



Carta al Director

REPRESENTATION OF EXPLORATORY GRAPHICAL ANALYSIS: A CONTRIBUTION TO CLINICAL INSTRUMENTAL RESEARCH

Dear Editor,

An article has been reported in this journal concerning a variant of psychometric network analysis denominated Exploratory Graph Analysis (EGA) (1) as an alternative to exploratory factor analysis (EFA). Therefore, and with the purpose of complementing the information and of contributing in a practical way to its execution, the objective of this letter is to describe the procedure to perform EGA.

EGA is a recent method based on graph theory and psychometrics (2,3), which makes it possible to determine the number of factors extracted to examine the structure of an instrument or, according to a previous theoretical framework, composed of indicators whose common underlying feature allows correlation between them. This method can be easily calculated using the EGAnet package (4) in R software.

EGA *versus* AFE has shown better accuracy when the instruments are multidimensional, especially when interfactor correlations are moderate or high. Likewise, the execution and interpretation of EGA can be simpler, as it does not require rotations and simplifies the result, since, being graphical, it facilitates the understanding of the model (5,6). It is also recommended to include an *a priori* analysis of the sample size (7).

To determine the number of dimensions and the items belonging to each of them, the graph will show different colors. Thus, for example, items belonging to dimension 1 will be sky blue, and those belonging to dimension 2 will be red. In addition, to interpret the results and obtain more information, it should be taken into account that the network is composed of nodes (items) linked by edges (statistical relationships), where thicker edges indicate a higher degree of relationship (8). Finally, analogous to factor loadings, the EGA can show network loadings, whose values can be interpreted as small (0.15), moderate (0.25) or large (0.35) (9).

The procedure for performing EGA is explained with an example using data from a study that included the Patient Health Questionnaire (PHQ-9) in Peruvian adults with hypertension (10).

To do this, the EGAnet package is first installed and executed in R using the following command:

```
install.packages("EGAnet")
library(EGAnet)
```

Then the data are loaded into R and the dimensions are estimated with the EGA function. Inside, you will have the option to indicate the data matrix and method specification (Glasso or TMFG), and to create the plot with the command plot.EGA:

```
phq.ega <- EGA(data = depression, model = "glasso", plot.
EGA = TRUE).
```

To obtain the network loads, use is made of the net.loads function, the interpretation of which can be performed following the suggested cut points indicated above:

```
net.loads(phq.ega)
```

Such commands generate figure 1A, where it is observed that EGA indicates the bidimensionality of the PHQ-9, where items 1, 2, 6, 7, 8 and 9 belong to the cognitive-affective dimension (sky blue) and items 3, 4 and 5 conform the somatic expression dimension (red). Finally, in the example, the PHQ-9 network loads were calculated and are shown in figure 1B. In conclusion, EGA is a novel option for the graphical exploration of dimensionality of a test through network analysis.

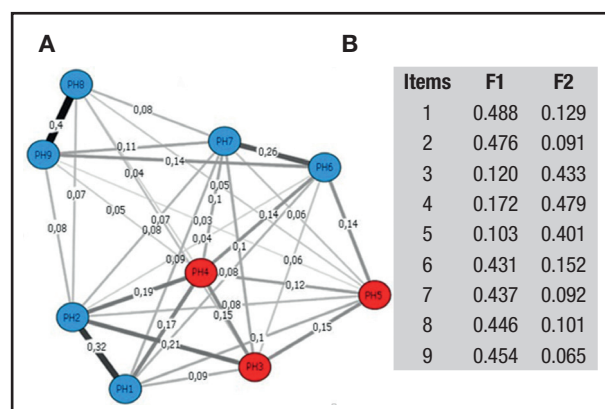


Figure 1.

A. EGA of the Patient Health Questionnaire (PHQ-9). B. PHQ-9 network loads.

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Conflicts of interest: the author declares none.

REFERENCES

1. Ramos Vera C. Las redes de relación estadística en la investigación de nutrición. *Nutr Hosp* 2021;38(3): 671-2. DOI: 10.20960/nh.03522
2. Golino HF, Epskamp S. Exploratory graph analysis: A new approach for estimating the number of dimensions in psychological research. *PLoS One* 2017;12(6):1-26. DOI: 10.1371/journal.pone.0174035
3. Golino H, Shi D, Christensen AP, Garrido LE, Nieto MD, Sadana R, et al. Investigating the performance of exploratory graph analysis and traditional techniques to identify the number of latent factors: A simulation and tutorial. *Psychol Methods* 2020;25(3):292-320. DOI: 10.1037/met0000255
4. Golino HF, Christensen AP. EGAnet: Exploratory graph analysis: A framework for estimating the number of dimensions in multivariate data using network psychometrics; 2020. Available in: <https://cran.r-project.org/package=EGAnet>
5. Ramos-Vera C. Statistical Relationship Networks in Psychiatric Research: The Case of Delirium in the Context of Covid-19. *Rev Colomb Psiquiatr (Engl Ed)* 2021;50(3):158-9. DOI: 10.1016/j.rcp.2021.02.004.
6. Christensen AP, Golino H, Silvia PJ. A psychometric network perspective on the validity and validation of personality trait questionnaires. *Euro J Pers* 2020;34(6):1095-108. DOI: 10.1002/per.2265
7. Ramos-Vera CA. Beyond sample size estimation in clinical univariate analysis. An online calculator for structural equation modeling and network analysis on latent and observable variables. *Nutr Hosp* 2021. DOI: 10.20960/nh.03751
8. Ramos-Vera C. Relaciones de red del complejo estigma-discriminación y el miedo a la COVID-19 durante la segunda ola pandémica en adultos peruanos. *Rev Colomb Psiquiatr* 2021. DOI: 10.1016/j.rcp.2021.05.010
9. Christensen AP, Golino H. On the equivalency of factor and network loadings. *Behav Res Methods* 2021. DOI: 10.3758/s13428-020-01500-6
10. Ramos-Vera C, Baños-Chaparro J, Ogundokun R. Network structure of depressive symptoms in Peruvian adults with arterial hypertension. *F1000Research* 2021;10:19. DOI: 10.12688/f1000research.27422.2