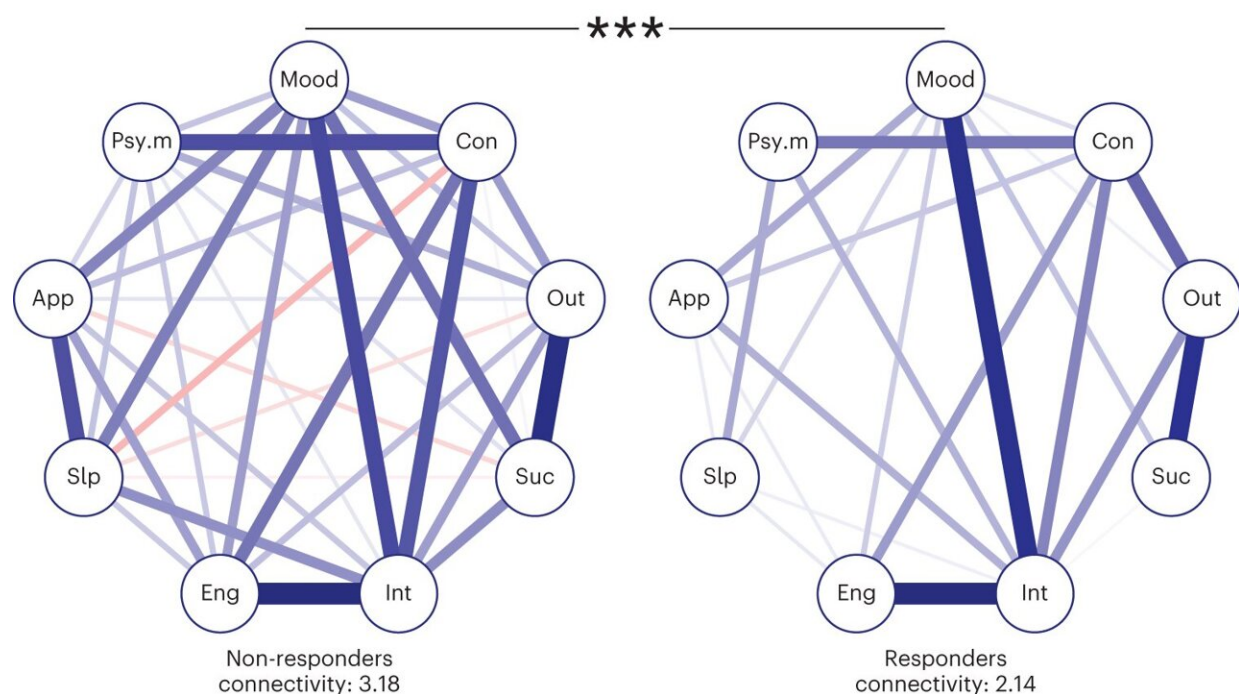


# Network analysis highlights the key role of plasticity in the transition from depression to mental health

February 20 2024, by Ingrid Fadelli



Connectivity strength of the symptom network is weaker in responder than in non-responder patients. Network structures of non-responders ( $n = 1,907$ ) and responders ( $n = 637$ ) at baseline. Blue connections represent positive associations, whereas red connections represent negative associations. Thicker edges represent stronger associations (both for positive and negative). Psy.m, psychomotor agitation; Con, concentration/decision making; Mood, depressed mood; Eng, fatigue or loss of energy; Slp, sleeping problem (sleep onset insomnia, mid, early and hypersomnia); Out, self-outlook; Suc, suicidal ideation; Int, involvement; App, weight/appetite change. A network comparison test was

used to compare groups. \*\*\*P-value = 0.004. Credit: *Nature Mental Health* (2024). DOI: 10.1038/s44220-023-00192-z

Surveys and statistics suggest that mental illnesses are becoming increasingly widespread, as the number of people worldwide accessing mental health services has increased in recent years. Understanding the factors that can predict well-being and contribute to the recovery from mental health disorders is thus of utmost importance, as it could inform the development of new therapeutic interventions.

Researchers at Istituto Superior di Sanita' recently set out to explore the role of plasticity, the ability of the brain to change in response to new experiences and environmental factors, in the recovery from depression. Their paper, [published](#) in *Nature Mental Health*, presents the results of an in-depth network analysis of data on depressed patients, which could inform the work of psychiatrists and [mental health professionals](#).

This research group has been conducting studies focusing on the human brain's plasticity for some time now. Their recent work takes a so-called network perspective; an emerging approach in psychology research that views mental health disorders as networks.

