A bibliometric analysis of 10 years of research on symptom networks in psychopathology and mental health

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ABSTRACT

Psychopathology networks consist of aspects (e.g., symptoms) of mental disorders (nodes) and the connections between those aspects (edges). This article aims to analyze the research literature on network analysis in psychopathology and mental health for the last ten years. Statistical descriptive analysis was complemented with two bibliometric techniques: performance analysis and co-word analysis. There is an increase in publications that has passed from 1 article published in 2010 to 172 papers published in 2020. The 398 articles in the sample have 1,910 authors in total, being most of them occasional contributors. The Journal of Affective Disorders is the one with the highest number of publications on network analysis in psychopathology and mental health, followed by the Journal of Abnormal Psychology and Psychological Medicine stand out. The present study shows that this perspective in psychopathology and mental health is a recent field of study, but with solid advances in recent years from a wide variety of researchers, mainly from USA and Europe, who have extensively studied symptom networks in depression, anxiety, and post-traumatic stress disorders. However, gaps are identified in other psychological behaviors such as suicide, populations such as the elderly, and gender studies.

1. Introduction

The guidelines provided by the traditional diagnostic classifications in use, such as the Diagnostic and Statistical Manual of Mental Disorders (DSM) (American Psychiatric Association, 2013) and the International Statistical Classification of Diseases and Related Health Problems (ICD) (World Health Harrison et al., 2021; World Health Organization, 2004), have helped clinicians in establishing whether a person’s mental health problems meet all the criteria for diagnosing a psychological disorder. However, despite their utility, these classifications are not free of controversy, as they represent a traditional categorical approach (Blanco et al., 2019). Besides the widespread criticism of the latest version of DSM 5 (Frances and Nardo, 2013; Ramens et al., 2017), these classifications also present considerable limitations for their use as the only strategy for the design of mental health treatments, due to the lack of functional value (Munoz et al., 2019). Neither do they solve the high comorbidity of symptoms (Cramer et al., 2010) nor the low inter-rater reliability found (Contreras, 2021; Ramos, 2016). In sum, they do not solve the debate on conceptualizing mental disorders dimensionally or categorically (McNally, 2016).

The symptom-network perspective in psychopathology questions the fact that diagnostic criteria within the same mental disorder are distinct of each other (Borsboom, 2017). It also points out that variables traditionally considered as indicators of latent constructs should be taken as autonomous causal variables in a network of dynamic systems. Network Analysis (NA) has been used to identify and examine patterns of statistical association in multivariate psychological data with different data structures (Borsboom et al., 2021) long been used in various disciplines such as the social and behavioral sciences (Nettleton, 2013; Su et al., 2020; Wasserman and Faust, 1994). Nevertheless, its uses relatively new for understanding the dynamic interactions between psychopathological symptoms (Borsboom and Cramer, 2013). From the network perspective, individual symptoms are represented as nodes, and connections are placed between symptoms that tend to co-occur, forming a particular psychopathology network. This analysis in psychopathology provides a visual description of the complex associations between symptoms, which can be interpreted as partial correlations. Thus, instead of an underlying entity producing symptoms classified into categories, the origin of the disorders would be the covariation between symptoms and their dynamic causal interactions. Hence, considering

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many more variables and aspects that were not traditionally included in diagnostic classifications.

The emergence of these analyses has caused a shift in the approach to mental health problems. In the last decade, there has been a significant increase in research carried out from a network perspective. Two recent reviews summarize the research carried out on this subject. Contreras et al. (2019) conducted a systematic review on 65 studies, concluding that NA helps to identify, in an innovative way, important aspects of psychopathology such as the centrality of symptoms in a given disorder, as well as the mutual dynamics between symptoms. Also, Robinaugh et al. (2020) provided a broad overview, suggesting the identification of solid empirical phenomena and the development of formal explanatory theories. However, none of these reviews discusses how NA literature has evolved, nor do they examine its main actors (researchers, institutions, journals, etc.), or identify the most influential articles per research topic.

This article complements the aforementioned reviews with a bibliometric analysis on psychopathology and mental health research based on NA carried out over the last decade. The study encompasses the evolution of NA literature, identifying the most influential authors, the journals with the highest number of publications, the origin of the articles (institutions and countries), as well as the most studied topics within NA in mental health and their relationships.

