



The European Journal of Psychology Applied to Legal Context

<https://journals.comadrid.org/ejpalc>



Network Analysis of Emotional Symptoms and their Relationship with Different Types of Cybervictimization

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ARTICLE INFO

Article history:

Received 13 October 2022

Accepted 16 November 2022

Keywords:

Anxiety
Cyberbullying
Cybervictimization
Depression
Stress

ABSTRACT

Background: Cyberbullying is a highly prevalent problem in our society with important implications for adolescent psychological wellbeing. The objective of the study was to examine the network structure of the Depression, Anxiety, and Stress Scale in a sample of youths, and find out the relationships between different types of cybervictimization and the presence of negative emotional states. **Method:** This was a descriptive cross-sectional study. The sample was made up of 2,171 high school students with a mean age of 13.84 (with 50.53% males and 49.47% females). The Cybervictimization Questionnaire (CYVIC) and the Spanish version of the Depression, Anxiety, and Stress Scale (DASS-21) were administered. **Results:** Positive correlations were found between all the dimensions of the DASS-21 and the types of cybervictimization. The network structure showed that the different nodes of three emotional states were positively related to each other (although some relationships were stronger than others). Furthermore, girls had significantly higher means in depression, anxiety, and stress. In analyzing the network, the strongest associations in both sexes were found to be between anxiety and written-verbal cybervictimization and exclusion. **Conclusions:** Negative emotional states and types of cybervictimization were related in a complex network where efforts to approach reduction of emotional symptoms associated with cybervictimization could produce lasting benefits for the emotional wellbeing of youths.

Análisis de red de síntomas emocionales y su relación con distintos tipos de cibervictimización

RESUMEN

Antecedentes: El *cyberbullying* es una problemática con una alta prevalencia en nuestra sociedad y que tiene importantes implicaciones para el bienestar psicológico de los adolescentes. El objetivo del trabajo fue examinar la estructura de red de la Escala de Depresión, Ansiedad y Estrés en una muestra de jóvenes, así como comprobar las relaciones que se establecen entre diferentes tipos de cibervictimización y la presencia de estados emocionales negativos. **Método:** Se realizó un estudio descriptivo transversal. La muestra estuvo formada por 2,171 estudiantes de Educación Secundaria, con una media de edad de 13.84 años (donde el 50.53% fueron hombres y el 49.47% mujeres). Se aplicó el Cuestionario de Cibervictimización (CYVIC) y la versión española de Depresión, Anxiety and Stress Scale (DASS-21). **Resultados:** Se encontraron correlaciones positivas entre todas las dimensiones del DASS-21 y los tipos de cibervictimización. Atendiendo a la estructura de redes, se halló que los diferentes nodos de los tres estados emocionales se relacionaban positivamente entre sí (aunque algunas relaciones eran más fuertes que otras). Por otro lado, en relación al sexo, las mujeres mostraron medias significativamente más elevadas en depresión, ansiedad y estrés. Al analizar la red, las asociaciones más estrechas se dieron entre la ansiedad y la cibervictimización de tipo escrita-verbal y la exclusión en ambos sexos. **Conclusiones:** Los estados emocionales negativos y los tipos de cibervictimización se relacionaban en una compleja red donde los esfuerzos por abordar la reducción de los síntomas emocionales asociados a la cibervictimización podrían producir beneficios duraderos en el bienestar emocional de los jóvenes.

Palabras clave:

Ansiedad
Cyberbullying
Cibervictimización
Depresión
Estrés

Almost five decades have passed since Olweus defined bullying for the first time as a type of aggressive behavior repeated over time with the intention to harm the victim with whom there is an

imbalance of power or strength (Olweus, 1978). However, it is still current. Continuous technological development has generated new online formats and platforms facilitating social interaction, learning,

Cite this article as: Molero, M. M., Pérez-Fuentes, M. C., Martos, A., Pino, R. M., and Gázquez, J. J. (2023). Network analysis of emotional symptoms and their relationship with different types of cybervictimization. *European Journal of Psychology Applied to Legal Context*, 15(1), 23-32. <https://doi.org/10.5093/ejpalc2023a3>

Funding: This research has been carried out thanks to the project "Análisis de habilidades emocionales y desarrollo de un programa para el entrenamiento emocional de los jóvenes de Almería: Cuidemos la Salud Mental": EMOTRAIN-ALMERIA (TRFE-SI-2021/008), with funding from the UALtransferE-2021 Program of the University of Almería.

