Evidence for the health benefits of the Belgian coast: Psycho-physiological mechanisms and environment- and person-specific influential factors

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Health is defined as a dynamic state of physical, mental and social wellbeing that is constantly responding to environmental, social, biological, emotional and cognitive conditions or states, and thus not merely the absence of disease or infirmity (Lovell *et al.*, 2018). Recent studies have highlighted that visiting or residing near **coastal environments can improve diverse mental, physical, and social aspects of health** (White *et al.*, 2020). This is highly promising for the many people who currently have a poor mental health or are socio-economically deprived and in need of **free health resources**. However, there is a major knowledge void when it comes to the effects of coastal environments on the restorative and instorative processes related to mental health (Gascon *et al.*, 2015, 2017). A recent high-level report of the Seas, Oceans, and Public Health in Europe (SOPHIE) project has identified several key target priorities for researchers on blue spaces, tourism, and wellbeing, referring to the '**what', 'why', 'where', 'who', and 'how much'** (H2020 SOPHIE Consortium, 2020). I have been contributing to addressing those knowledge gaps since I have begun to investigate the effects of the ocean on human health over four years ago.

The research that I conduct tries to acquire the knowledge needed to thoroughly understand:
- the **psychological and physiological effects** of coastal exposure on mental health,
- the environment- and person-specific **influential factors** that are at play, and
- the **underlying sociological structuring** behind these effects.

Conceptually, it must provide society with relevant knowledge **for making optimal use of these health-benefits** while maintaining sustainable interactions between the health of the ocean and the health of the people.

My first study tested whether coastal residents in Belgium have a better general health compared to inland residents (**Hooyberg *et al.*, 2020**). It also assessed whether the hypothesized mechanisms often described in the literature to explain the health benefits from natural environments (i.e. less stress, increased physical activity, better social interactions, and less environmental harm) might mediate the relationship between living near the coast and general health. By using national health survey data (N = 60,939), I provided **the first evidence that living at 0-5 km from the coast in Belgium associates with a better general self-reported health**. None of the four hypothesized mechanisms mediated these effects, which led me to believe that the spatial heterogeneity of the Belgian coast should be further investigated.

My second study quantified how restorative ten typical coastal environments and five beach-specific environments are rated by a sample of inland students, and which of these environments' natural and urban components are responsible for the observed differences (**Hooyberg *et al.*, 2022**). Using a lab-experiment showing pictures to inland students (N = 102), I show that **the perceived restoration of the ten coastal environments differed up to 30 %, was neutral to positive, and seemed to associate with the environments' 'naturalness'**. I was also able to differentiate between locations at the beach: being at a breakwater, in the water, or at an open beach scored up to 20% better than being between beach cabins or in a beach bar. The **vegetation, sand, and sky visibility** in coastal areas contributed positively to the perceived restoratives, while **buildings, vehicles, and hard undergrounds** contributed negatively.

My third study compared both psychological and physiological responses to beaches with those to inland green and urban environments (**under review**). Therefore, I did a comprehensive virtual reality experiment with adult participants from all ages and socio-demographic and health backgrounds (N = 164). As such, I was able to provide **the first evidence that exposure to beaches caused a lower sympathetic nervous system activity and slower breathing rates** compared to green and urban environments. The results of cardiovascular and muscular indices were inconclusive. I also show that the sympathetic effects of the beach
apply for any level of precedent stress, while those of green spaces only apply for those with a low stress level in the past week.

In my most recent study, I am disclosing the social structuring of coastal leisure activities and the experiences people gain from them (analysis stage). Although this seems as a very abstract target, it can actually reveal **what kind of people in terms of socio-demographic and health characteristics perform what kinds of activities, visit which types of coastal environments, and gain different kinds of mental and physical experiences**. As such, it will both widen and deepen the knowledge gained from the second and third studies by taking a person-centred approach on a societal level. Currently, a survey has gathered information from a representative sample of 1862 individuals from the Flanders population.

I always try to make sure that the knowledge that I generate **reaches the public, health-professionals, policy-makers, and other envisioned stakeholder**s. Therefore, I have published in high-impact-factor A1 journals, have exchanged knowledge on many top scientific events, am in the process of writing a policy-informing document about Ocean and Human Health relationships, have released local press-releases and social media posts (with explanatory video's), and have built a website (www.uitzicht.org).

I have a **deep motivation** for doing excellent research that contributes to understanding the relationships between the ocean and human health and is relevant for societal applications. The knowledge that I gather is relevant for using the coast on medical prescription, for the blue tourism sector, and for optimizing the spatial design of (coastal) cities.