2. Methods

According to the directions given by Börner et al. (2003), Mohr et al. (2009), and Cobo et al. (2011), we followed the systematic procedure represented in Fig. 1 to analyze the literature on NA. First, a sample of papers was retrieved from the Web of Science (WoS) database. The initial sample was filtered to exclude false positives and expanded with relevant missed papers. Then, the bibliographic data was normalized and examined using descriptive statistics, performance analysis, and co-word analysis.

2.1. Data retrieval

In practice, collecting the whole population of articles published on a given topic is unfeasible (Kitchenham, 2007; Wohlin et al., 2013). Accordingly, this first step aims to obtain a representative sample with a view to generalizing the analysis results for the population. To do so, we conducted the following query on WoS Core Collection, retrieving 407 articles.

$\text{TS} = \{\text{network NEAR/0 analysis?}\}$

AND (symptom* OR diagnos* OR psychopath* OR depress* OR anxiety OR psychosis)

OR bipolar OR schizophrenia OR dementia OR “obcessive compulsive” OR OCD OR

(post NEAR/0 “traumatic stress disorder”) OR PTSD OR “personality disorder”)

AND $\text{SU} = \{\text{Psychology OR Psychiatry}\}$

NOT $\text{TS} = \{\text{neur* OR gene$ OR “brain network” OR “social network” OR “social media analysis?” OR “text mining” OR “data mining” OR “content analysis?” OR “semantic network analysis?” OR “thematic network analysis?” OR cancer OR HIV OR metabol*}\}$

The query includes the next WoS operators (highlighted in red):

- **Field operators** that limit the scope of the search. $\text{TS}$ stands for “topic” and restricts the search to the articles’ title, abstract, and keywords. $\text{SU}$ stands for “research area” and looks into the WoS subject categorization scheme.

- **Boolean operators** that link the terms in the query. Besides the propositional logic operators ($\text{AND}$, $\text{OR}$, and $\text{NOT}$), we used the proximity operator $t1 \text{ NEAR/}N t2$, which finds articles whose terms $t1$ and $t2$ are within $N$ number of words of each other. Accordingly, post NEAR/0 “traumatic stress disorder” incorporates the strings “post-traumatic stress disorder”, “post-traumatic stress disorder”, and “post-traumatic stress disorder”.

- **Wildcards** that account for unknown characters. * means any group of characters ? is any single character, and $\$ $ refers to zero or one character (excluding spaces).

The query was successively polished until a convenient balance between coverage and absence of false positives was accomplished. Also, Sugimoto and Larivière’s recommendations (Sugimoto and Larivière, 2018) were followed, and thus WoS was selected in favor of other databases (e.g., Scopus, Google Scholar, etc.) due to its data quality reputation and suitability for secondary studies covering long time periods.

2.2. Data filtering

The query was run on February 2, 2021, and the sample obtained was filtered according to the following exclusion criteria used: (1) Non-peer reviewed articles; (2) Articles not written in English; (3) Articles not focused on the psychological/psychiatric application of NA. This third criterion includes articles whose main objective is to describe the methodology of NA. As a result, 62 articles were discarded.

To prevent missing relevant articles, Wohlin’s snowballing guidelines (Wohlin et al., 2013) were followed. Snowballing is an iterative process where new papers are identified in each subsequent cycle by examining the references of the articles that are already in the sample. As a result, our paper collection was enlarged with 53 new papers and, therefore, the final sample included 398 articles.

Before analyzing the sample, bibliographic data typically require to be normalized (Cobo et al., 2011) since a researcher may appear in several records with slightly different names, or distinct keywords must be treated as synonyms in the further analysis. For example, in the scope of this paper, the keywords children, child, preschool children, preadolescent, adolescence, adolescents, etc. were grouped as children/adolescents.

2.3. Data analysis

Statistical descriptive analysis was complemented with two bibliometric techniques: performance analysis and co-word analysis.

Performance analysis measures research impact. In particular, we have followed Martinez et al.’s recommendations (Martinez et al., 2014) to identify the most impacting articles by using the $h$-index (Hirsch, 2005). To do so, the $h$-index is defined as follows: “a research area has index $h$ when $h$ of its $n$ articles have at least $h$ citations each, and the remaining $n-h$ articles have less than or equal to $h$ citations each”. Those articles with a number of citations greater than or equal to the $h$-index are considered the classics of the area.

