

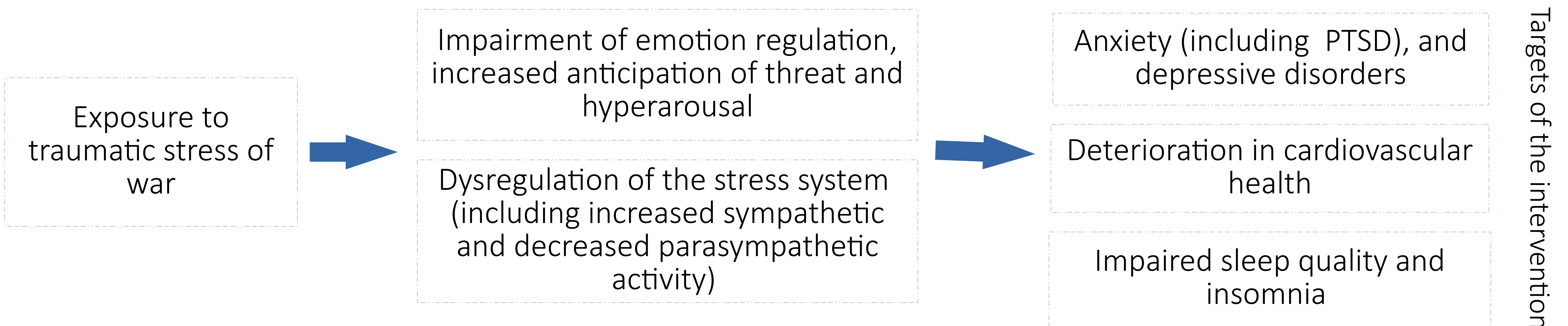
# Transcutaneous auricular Vagus Nerve Stimulation (taVNS) combined with slow breathing as an intervention for people with experience of war and symptoms of PTSD- rationale and the study design.



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During wartime, the number of people exposed to the traumatic experience of war and forced migration is very high, making typical methods of psychotherapeutic help non-scalable. The present study will test the feasibility and effectiveness of a hybrid behavioral and neurostimulation intervention which, due to its ease of application, potential high cost-effectivity could meet the requirements of intervention for populations with mass traumatic experiences in low-resource settings.

## Intervention

Breathing at 0.1 Hz ( breaths/minute) combined with taVNS (at 100Hz synchronized with expiration)

Both taVNS and slow breathing modulate the activity of vagal afferents and have overlapping treatment targets and clinical applications.

Both methods have been tested with success or considered (based on preliminary findings) as an add-on method:

- for depressive and anxiety disorders (including PTSD),
- of the management of chronic pain,
- to improve sleep quality,
- improving cardiovascular health and autonomic balance.



Fig. 1 Location of electrodes indicated by a gray rectangle and circle (dashed line indicates the placement of on the inside of the tragus).

