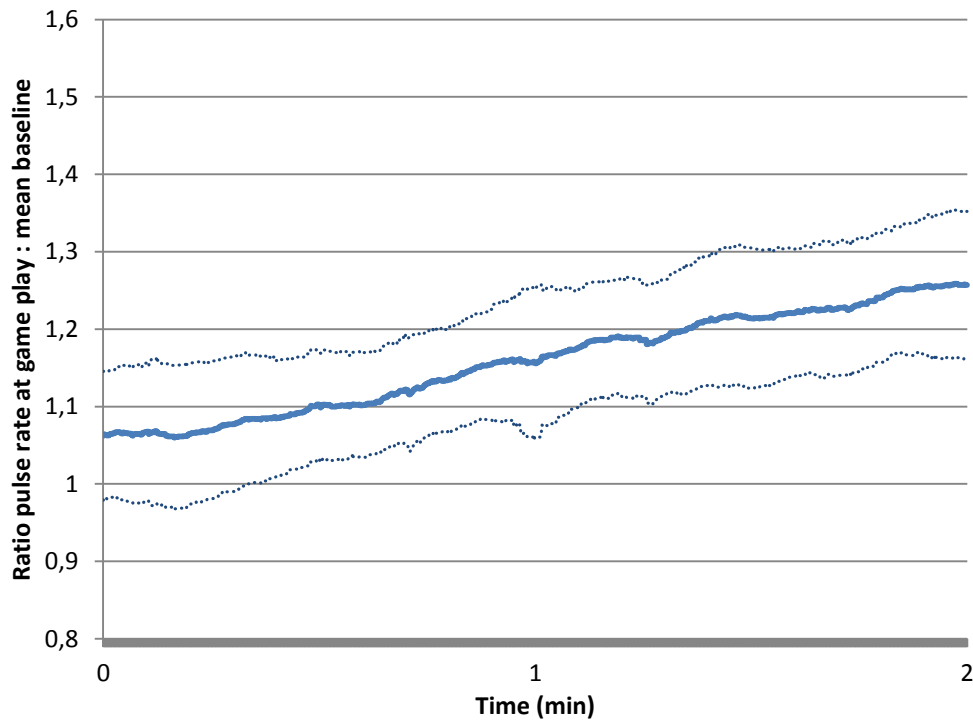


Figure 1; Ratio '*pulse rate during game play : mean pulse rate at baseline*', with standard deviation. Patients first performed a measurement in rest to obtain a mean baseline score for pulse rate. For every patient, we divided each sample point at game play by the mean baseline score of that patient. These ratios are averaged to obtain a group ratio and plotted against time (blue line), with standard deviations (dotted blue lines).