Co-word analysis (Coulter et al., 1998) helps to identify the most relevant research topics and their inter-relationship by measuring the co-occurrence frequency of pairs of an article’s keywords. We also used co-word analysis to examine the collaboration networks among the most prolific authors, obtaining a graph whose nodes and edges represent researchers and number of co-authored articles, respectively.
We carried out data normalization, performance analysis, and co-word analysis with the open-source tool SciMAT, available at https://sci2s.ugr.es/scimat/. The raw bibliographic data was retrieved from WoS, the normalized database in SciMAT format is publicly available at Zenodo (https://doi.org/10.5281/zenodo.4614134).

3. Results

3.1. Number of publications and evolution over time

The results of our data collection resulted in 398 articles on NA in psychopathology published in the last 10 years. As Fig. 2 shows, the publication rate has grown dramatically from 2010 to nowadays.

3.2. Article citations

The histogram in Fig. 3 shows the articles’ distribution according to their citation number. This distribution is extremely right-skewed, being 4 and 21.74 the median and mean, respectively. Whereas 22.36% of the articles have not received any citation at all (see the highest bar on the left), a few papers that will be summarized in Table 1 have 42 or more citations (see the low bars on the right).

Fig. 4 distinguishes among the number of citations (i) in total, (ii) excluding self-citations, and (ii) restricting the citing papers to those in the sample. The bottom bar shows that 66.94% of the citations come from the collaborative community that has published the article sample.

3.3. Most influential articles and prolific journals

Table 1 lists the most influential articles on NA and psychopathology, i.e., the area’s classics. According to our sample, the area’s h-index is 42, thus Table 1 summarizes the 42 articles that have received at least 42 citations. Fig. 5 shows the top 15 journals that have published the greatest number of articles, in particular the Journal of Affective Disorders, and Journal of Abnormal Psychology and Psychological Medicine.

3.4. Most productive authors

The 398 articles in our sample have 1910 authors in total. Most of them are occasional contributors. Indeed, 83.98% of the authors have published a single paper, and only 3.3% have written four or more articles. This authorship distribution is not surprising as it approximately follows Lotka’s law (Lotka, 1926), an important bibliometric principle which states that the number of authors with n papers tends to be inversely proportional to n².

Fig. 6 shows the collaboration patterns among the most prolific authors. There is a node for each author with at least four articles. Node size is proportional to the number of papers authored within the sample. An edge linking two nodes represents the corresponding researchers who have co-authored some article. Edge thickness is proportional to the number of co-authored articles. Nodes and edges are colored according to the collaborating authors’ groups identified with Leiden’s algorithm (Traag et al., 2019).

3.5. Most relevant countries and institutions

Fig. 7 shows the number of articles published per country. Most research is concentrated in the USA, with 44.88% of all the articles. The top five countries after the USA are the Netherlands (18.37%), the UK (11.38%), Germany (7.64%), Belgium (7.32%), and Italy (6.5%). Fig. 8 shows the institutions with the highest number of publications, in particular, the University of Amsterdam, Harvard, and Groningen.

3.6. Keyword analysis

The graph in Fig. 9 shows the most frequent article keywords (represented by nodes) and their co-occurrence relationships. Node size is proportional to the number of papers containing the keyword. An edge linking two nodes shows the corresponding keywords that appear together in some article; edge width accounts for the number of articles where the keywords co-occur. Keyword examination shows that within the articles on NA in psychopathology and mental health, the most frequently studied categories are: methodologies (80.55%), mood disorders (56.36%), psychological variables (43.14%), therapies (34.16%), and anxiety disorders (29.93%). In contrast, the topics with the least amount of research are: older adults (1%), suicide and self-harm (4.24%), and gender studies (6.48%). Table 2 summarizes (i) each keyword’s bibliometric indicators (number and percentage of articles including the keyword, and h-index and average citations the papers with the keyword have received), and (ii) the most cited articles per keyword (the last column follows the notation reference[#citations]). It is worth noting that, just as a keyword may be used in many articles, an article typically includes more than a single keyword. For example, in Table 2, (Borsboom and Cramer, 2013) is classified into five categories because it includes the keywords (i) mood disorders, (ii) children and/or adolescents, (iii) other disorders, (iv) psychological variables, and (i) methodologies.