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and recreation, especially among the young (Livingstone et al., 2017; Novo et al., 2016). But it has also given rise to a new scenario where severe problems (Gámez-Guadix et al., 2022; Hidalgo-Fuentes, 2022; Oksanen et al., 2021), such as bullying (Gázquez et al., 2008, 2010), become easier and more accessible (Steer et al., 2021).

Even though cyberbullying may in some way be considered a form of traditional harassment using electronic media (Olweus & Limber, 2018), it is different in some respects. Specifically, the repeated execution of cyberbullying does not have as much to do with the bully repeatedly behaving aggressively as it does a single action being shared repeatedly, generating prolonged exposure of the victim. Furthermore, while the imbalance of power in the traditional context refers to strength or status, in the scope of cybernetics it is related to the anonymity provided by networks or the bully's ability to use the Information and Communication Technologies (ICT), which provide an imbalance of real or perceived power (Dooley et al., 2009; Smith, 2015; Steer et al., 2021; Vandebosch & Van Cleemput, 2008).

These characteristics, along with their effects, make cyberbullying a problem requiring special attention (Álvarez-García, Núñez, et al., 2017), more so when studies, such as the one by Montiel et al. (2016), have shown that the prevalence of cybervictimization among Spanish adolescents is as high as 60%. A recent survey by Save the Children (2019) of youths 18 to 20 years old also showed that 75% of those surveyed had been the victim of online violence during their childhood or adolescence. It is therefore not surprising that more and more efforts are being made by the scientific community to study it (Barragán et al., 2021). This study concentrates on an analysis of the psychological symptoms of Spanish youths and their relationship to online victimization, which is essential to be able to detect and improve the wellbeing of young people who experience such situations.

Cybervictimization and Emotional Symptoms in Adolescence

As mentioned above, cyberbullying is defined as an aggressive and intentional act or behavior reiterated and/or maintained over time in electronic forms of contact by one or several individuals against a victim who cannot easily defend her/himself (Smith et al., 2008). There are different forms of cyberbullying. Written-verbal cyberbullying (insults or threats in messages, wounding comments through Internet, or intimidating anonymous calls), visual cyberbullying (recording and spreading compromising images or "happy slapping", that is, aggression or humiliation that is recorded and spread), exclusion (deliberate omission from an online group), and impersonation are types of aggressive behavior presented on digital devices. And among these, verbal cyberbullying and exclusion seem to be the most common (Álvarez-García, Barreiro-Collazo, et al., 2017). However, other studies have shown verbal and visual cyberbullying with humiliating images as the most prevalent (Cuadrado-Gordillo & Fernández-Antelo, 2016).

The psychoemotional adjustment of adolescents is intimately related to victimization by internet (Evangelio et al., 2022; Quintana-Orts et al., 2021) and other types of exposure to violence (Vilariño et al., 2022). Some emotional characteristics have been related to higher risk of cybervictimization of adolescents, such as low esteem, feeling afraid or shame of revealing to others what they feel or what happens to them, high sensation-seeking (Save the Children, 2019), along with feeling lonely (Sahín, 2012; Save the Children, 2019), seem to be factors present in cyberbullying victims. Low emotional control (Hempehill & Heerde, 2014) has also been related to cybervictimization. In this regard, specific moods, such as anger, confusion and tension/anxiety are related to higher risk of being a cyberbullying victim or aggressor, which highlights the importance of emotional management in this issue (De Pasquale et al., 2021).