"We worked with antidepressants and [selective serotonin reuptake inhibitors](#) (SSRIs) and found that, just as shown by a growing number of studies, these drugs have an important effect on plasticity," Igor Branchi, co-author of the paper, told Medical Xpress. "These drugs increase plasticity and make patients more susceptible to change their mood and mental health. Once a patient is more plastic and susceptible to change their mood, then it's the environment that may play a key role."

Many recent studies have investigated the impact of the brain's plasticity

on mental health. Branchi and his colleagues hypothesized that while plasticity in itself is neither good or bad, when combined with a favorable environment it can predict the transition from depression to mental health.

"One could view plasticity as the door of a room, where being in the room represents being sick, and the outside the room being healthy," Branchi explained. "In this metaphor, increasing plasticity is like opening the door, while it does not push me out of my room, it allows me to exit the room. What pushes me out of the room is typically something else, typically associated with the individual's context that includes both the objective features of the environment and the subjective appraisal."

If viewing plasticity from this perspective, identifying a strategy to reliably measure it could be greatly beneficial, as it could help to better understand the factors contributing to the poor mental health of individual patients. By determining if patients exhibit little neuroplasticity or if their brain readily adapts based on their experiences, psychiatrists may be able to devise more effective therapeutic strategies.

The recent study by Branchi and his colleagues draws inspiration from recent studies that examine mental health from a network perspective. Network theories of psychopathology view mental health disorders as networks, with symptoms as nodes and the relationship between them represented as the connections between these nodes.

"In these networks, the nodes are the symptoms, while the connections between nodes characterize how these symptoms correlate to each other," Branchi said. "If they correlate to each other, it means they occur at the same time."

In the context of this study, plasticity entails a weaker correlation

between different symptoms, while no plasticity entails a stronger correlation. Branchi and his colleagues analyzed one of the largest datasets published to date, the STAR\*D dataset published by the National Institute of Mental Health (NIMH) in the United States.

"STAR\*D is a large data set that has been developed to study alternatives, therapeutic alternatives to treat depressed patients," Branchi said. "In our study, we exploited this data set in a totally different perspective from its original purpose, looking at the recorded patients' symptoms and the perceived quality of their environment."

The researchers also considered subjective survey responses designed to measure the participants' overall life satisfaction. This is important as different individuals might view their life in a more optimistic or pessimistic light, irrespective of their objective socio-economic status and environmental context.

"We then used the symptoms recorded in the dataset to build a network," Branchi said. "We also looked at how much they improved after the four weeks intervention period. It's important to say that we selected patients with the same baseline level, to ensure that patients who improved and those who didn't had started from the same point."

The analysis carried out by Branchi and his colleagues yielded some interesting results, ultimately suggesting that the mental health of patients who had a greater neuroplasticity at baseline, (i.e., those whose symptoms were loosely correlated) had improved more over time. Overall, this hints at the potential value of network theories of psychopathology for predicting people's plasticity.

"Our findings suggest that the improvement observed in patients is also associated to the quality of their environment," Branchi said. "This is why we are not measuring improvement, but plasticity. In other words,

we measure how much a person is susceptible to change given a favorable environmental context."

The recent work by this research group hints at the potential value of network theories as tools to operationalize plasticity in research and clinical settings. While Branchi and his colleagues specifically focused on recovery from depression, their approach could soon also be applied to other mental health disorders characterized by multiple interacting symptoms, such as anxiety disorders, bipolar disorder, and so on.

"The strategy we developed allows for a stratification of patients into those who are already plastic and could thus most benefit from psychotherapy and positive life changes, and others who already live in a favorable environment but are stuck in a depressive condition.

"Probably this second type of patients would firstly benefit from an intervention designed to increase plasticity and susceptibility to change, such as pharmacological treatments that have been found to increase neuroplasticity.

"There is also a third type of patient that lives in unfavorable conditions and are not plastic, thus they would probably need both psychotherapy and pharmacological treatment. A fourth type who already live in a favorable environment and are already plastic, might benefit from different therapeutic approaches."

By dividing patients based on these factors, clinicians might be able to introduce carefully tailored treatments that could yield more positive results. While the recent paper by Branchi and his colleagues does not provide precise medical advice, it could inform the work of mental health practitioners, offering a new way to predict a patient's plasticity.

"From a philosophical standpoint, our study suggests that in a networked

system, plasticity arises from the interaction between different nodes," Branchi added. "So, there is no behavior of processes associated with plasticity, but rather plasticity arises from the interaction between the different symptoms, behaviors, or elements. This is something that we think could conceptually be very important."

**More information:** Towards a network-based operationalization of plasticity for predicting the transition from depression to mental health. *Nature Mental Health*(2024). [DOI: 10.1038/s44220-023-00192-z](https://doi.org/10.1038/s44220-023-00192-z).

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