Environmental influence on mental health - psychological, neural, and daily affective functions in at-risk populations

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The improved understanding of the daily-life psychological and neural characteristics of risk states in general population is important because the identification of salient risk markers can guide the development of novel early individually-tailored interventions at multiple levels of influence, such as mental health services, digital mental health and neurofeedback therapy. In this work we employed unorthodox definition of at-risk mental state - the extended subthreshold phenotype, by investigating three at-risk populations - community non-help-seeking individuals with subclinical symptoms, with childhood trauma history and those who suffered mental disorder in the past, the population groups that usually remain unnoticed and unattended from the clinical and research communities. We took advantage of the modern multimodal environmental neuroscience approach to investigate brain-behavior relationships in at-risk populations by monitoring the dynamic emotional states in the natural context under the influence of environmental, emotional and cognitive factors and relating them to the reliable neural phenotype.

Both presented studies (study 1 and study 2) consistently found reduced daily life affective well-being, indexed by affective valence, across all studied at-risk populations against a background of unnoticeable changes in other real-life functions. This observation provides further evidence suitability and sensitivity of EMA method and used EMA scales for mapping daily symptoms of subclinical intensity below the sensitivity threshold of traditional clinical scales. We further identified a psychological risk profile for the investigated at-risk populations, reflecting features detrimental to mental health. While all demonstrated an analogous load-dependent alterations in known risk and protective factors, community individuals with proxy risk (study 1) showed a selected risk phenotype, contrary to individuals with early adverse profile (study 2), who showed psychological deficit almost in all studied measures - an extended risk phenotype. Together with the daily impairments, this suggests that community individuals at-risk for mental disorder exhibit risk phenotypes on the behavioral and experiential level, including limited personal resources to cope with stress-related experiences and a reduction in affective valence in daily life.

At the neural systems level, we observed deficient amygdala habituation in at-risk individuals (study 1) and replicated these findings in the independent at-risk sample (study 3), thus suggesting of a neural plasticity-related alteration in the affective processing of emotional stimuli in at-risk population. These findings further point to a convergence of the multiple sources of illness risk in this neural phenotype, wherein even moderate impairments in amygdala habituation may signal clinical vulnerability. Alongside observed psychological and daily life impairments, we suggest that reduced biological plasticity in the amygdala in at-risk population may require alternative regulatory strategies to deal with perceived daily stress. We further speculate that the relationship between brain function and everyday experience is a complex, reciprocal causal process, an assumption that should be further explored in future experimental studies.

Future studies can be motivated and guided by these findings. First, large-scale multimodal community-based longitudinal studies that span the range from non-risk to high-risk individuals can enrich risk stratification allowing for more accurate prediction models and tailored interventions, and shed light on a complex causal relationship between brain function and daily experience. Further, these studies should include the dimensional psychological and real-life measures allowing for comprehensive coverage of affected symptom domains. And finally, I believe, the results of this work are novel and markedly improve our current understanding of the risk-associated psychological, real-life, and neural affective alterations in the population and can inform the future intervention studies at multiple levels of influence, such as ecological momentary intervention, or amygdala-neurofeedback modulation.