

Perceived social isolation (PSI), or as it is commonly termed - 'loneliness', refers to the unpleasant psychological state which is elicited by the subjective mismatch between the quantity and quality of social relationships one has and his/her preferences for social involvement. While loneliness can be linked to objective social isolation and reduced social contact, the former does not implicate the latter and individuals may often report feeling lonely even despite maintaining numerous social relationships. It has been also emphasized, that PSI is driven rather by one's perception of his/her social relationships, rather than by objective qualities of social relationships *per se*. This way, the same relationship (e.g. marital relationship) may be perceived as either loving and caring or detached and unaffectionate, depending on one's personal experiences, attitudes and needs. Loneliness has been increasingly recognized as a major societal problem - population studies have shown that PSI has the same impact on mortality rates as smoking 15 cigarettes a day and higher impact on mortality rates than hypertension and obesity. At the same time, little is known about precise physiological mechanisms through which loneliness may negatively impact the health outcomes. Loneliness was shown to elicit specific cognitive mechanisms, which can lead to increased vigilance for social threats and reduced ability to adopt other's perspective, due to the increased focus on one's own needs. These mechanisms may be linked to structural and functional abnormalities which may be observed in lonely individuals in key brain structures that are involved in the processing of social information (the posterior superior temporal sulcus; the temporoparietal junction; the medial prefrontal cortex). In addition, decreased level of the so-called heart rate variability, which may serve as an indicator of the ability to regulate activity in response to unknown and potentially threatening stimuli that appear in the environment, may be observed in lonely individuals. The main goal of the current project is to examine the relationship between decreased activity of brain networks during social information processing and behavioral and physiological (reduced heart rate variability) markers of everyday activity in lonely individuals.

During the first part of the project, the short-term effects of PSI will be examined - a group of 50 healthy individuals will be randomly assigned to one of the two subgroups, one of which (n=25) will be subjected to a procedure to induce PSI and the other will be subjected to a procedure aimed at inducing a sense of social belonging (n=25). Then, participants will be asked to complete two social information processing tasks. During the first task, participants will be presented with vignettes depicting social interactions and individual actions of two agents who will be presented with a limited number of "point-lights" corresponding to the major parts of the body of each person. During the second task, participants will be asked to rate the valence of the negative, neutral and positive pictures with or without social content. During the session, task-related brain activity will be recorded using functional magnetic resonance imaging (fMRI), which will allow to create spatial maps of neural activity. In addition, electrocardiographic data (ECG) will be collected during the tasks to measure heart rate variability in participants. The combination of the data collected with both methods will be used to determine how the initial induction of either PSI or social belonging influenced the brain activity and heart rate variability in participants and what is the nature of the relationship between these two types of activity. During the second part of the project, groups of lonely (n=48) and non-lonely (n=48) individuals will undergo neuropsychological examination and, then, will be asked to perform tasks described above during a fMRI scanning session. Then, participants will be asked to wear a *smartwatch* device for a week. The device will be used to measure the heart rate variability during the day-to-day functioning of the participants. In addition, participants will be asked to complete mobile surveys which will include questions about the participants' current social context (e.g. *How many individuals are you interacting with?*) and their current state (e.g. *What is your current stress level?; Do you feel threatened by the people you are with?*). Data collected during the laboratory examination and everyday functioning of participants will be used to examine whether lonely and nonlonely individuals differ in patterns of neural activity associated with social information processing and in patterns of physiological activity (heart rate variability) during social interactions. Next, data collected during the both parts of the procedure will also be used to determine whether there is relationship between patterns of brain activity recorded during social information processing with fMRI, results observed with psychological tests and behavioral and physiological markers of social functioning observed throughout everyday functioning in participants. Results of the project may significantly broaden current state of knowledge about mechanisms linking perceived social isolation with long-term health outcomes. Furthermore, exploration of these mechanisms may also be of crucial importance for increasing the effectiveness of psychosocial interventions which are aimed at reducing loneliness.