Exploring preventive health strategies: The role of coastal environments in the physical and cognitive well-being of older adults

Kinet Julia[1,2]

[1] Blue Growth Research Lab, Ghent University, Ostend Science Park, Wetenschapspark 1, 8400 Ostend, Belgium
E-mail: silke.lambert@ugent.be

[2] Flanders Marine Institute, Jacobsenstraat 1, 8400 Ostend, Belgium

With rising life expectancy, the prevalence of chronic health conditions such as cardiovascular disease and Alzheimer's disease is creating a significant healthcare burden. As healthcare systems face increasing pressures, innovative preventive strategies are essential. Exposure to natural environments has shown promise for reducing stress and improving cognitive function, outcomes that are particularly relevant for older adults. While the health benefits of green spaces are well-documented, the effects of coastal environments, with their unique sensory and atmospheric qualities, remain underexplored. Moreover, most studies focus on perceived health outcomes, rather than objective physiological measures, and older adults—who represent a significant part of Belgium's coastal population—are rarely the primary study group. In addition, research often overlooks the physiological differences between specific coastal components (e.g., beaches, dunes, and dikes), frequently treating coastal areas as a singular entity. Wearable technology offers an innovative way to address these knowledge gaps by enabling objective, continuous measurement of physiological signals during everyday activities. Additionally, since research often focuses on passive exposure, wearables provide a unique opportunity to explore the potential amplifying effects of physical activity on health outcomes.

This interdisciplinary research, conducted at Ghent University (Faculty of Bioscience Engineering and Faculty of Medicine and Health Sciences) in collaboration with the Flanders Marine Institute (VLIZ), examines the health effects of coastal exposure in older adults using wearable technology. It focuses on three critical aspects of their well-being: physiological stress, cognitive performance, and the role of physical activity.

As a first step, a pilot study was conducted to refine the protocol for future research, exploring the effect of a coastal walk on stress-related physiological parameters. In a randomized cross-over design, 15 participants (21–56 years, 53% female) completed two 45-minute walks: one in a coastal environment (Ostend) and one in an urban environment (Ghent), on separate days. Participants' physiological responses were measured using the NeXus-10 MKII wearable device, recording electrodermal activity (EDA) as a proxy for sympathetic nervous system (SNS) activity and high-frequency heart rate variability (HF-HRV) for parasympathetic nervous system (PNS) activity. Perceived stress, mental exhaustion, and positive and negative mood before and after exposure were also assessed, and GPS and acceleration data were collected during the walks. Although the sample size was too small to draw definitive conclusions about the health effects of coastal exposure, this preliminary experiment provided four key methodological insights. Firstly, the urban walk unexpectedly showed a greater stress-reducing effect than the coastal walk, likely influenced by participants' familiarity with the urban environment. Secondly, the interaction between physical activity and environmental type highlighted the need to further investigate the differences between active and passive coastal exposure and their distinct health benefits. Thirdly, variations in physiological responses across coastal segments, such as the dyke and dunes, underscored the importance of examining specific coastal features rather than treating the coastal environment as a single entity. Lastly, methodological limitations with the NeXus-10 MKII in outdoor settings revealed the need for more robust wearable technology in future studies.

Building on these insights, a larger study involving older adults was conducted. Following the design of the pilot study, a group of 48 participants (61-86 years, 54% male) completed two 30-minute walks, one in a coastal environment and one in an urban environment in Ostend, on separate days. Each session included 15 minutes of seated exposure prior to walking. HRV and EDA data were continuously collected using two wearable devices, the Empatica EmbracePlus wristband and the Polar H10 chest strap, and saliva was sampled at four time points to measure cortisol levels. Cognitive performance pre- and post-exposure was assessed using the validated D2 Test of Attention and Symbol Digit Modalities Test, and self-reported mental health data was collected. The data are currently being analysed. It is hypothesized that exposure to coastal natural environments will have stronger positive effects on physiological stress and cognitive performance compared to urban environments in older adults.

With the dual challenges of rising life expectancy and climate change, incorporating nature into health strategies for older adults is more crucial than ever. This research directly supports preventive health interventions by providing evidence-based insights into how coastal environments can enhance the well-being of ageing populations. The findings could guide urban planners and policymakers in designing health-promoting public spaces that encourage physical activity, improve stress reduction and benefit cognitive functioning. Furthermore, by highlighting these environments as valuable public health resources, it also underscores the importance of protecting marine environments for future generations.

I would like to thank my supervisors: Prof. Asselman, Prof. Everaert, Prof. Petrovic, and Prof. Cardon, for their invaluable support and guidance during this first phase of my PhD research. I am truly grateful for the opportunity to spend the next four years working on such an innovative and meaningful topic. I also extend my appreciation to the Special Research Fund of Ghent University (BOF-UGent) for supporting this research through a BOF Blue Growth scholarship. Finally, I am thankful to HYDRO vzw and VLIZ for the dr. Delcroix Incentive Award and for providing both recognition and a platform to highlight this research field.

Keywords
Coastal Environments; Older Adults; Wearable Technology; Physical Activity; Physiological Stress, Cognitive Function