Moreover, cybervictimization has been related to a series of

negative results in terms of the mental wellbeing of youths (González-Cabrera et al., 2020). Specifically, cybervictimization has been pointed out as a factor highly linked to psychological harm among adolescents (Montes et al., 2022). Victims of cyberbullying show a significantly higher prevalence of major depressive disorder than those who are not (Mallik & Radwan, 2020; Thai et al., 2022). Previous studies have shown cyberbullying to be a risk factor in increased depressive and anxiety symptoms in adolescents (Evangelio et al., 2022; Molero et al., 2022). This could in turn lead to feelings of isolation and loneliness, and less wellbeing. Similarly, a longitudinal study found cybervictimization to be a risk factor for future development of depressive and social anxiety symptoms, and diminishing wellbeing in adolescence (Fahy et al., 2016). Emotional self-efficacy and maladaptive emotional regulation, such as rumination, have an important role in this as mediators between cybervictimization and wellbeing. Thus, the capacity of youths to manage their negative emotions is in a way responsible for the adverse psychological consequences of cyberbullying (Schunk et al., 2022). The search for social support has also been shown to be a relevant variable in results derived from cyberbullying, as it moderates depressive symptoms. This coincides with the results found in other groups exposed to violence (Pérez-Fuentes et al., 2021), while other strategies, such as assertiveness or helplessness, are less effective (Machmutow et al., 2012). In this regard, adolescents who are more likely to employ unproductive strategies in facing cybervictimization are also more likely to develop depression, anxiety, and stress (McLoughlin, 2021).

McLoughlin et al. (2019) showed that face-to-face social connections protect against the negative results of mental health linked to cybervictimization. This could be because the connection with others through digital media (for example, social networks) seems to increase feelings of loss and loneliness, both when they do not use them (preventing communication) and when they do (since they feel excluded when they see what others are doing) (Twenge et al., 2021).

Cybervictimization also leads to other negative results such as the appearance of feelings of isolation and self-guilt, and even suicidal thinking and behavior (Dorol-Beauroy-Eustache & Mishara, 2021; Save the Children, 2019).

Psychological Effects of Cyberbullying: Gender Differences

Research has shown differences in cybervictimization between boys and girls. Cybervictimization by girls seems to be more influenced by online gossip, that is, evaluative comments about third persons. Meanwhile, boys seem to be especially influenced by a problematic use of the internet, which is in turn linked to low self-esteem (Cebollero-Salinas et al., 2022). However, studies such as the one by Álvarez-García, Barreiro-Collazo, et al. (2017) on Spanish adolescents showed that there are no significant differences in the type of cyberbullying received between boys and girls, although there is a generalized trend in which girls are victims more than their male classmates, which coincides with other studies (Carvalho et al., 2021; Evangelio et al., 2022; González-Cabrera et al., 2020). This could be especially problematic considering that women who experience cyberbullying and have unstable family relationships and a problematic Internet use pattern are at a higher risk of becoming future cyberbullies. These adolescents, who show a dual pattern (online victims and bullies), are especially disposed to psychological alterations, such as depression, anxiety, and emotional problems (Lozano-Blasco et al., 2020). Women who are victims of cyberbullying and have a problematic use of internet also have emotional regulation problems (Arrivillaga et al., 2022).

Moreover, girls have been found to have a stronger tendency to choose coping strategies for dealing with cybervictimization focused on emotions than their male counterparts. And in turn, this

type of strategy is related to higher levels of depression, anxiety, and stress (McLoughlin, 2021). Girls' problems with emotional management have also been found to be related to victimization, but not boys' (Rodríguez-Álvarez et al., 2021). It has also been shown that depression, and especially anxiety, may be caused by cybervictimization, particularly in women (Molero et al., 2022). All the above suggests that gender may be related to possible negative results of cyberbullying.