4. Discussion

This article aims to analyze the research literature on NA in psychopathology and mental health for the last ten years. To do so, bibliometric techniques have been applied, analyzing a sample of 398 articles that represents the increasing literature, which has passed from 1 article published in 2010 to 172 papers published in 2020. This dramatic increase shows the scientific community’s growing interest in the study of symptom NA in psychopathology. This may happen because the symptom network perspective is a categorical classification alternative that can overcome some of their disadvantages (Borsboom, 2017; Frances and Nardo, 2013; Kamens et al., 2017; McNally, 2016; Muñoz et al., 2019).

For the sake of objectiveness, our analysis has followed a systematic and partially automatized workflow. We have tried to mitigate subjectivity by using clear and well-justified criteria: (i) WoS was selected because it provides the highest quality bibliometric indicators (Sugimoto and Larivière, 2018); (ii) the WoS query was increasingly developed until a convenient balance between coverage and absence of false positives was achieved; and (iii) article filtering and keyword
Table 1
Most influential articles on NA and psychopathology.

| Title                                                                 | Reference                      | #Citat. |
|----------------------------------------------------------------------|-------------------------------|---------|
| Network analysis: An Integrative Approach to the                     | (Borsboom and Cramer, 2013)   | 839     |
| Structure of Psychopathology                                         |                               |         |
| Comorbidity: A network perspective                                    | (Cramer et al., 2010)         | 471     |
| A network theory of mental disorders                                 | (Borsboom, 2017)              | 422     |
| The Small World of Psychopathology                                    | (Borsboom et al., 2011)       | 239     |
| State of the art personality research: A tutorial on                  | (Costanzi et al., 2021)       | 229     |
| network analysis of personality data in R                             |                               |         |
| Depression is not a consistent syndrome: An investigation of         | (Fried and Nesse, 2015)       | 224     |
| unique symptom patterns in the SPAR-D study                          |                               |         |
| Mental Disorders as Causal Systems: A Network Approach to             | (McNally et al., 2015)        | 222     |
| Posttraumatic Stress Disorder                                        |                               |         |
| Deconstructing the construct: A network                              | (Schmittmann et al., 2013)    | 214     |
| perspective on psychological phenomena                               |                               |         |
| A Network Approach to Psychopathology: New                              | (Bringmann et al., 2013)      | 211     |
| Insights into Clinical Longitudinal Data                             |                               |         |
| Association of Symptom Network Structure With the                    | (van Borkulo et al., 2015)    | 200     |
| Course of Longitudinal Depression                                    |                               |         |
| Can network analysis transform                                        | (McNally, 2016)               | 187     |
| psychopathology?                                                      |                               |         |
| What are ‘good’ depression symptoms?                                 | (Fried et al., 2016)          | 176     |
| Comparing the centrality of DSM and non-DSM                          | (Fried and Cramer, 2017)      | 175     |
| symptoms of depression in a network analysis                          |                               |         |
| Moving Forward: Challenges and Directions for                        | (Bringmann et al., 2015)      | 130     |
| Psychopathological Network Theory and Methodology                     |                               |         |
| Revealing the dynamic network structure of the Beck                   | (Bringmann et al., 2015)      | 127     |
| Depression Inventory-II                                              |                               |         |
| Identifying Highly Influential Nodes in the                          | (Robinaugh et al., 2016)      | 124     |
| Complicated Grief Network                                            |                               |         |
| The Impact of Individual Depressive Symptoms on                      | (Fried and Nesse, 2014)       | 104     |
| Impairment of Psychosocial Functioning                                |                               |         |
| Replicability and Generalizability of                                | (Fried et al., 2018)          | 113     |
| Posttraumatic Stress Disorder (PTSD) Networks: A Cross-Cultural       |                               |         |
| Multisite Study of PTSD Symptoms in Four Trauma Patient              |                               |         |
| Samples                                                              |                               |         |
| A Network Approach to Psychotic Pathways                              | (Izovrane et al., 2017)       | 112     |
| Between Childhood Trauma and Psychiatric                              |                               |         |
| Symptoms                                                             | (Froh et al., 2011)           | 105     |
| Measuring gratitude in youth: assessing the                           | (Cramer et al., 2016)         | 105     |
| psychometric properties of adult gratitude                            |                               |         |
| scales in children and adolescents                                   | (Cramer et al., 2015)         | 104     |
| Major Depression as a Complex Dynamic System                          | (Fried et al., 2014)          | 89      |
| From Loss to Loneliness: The Relationship Between                     |                               |         |
| Bereavement and Depressive Symptoms                                   | (Armour et al., 2017)         | 91      |
| The Network Structure of Symptoms of the Diagnostically and           | (Boschloo et al., 2015)       | 92      |
| Statistical Manual of Mental Disorders                               |                               |         |
| A network analysis of DSM-5 posttraumatic stress                      | (Robinaugh et al., 2014)      | 87      |
| disorder symptoms and correlates in US                               |                               |         |
| military veterans                                                     | (Bryant et al., 2017)         | 89      |
| Acute and Chronic Posttraumatic Stress                              | (Bryant et al., 2017)         | 89      |
| Symptoms in the Emergence of Posttraumatic                          | (Robinaugh et al., 2014)      | 87      |
| Stress Disorder: A Network Analysis                                  |                               |         |
| Network analysis of Persistent Complex                                | (Izovrane et al., 2017)       | 91      |
| Bereavement Disorder in Conjugally Bereaved Adults                   | (Fried et al., 2017)          | 84      |
| Exploring the Idiographic Dynamics of Mood and                       | (Izovrane et al., 2016)       | 81      |
| Anxiety via Network analysis                                        | (Cramer et al., 2012)         | 78      |
| A Complex Network Perspective on Clinical                            |                               |         |
| Science                                                               | (Borsboom et al., 2019)       | 73      |
| The pathophysics of dysphoric episodes:                               | (Wigram et al., 2015)         | 69      |
| differential impact of stressful life events on the                  |                               |         |
| pattern of depressive symptom inter-                                 |                               |         |
| correlations                                                         |                               |         |
| Brain disorders? Not really: Why network                             | (Borsboom et al., 2019)       | 73      |
| structures block reduction in psychopathology research                |                               |         |
| Exploring the underlying structure of mental                        | (Wigram et al., 2015)         | 69      |
| disorders: cross-diagnostic differences and                          |                               |         |