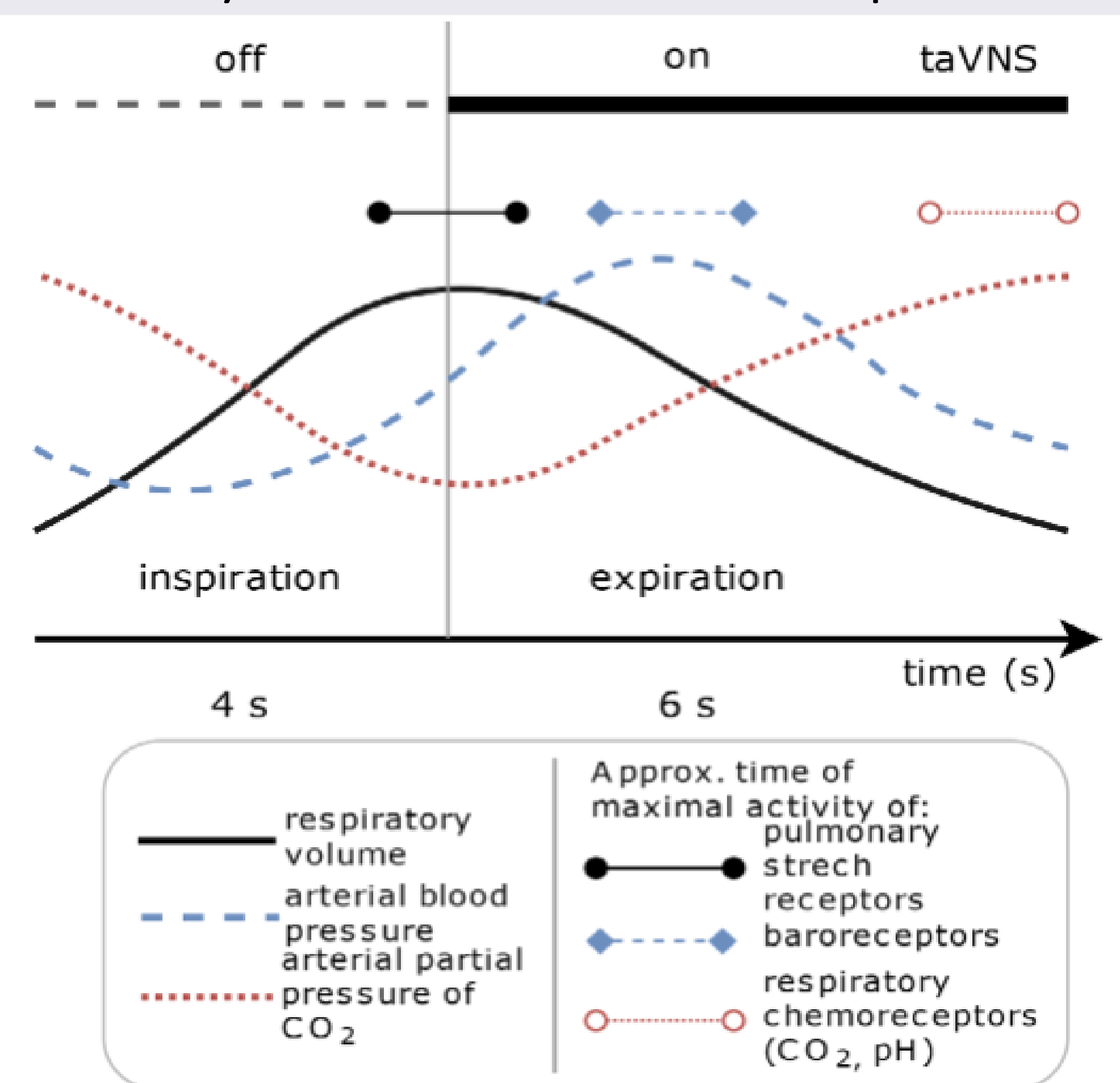
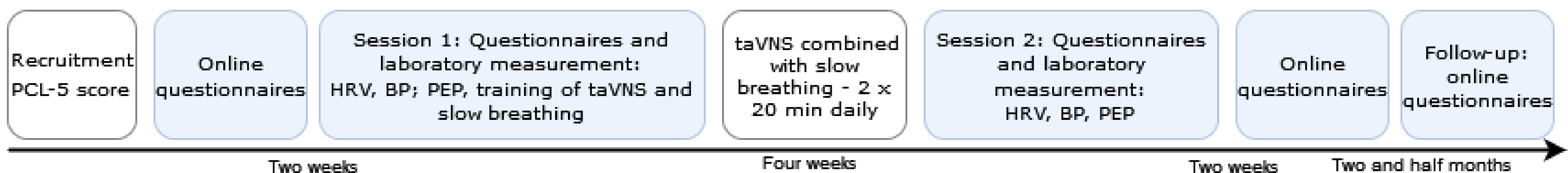


Fig. 2 Respiratory-related fluctuations in physiological parameters during slow breathing, time of maximal activity of vagal interoceptors and timing of taVNS.

## Study design

The study will be a prospective pragmatic pre-post observational study (n=20).



### Self-reported measures:

- post-traumatic stress disorder- PTSD Checklist for DSM-5
- depressive and anxiety symptoms- The Hopkins Symptom Checklist-25),
- somatic symptoms- the somatization scale of Symptom Checklist-90-Revised,
- sleep problems (Insomnia Severity Index)

### Physiological measures:

- heart rate and HRV (rMSSD and HF power)
- pre-ejection period (PEP),
- from normalized values of rMSSD and PEP an index of cardiac autonomic balance and cardiac autonomic regulation will be computed
- blood pressure

For a discussion on combining taVNS and slow breathing, technical consideration and summary of reviews and meta-analyses on the therapeutic effects of both methods see: Szulczewski, M. T. (2022). *Transcutaneous auricular vagus nerve stimulation combined with slow breathing: Speculations on potential applications and technical considerations*. *Neuromodulation: Technology at the Neural Interface*, 25(3), 380-394.. doi:10.1111/ner.13458

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