The Present Study

Cybervictimization has been related to poor mental health and internalizing symptoms (Beaudequin et al., 2020; Fahy et al., 2016; Mallik & Radwan, 2020). This study attempts to take one step further by relating specific emotional states to the concrete type of cybervictimization. This will provide us with more precise knowledge about whether certain internalizing behaviors are more closely related to types of cyberbullying.

Therefore, this study posed two objectives. First, it was intended to examine the network structure of items and dimensions in the Depression, Anxiety and Stress Scale (DASS-21) in a sample of Spanish adolescents. A network graph was created, where the components of the dimensions and their associations (edge weight and centrality), as well as the robustness and stability of the network, were evaluated.

The second objective was to test how the different modalities of cybervictimization (CYVIC) relate to the presence of emotional states (DASS-21), in this case, by means of network analysis of the dimensions (depression, anxiety, and stress).

Method

Participants

The original sample had 2,241 participants who had agreed to participate and gave their consent, but 70 cases were removed from the database because they did not complete the whole battery of questionnaires. The final study sample was therefore comprised of 2,171 adolescents aged 11 to 18, with a mean age of 13.84 ($SD = 1.46$). Gender distribution revealed equitable representation with 50.53% ($n = 1,097$) males and 49.47% ($n = 1,074$) females with a mean age of 13.88 ($SD = 1.45$) and 13.81 ($SD = 1.46$), respectively. The courses they were studying at the time data were collected were distributed as follows: 25.51% ($n = 554$) 1st year of compulsory education (ESO), 22.98% ($n = 499$) 2nd year of compulsory education, 23.35% ($n = 507$) 3rd year of compulsory education, 19.94 ($n = 433$) 4th year of compulsory education, 4.33% ($n = 94$) 1st year high school, 3.27% ($n = 71$) 2nd year high school, and 0.59% ($n = 13$) vocational training.

Instruments

Questionario de Cibervictimización para Adolescentes [Cybervictimization Questionnaire for Adolescents] (CYVIC; Álvarez-García, Núñez, et al., 2017)

This questionnaire was designed to evaluate to extent the informant has been the victim of aggression by cellphone or Internet in the last three months. It is made up of 19 items, with four answer choices rated on a 4-point Likert-type scale, ranging from (1) *never* to (4) *always*, distributed in four factors: impersonation (refers to others simulating the profile of the person in online media; e.g., “Se han hecho pasar por mí en Internet publicando comentarios en mi nombre, como si fuese yo” [“Someone has impersonated me on the Internet, posting comments under my name, as if they were me”]), visual-sexual cybervictimization (related to compromising or humiliating videos or photos and spreading them online; e.g.: “Me

han hecho fotos o grabaciones de vídeo sin mi consentimiento con un contenido sexual o sugerente – e.g., en la playa, en un vestuario – y las han difundido a través del móvil o Internet” [“Someone has taken pictures or video recordings of me with a sexual or suggestive content – e.g., on the beach, in a locker room, ... – without my consent and they have disseminated them over the mobile phone or the Internet”]), verbal-written cybervictimization (reference to receiving harmful and frightening or insulting comments on the internet; also includes threatening anonymous or distressing calls; e.g., “He recibido llamadas a mi móvil, que no contestan, supongo que para fastidiar” [“I have received calls on my mobile that are not answered, I guess to annoy me”]), and online exclusion (refers to being deliberately left out of an online group; e.g., “Se ponen de acuerdo para hacerme el vacío – ignorarme – en las redes sociales” [“They agree to ignore me on the social networks”]). The reliability of each of the scales was: identity impersonation, $\alpha = .662$, $\omega = .663$; visual sexual cybervictimization, $\alpha = .662$, $\omega = .663$; written-verbal cybervictimization, $\alpha = .812$, $\omega = .812$; online exclusion, $\alpha = .704$, $\omega = .710$.