Fig. 4. Number of citations (i) in total, (ii) excluding self-citations, and (ii) restricting the citing papers to those in the sample.

Fig. 5. Journals that have published the highest number of articles. standardization were based on the consensual agreement among three of us.

Regarding the journals with the highest number of publications on NA in psychopathology and mental health, the Journal of Affective Disorders and the Journal of Abnormal Psychology and Psychological Medicine
Fig. 6. Collaboration networks of the authors with four or more papers.

Fig. 7. Article distribution per country.
stand out. Out of the total number of articles published on the subject, 324 refer to NA in mood disorders, which would explain the great interest of the Journal of Affective Disorders in publishing information on that subject.

Concerning the researchers’ involvement and collaboration, the 398 articles in our sample have 1910 authors in total, but most of them are occasional contributors. A core of researchers (3.3% of all authors) has written four or more articles. These authors collaborate in groups. The most relevant groups are formed by (i) Borsboom, D., Fried, E.I., Epskamp, S., Cramer, AOJ. et al., (ii) Cascino, G., Monteleone, AM., Solmi, M., Ruzzi, V. et al., (iii) Levinson, CA., Crosby, RD., Christian, C., Vanzhula, IA. et al., (iv) Cheung, EFC., Wang, Y., and Chan, RCK., (v) McNally, RJ., Robinaugh, D.J., Jones, PJ., Heeren, A. et al., and (vi) Cervin, M., Pozza, A. and Barcaccia, B. The proliferation of research groups, most of them composed of more than 7 authors, highlights the enormous number of researchers and research groups on the topic of symptom networks in psychopathology.

Regarding the articles’ origin, most research concentrates on the USA, with 44.88% of all articles, followed by the Netherlands (18.37%), the UK (11.38%), Germany (7.64%), Belgium (7.32%), and Italy (6.5%). Among the 7 universities that have published the most articles on the subject are logically some of the major American universities (Harvard University or Yale University). In contrast, it is worth noting that the institution with the highest number of publications is the University of Amsterdam, with the University of Groningen and Leiden in third and fifth places. This again underlines the importance and growing interest in the subject, present both in the USA and in Europe. It is worth mentioning the important role that the Netherlands and its authors (Borsboom, Cramer, and others) have played.

