PSYCHOPATHOLOGICAL NETWORKS

For many decades, clinicians have observed that patients often struggle with a number of problems that reinforce each other. Such dynamic systems of mutually interacting symptoms are defined as *psychopathological networks*. Depression provides a good example: insomnia may trigger fatigue, which in turn can activate concentration difficulties and sad mood that in turn feed back into insomnia—a feedback loop that is hard to escape from. Around 2010, psychologists and psychiatrists started using modern statistical tools to empirically examine these causal connections among symptoms, and there is a growing interest in both the scientific and the clinical community. The majority of research so far has focused on major depression, but there is also some recent work on post-traumatic stress disorder (PTSD), attention-deficit/hyperactivity disorder (ADHD), psychosis, bipolar disorder, autism spectrum disorder, generalized anxiety disorder, bereavement and complicated grief, as well as substance abuse and dependence.

The common cause framework

Specific symptoms often co-occur with each other, such as sadness and loss of interest for the depressive syndrome, or fear and avoidance for anxiety problems. The traditional explanation in general medicine for such syndromes is called the *common cause framework* and assumes that an underlying disease serves as common cause for specific symptoms. Measles, for instance, is the common cause for fever, rashes, and Koplik's spots. For mental disorders, this notion has been the standard approach as well: symptoms are considered passive and roughly interchangeable indicators of underlying diseases such as depression, schizophrenia, or PTSD.

The nature of symptoms is not considered particularly important, as long as a patient qualifies for a given disorder.

Mental disorders as complex dynamic systems

An alternative approach that is radically different is to conceptualize mental disorders as *networks of symptoms*: symptoms do not co-occur because they are passive consequences of a common cause, but because they trigger and influence each other. This approach not only has great intuitive appeal and is supported by clinical observations, it specifically examines the interactions among symptoms that are considered irrelevant from the common cause perspective. When mental disorders are conceptualized as dynamic systems of symptoms, they can reach so-called attractor states that are very difficult to escape; this is the case when symptoms fuel each other in feedback loops.

Figure 1 provides an example of an empirical psychopathological network, consisting of 28 depression symptoms assessed in 3463 depressed patients. Green lines represent positive associations between symptoms, red lines negative associations, and thickness indicates the strength of the association.
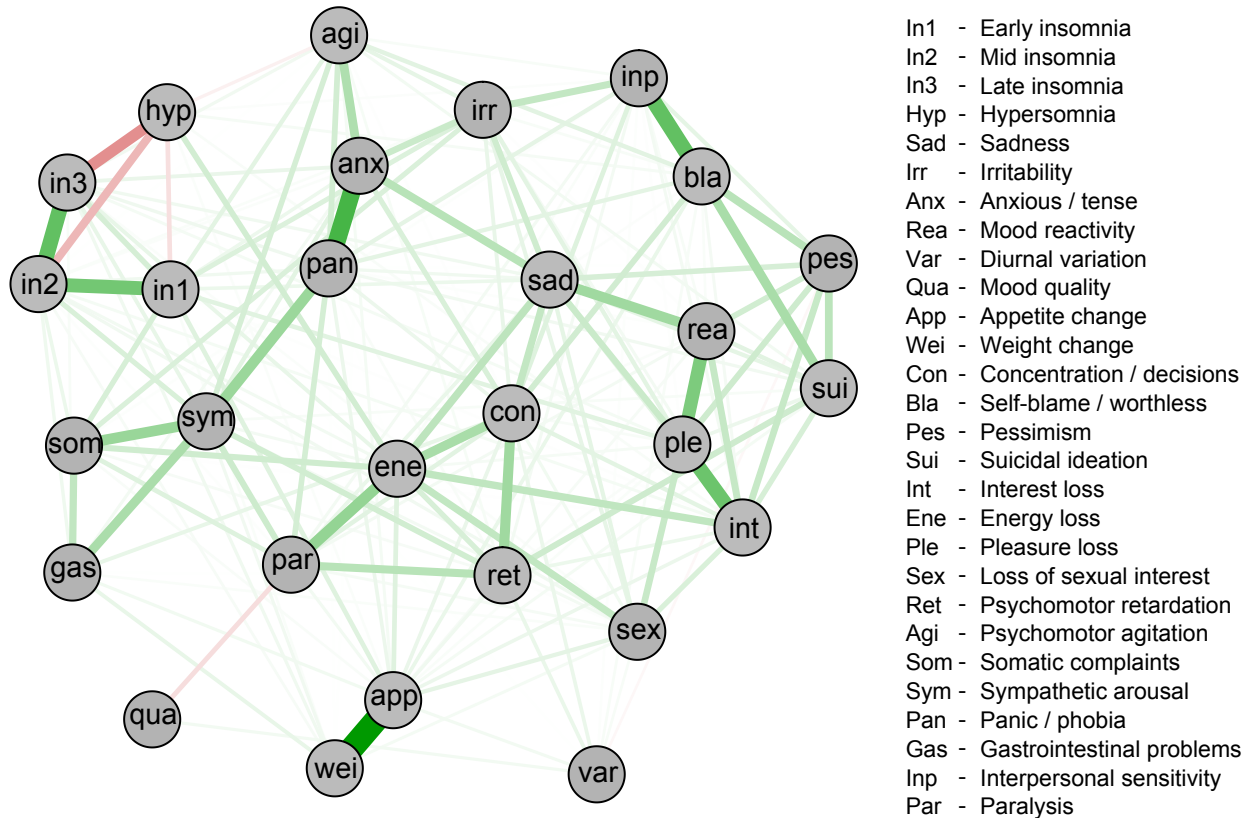
In1 - Early insomnia
In2 - Mid insomnia
In3 - Late insomnia
Hyp - Hypersomnia
Sad - Sadness
Irr - Irritability
Anx - Anxious / tense
Rea - Mood reactivity
Var - Diurnal variation
Qua - Mood quality
App - Appetite change
Wei - Weight change
Con - Concentration / decisions
Bla - Self-blame / worthless
Pes - Pessimism
Sui - Suicidal ideation
Int - Interest loss
Ene - Energy loss
Ple - Pleasure loss
Sex - Loss of sexual interest
Ret - Psychomotor retardation
Agi - Psychomotor agitation
Som - Somatic complaints
Sym - Sympathetic arousal
Pan - Panic / phobia
Gas - Gastrointestinal problems
Inp - Interpersonal sensitivity
Par - Paralysis

Figure 1. [Source: DOI 10.1016/j.jad.2015.09.005; insert appropriate copyright note]

Research opportunities

This novel perspective offers important research opportunities. First, the framework encourages the investigation of the most symptoms with the most connections in the network (the most *central* symptoms). These may be particularly relevant targets for intervention and prevention strategies, seeing that the activation of such central symptoms likely leads to a host of subsequent symptoms.

Second, network research offers a new perspective on high comorbidity rates among psychiatric conditions such as mood and anxiety disorders. Traditionally, comorbidity is understood as a patient having two separate diseases. Contrasting this notion, network research

has shown that bridge symptoms that are present in multiple diagnoses (such as insomnia in mood and anxiety disorders) may carry over the activation from one network to the other.

Third, consistent with the emerging field of personalized medicine, researchers have started to use portable electronic devices such as smartphones to obtain psychopathological networks of individual patients. Participants in such studies provide information on a number of symptoms several times per day, for a number of weeks. Using modern statistical methods, this allows to determine the specific network structure—including the most relevant symptoms—for each particular patient, which may offer crucial insights to guide treatment.

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See also Comorbidity; Major Depressive Disorder; Mental Health Disorder

Further readings

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