Depression Anxiety and Stress Scale, Spanish version (DASS-21; Ruiz et al., 2017)

This instrument consists of 21 items that describe negative emotional states. Participants responded on a 4-point Likert-type scale (from 0 = *did not apply to me at all* to 3 = *applicable to me very much or most of the time*). The DASS-21 enables emotional symptoms to be measured on three scales: Depression (e.g., “No podía experimentar ningún sentimiento positivo” [“I couldn't seem to experience any positive feeling at all”]) ($\alpha = .884$, $\omega = .887$); Anxiety (e.g., “Sentí que mis manos temblaban” [“I felt my hands were trembling”]) ($\alpha = .832$, $\omega = .836$); and Stress (e.g., “Me ha costado mucho descargar la tensión” [“I found it hard to wind down”]) ($\alpha = .786$, $\omega = .788$).

Procedure

This was a descriptive cross-sectional study. Before collecting the information, the school directors were contacted to inform them of the objectives of the study and guarantee confidential data processing. Two members of the research team went to the schools to administer the questionnaires. First, they gave the students the pertinent instructions and guaranteed them anonymity of their answers. The students filled in the tests individually in 25-30 minutes. In all cases, ethical research standards were met and all the participants voluntarily agreed to participate and had the written consent of their parents/guardians for their participation. The study was approved by the Bioethics Committee of the University of Almería (Ref: UALBIO2021/022).

Data Analysis

First, a descriptive correlational analysis was carried out with the study variables. Mean scores and standard deviations were calculated, and the bivariate correlation matrix was estimated using Pearson's correlation coefficient. Then any statistically significant gender differences were examined with a comparative analysis of the mean scores of all the study variables. Welch's *t*-test (1947) and *d* (pooled, weighted, and unbiased formula) were performed to estimate mean differences and the effect size (0.20, 0.50, and 0.80 were interpreted as small, medium, or large effect sizes, respectively). Complementarily, the statistical model error, i.e., the probability of error of the statistical model in cases' classification was estimated with the probability of inferiority score (Gancedo et al., 2021).

Table 1. Descriptive Statistics and Correlation Analysis of the Study Variables

Variables	<i>M</i> ± <i>SD</i>	1	2	3	4	5	6	7
Cybervictimization CYVIC								
1. Impersonation	3.47 ± 1.20	-						
2. Visual Sexual Cybervictimization	3.49 ± 1.39	.582	-					
3. Written-Verbal Cybervictimization	8.42 ± 3.34	.615	.553	-				
4. Online Exclusion	3.89 ± 1.62	.548	.547	.636	-			
Emotional Symptoms DASS-21								
5. Depression	8.09 ± 5.85	.174	.150	.316	.275	-		
6. Anxiety	7.50 ± 5.42	.207	.187	.349	.312	.754	-	
7. Stress	8.95 ± 5.02	.156	.122	.281	.252	.706	.740	-

Note. All associations were significant $p < .001$.

Instrument reliability was estimated using Cronbach's (1951) alpha coefficient and McDonald's (1999) omega (Ventura-León & Caycho, 2017).

Then, in view of the study objectives, two network models were estimated: Network 1 of emotional symptoms with all the DASS-21 items, and Network 2 combining the emotional symptoms (scales/dimensions) and the different types of cybervictimization (CYVIC). Networks were also estimated separately by gender for this model.

In network analysis, the variables correspond to nodes and connections between nodes are called edges. The strength of the relationship between the nodes was measured in terms of edge weights (the minimum is .30; Isvoranu et al. 2017). In this case, networks were estimated using JASP ver. 0.16.3 (JASP Team, 2022). Missing data were managed using pairwise deletion with the extended Bayesian information criterion (EBICglasso), with hyperparameter set at 0.5 (Epskamp & Fried, 2018). In the graphic representation of the network, edge weights are expressed in terms of edge thickness and color density, so thicker, brighter lines suggest stronger connections. Another aspect to consider is the distance between nodes, such that the nodes closest to each other would be the most closely related. Fruchterman and Reingold's (1991) algorithm, which places the nodes with the strongest correlations in the center of the network, leaving those with weaker correlations farther out, was used for this.