Fig. 8. Institutions that have published a higher number of articles.

Fig. 9. Keyword co-occurrence graph.

### Table 2

| Category                        | N  | %  | h-index | #Citat. | Average #Citat. | Main articles |
|---------------------------------|----|----|---------|---------|-----------------|---------------|
| Mood disorders                  | 324| 80 | 33      | 8276    | 25.5            | (Borsboom and Cramer, 2013) [839]; (Cramer et al., 2010) [471]; (Borsboom, 2017) [422]; (Borsboom et al., 2011) [239]; (Fried and Nesse, 2015) [224] |
| Anxiety disorders               | 120| 29 | 23      | 2514    | 20.95           | (Cramer et al., 2010) [471]; (Borsboom et al., 2011) [239]; (Isvoranu et al., 2017) [112]; (Cramer et al., 2016) [105]; (Isvoranu et al., 2017) [41]; (van de Grift et al., 2016) [28]; (Borsboom and Cramer, 2013) [839]; (Isvoranu et al., 2016) [59]; (R.J McNally et al., 2017a) [47]; (P.J. Jones et al., 2018) [43]; (Borsboom and Cramer, 2013) [839]; (Cramer et al., 2010) |
| Gender studies                  | 26 | 6  | 10      | 253     | 9.7             | (Bitchell et al., 2017) [41]; (van de Grift et al., 2016) [28]; (Borsboom and Cramer, 2013) [839]; (Cramer et al., 2010) |
| Children and/or adolescents     | 92 | 22 | 15      | 1589    | 17.3            | (Borsboom and Cramer, 2013) [839]; (Isvoranu et al., 2017) [112]; (Wigman et al., 2015) [69]; (Isvoranu et al., 2016) [68]; (Wigman et al., 2017) [33]; (Cramer et al., 2010) [471]; (McNally et al., 2015) [222]; (Fried and Cramer, 2017) [175]; (Robinaugh et al., 2016) [127]; (Cramer et al., 2010) [471] |
| Psychotic disorders             | 56 | 13 | 12      | 922     | 16.5            | (Isvoranu et al., 2017) [112]; (Wigman et al., 2015) [69]; (Isvoranu et al., 2016) [68]; (Wigman et al., 2017) [33]; (Cramer et al., 2010) [471]; (McNally et al., 2015) [222]; (Fried and Cramer, 2017) [175]; (Robinaugh et al., 2016) [127]; (Cramer et al., 2010) [471] |
| Trauma related disorders and stress factors | 102 | 25 | 22     | 2588    | 25.4            | (Cramer et al., 2010) [471]; (McNally et al., 2015) [222]; (Fried and Cramer, 2017) [175]; (Robinaugh et al., 2016) [127]; (Cramer et al., 2010) [471] |
| Substance abuse and other       | 31 | 7  | 11      | 719     | 23.2            | (Cramer et al., 2010) [471] |

(continued on next page)
Furthermore, articles that use children and adolescents are strongly related to issues such as trauma-related disorders and stress factors, eating disorders, anxiety, and mood disorders. Also, affective disorders appear to be strongly associated with other psychological variables (like self-esteem, emotion, resilience, or bereavement), other disorders, and methodologies for studying symptom networks.

By contrast, keywords with the least proliferation of studies on the subject are: older adults (1%), suicide and self-harm (4.23%), and gender studies (6.47%). According to the results, NA is applied to commonly researched areas in psychopathology. That is, the most studied areas in psychopathology are depression and anxiety (assessment, treatments, etc.), and the reason is that they are the most prevalent disorders. Furthermore, perhaps the stigma towards more vulnerable groups (women, elderly, homeless, etc.) may also be at the basis of this lack of studies prioritizing the group of adults and diagnoses of greater entities.

This could also reflect the difficulty of accessing samples, or may point out the low interest of the scientific community in these topics. However, this does not diminish its importance since around 90% of people who commit suicide had some previous kind of psychological problem (Arsenault-Lapierre et al., 2004; Brådvik, 2018). Also, it is worth noting that the older population is equally affected by mental health symptomatology as the adult population. In this regard, depression and anxiety disorders are some of the most prevalent conditions among mental disorders in individuals over 65 years of age. Regarding major depression disorders, 11.6% of people over 65 years of age have suffered such disorder in the last year, and 17.2% from some anxiety disorder (Andreas et al., 2017). On the other hand, NA studies the gender gap again, with few studies that explicitly include gender differences, despite the importance that gender roles and social pressure to conform to them may have in the etiology, maintenance, and expression of symptoms. In addition to the fact that certain diagnoses continue to be associated with the female gender (e.g., eating, as represented in the graph), these issues may affect the implications and help-seeking (Afifi, 2007).

The analysis of symptom networks in psychopathology and mental health raises the need to pay attention to disorders not only on the basis of the DSM or ICD categories but in trying to address mental health problems from a more flexible approach that can account for the particularities of each individual, and lead to more effective interventions. However, it is worth mentioning that NA is not free of criticism, as the debate related to replicability (Forbes et al., 2017; Borsboom et al., 2017), as well as the invariance found in networks developed by modifying certain variables (P.J. Jones et al., 2018; Schweren et al., 2017), or the debate related to replicability (Forbes et al., 2017; Borsboom et al., 2017), as well as the invariance found in networks developed by modifying certain variables (P.J. Jones et al., 2018; Schweren et al., 2018; van Loo et al., 2018). Other studies find that the network obtained, for example in depression, presents the same core symptoms as those proposed in the DSM 5 (Kendler et al., 2018), questioning the approach’s contribution to the approach. This highlights the need to (i) develop more rigorous analytical methods to explore the reliability of the networks (Contreras et al., 2019), (ii) undertake studies focused on the comparison and analysis of commonalities (Dejonckheere et al., 2017), and (iii) give greater weight to the hypotheses and not so much to the exploratory analyses with little theoretical support. This highlights the need to develop more rigorous analytical methods to explore the reliability of the networks (Contreras et al., 2019), as well as to carry out studies focused on the comparison and analysis of commonalities (Dejonckheere et al., 2017), and to give greater weight to the hypotheses and not so much to the exploratory analyses with little theoretical support (Wichers et al., 2017).

Despite these NA limitations, it can be a tool with important clinical implications. Among these implications, Blanco et al. (2019) point out that network models could help clinicians analyze psychological disorders as relational patterns of patients’ different events, cognitive processes and symptoms, thus opening a new field for individualized and targeted treatments of core symptoms. The challenge posed by the network model is more related to the conceptual than to the applied level (Blanco et al., 2019). Categorical diagnosis is probably necessary.
for many practical reasons (Evans et al., 2013): reducing information and facilitating communication, conducting epidemiological studies or evaluating care needs, producing reports and expert opinions, making legal expert opinions, legal decisions, etc. However, it will take time to find an effective replacement that covers the many functions that these old systems have and that psychologists themselves recognize (Blanco et al., 2019).

Our study has several limitations. First, the search for studies was carried out only from the WoS database, in English, and restricted to articles published in journals, which could have limited the generalizability of the findings. Secondly, although our bibliographical search was designed to be as exhaustive as possible, it may miss some relevant articles. Third, it is necessary to take into account the limitations of the methodology used. For example, the applied bibliometric techniques do not allow a priori definition of categories or hypothesis testing, so the results should be interpreted as descriptions of the sample of articles. Fourth, the search was carried out to be as relevant as possible regarding clinical practice and psychopathology. Future research could deepen on methodological issues or, on the contrary, encompass more general matters.

Although NA has just started to be applied to psychopathology and mental health, its use has proliferated, with a wide variety of researchers from the USA and Europe, who have extensively studied symptom networks in depression, anxiety and post-traumatic stress disorders. The findings support paradigm shift claims of approaching diagnosis from a more dimensional perspective, reflecting the complex associations between symptoms. Nevertheless, despite the optimism that accompanies this methodology, the approach needs to be addressed with caution. It also has important gaps, for example, in the study of other psychological behaviors such as suicide, and populations such as the elderly and gender studies.

Data availability statement

The raw bibliographic data retrieved from WoS, the normalized database in SciMAT format is publicly available at Zenodo (https://doi.org/10.5281/zenodo.4614134).

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Declaration of Competing Interest

None.

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