In addition, centrality indices (betweenness, closeness, degree, and expected influence) were calculated, although in this study we focused on degrees or strength, which reflect the direct influence that a certain node has in the network.

Finally, for Network 1, edge accuracy was also examined using bootstrap 95% non-parametric confidence intervals (CIs), and stability of centrality estimates using the case-dropping bootstrap procedure. In both cases, 1,000 bootstraps were estimated.

Results

Preliminary Analyses: Descriptives and Correlations

Table 1 shows mean scores and standard deviations of the study variables, and correlation matrix. As shown, positive associations

were found (in all cases with a significance of $p < .001$) between the modalities of cybervictimization (impersonation, visual sexual cybervictimization, written-verbal cybervictimization, and online exclusion) and the dimensions of the DASS-21 (depression, anxiety, and stress) as emotional symptoms.

In addition, a comparative analysis was conducted to test for the existence of statistically significant gender differences in the study variables. Levene's test was significant ($p < .05$), suggesting a violation of the assumption of homogeneity of variance, and therefore, Welch's t -test was applied to estimate gender differences. As shown in Table 2, mean scores were significantly higher in impersonation, $t = 2.32$, $p < .05$, $d = 0.10$, and visual sexual cybervictimization, $t = 2.76$, $p < .01$, $d = 0.12$, for boys. On the contrary, 46.0% (PIS = .460) of the males had scores under the mean of the females' group (error of the statistical model) in impersonation and in visual sexual cybervictimization, respectively.

Concerning the presence of emotional symptoms (see Table 2), statistically significant differences were observed in the three DASS-21 dimensions: depression, $t = -9.93$, $p < .001$, $d = -0.43$, anxiety, $t = -10.16$, $p < .001$, $d = -0.44$, and stress, $t = -7.77$, $p < .001$, $d = -0.33$, where girls had higher mean scores in all cases. Conversely, the probability of girls with a score under the mean of boys (error of the statistical model) was 33.4%, 32.9%, and 37.1% (PIS = .334, .320, and .371) in depression, anxiety, and stress, respectively.

Network Analysis 1: Network Structure DASS-21 Emotional Symptoms

With 21 nodes, the maximum number of edges in this network was 210. However, EBICglasso estimation used in the analysis reduced the estimated number of edges to 147. Sparsity is a value between 0 and 1, where the higher the sparsity, the more weakly connected the network. In this case, the sparsity index was .30. As shown in Figure 1, all the nodes were positively associated with each other. Furthermore, the stronger the association between nodes, the thicker and brighter the network edge.

Table 2. Cybervictimization and Emotional Symptoms by Sex. Descriptive and Welch's t -test

Variables	Male		Female		Welch's t -test	p	Mean Diff.	95% CI for Mean Diff.		d
	<i>N</i>	<i>M</i> ± <i>SD</i>	<i>N</i>	<i>M</i> ± <i>SD</i>				Lower	Upper	
Cybervictimization (CYVIC)										
Impersonation	1,097	3.53 ± 1.31	1,074	3.41 ± 1.08	2.32	.020	0.12	0.019	0.22	0.10
Visual Sexual Cybervictimization	1,097	3.57 ± 1.61	1,074	3.41 ± 1.11	2.76	.006	0.16	0.048	0.28	0.12
Written-Verbal Cybervictimization	1,097	8.32 ± 3.36	1,074	8.51 ± 3.32	-1.33	.183	-0.19	-0.472	0.09	-0.06
Online Exclusion	1,097	3.95 ± 1.72	1,074	3.82 ± 1.50	1.91	.056	0.13	-0.003	0.27	0.08
Emotional Symptoms (DASS-21)										
Depression	1,097	6.88 ± 5.36	1,074	9.33 ± 6.08	-9.93	< .001	-2.45	-2.929	-1.96	-0.43
Anxiety	1,097	6.35 ± 4.90	1,074	8.67 ± 5.68	-10.16	< .001	-2.32	-2.764	-1.87	-0.44
Stress	1,097	8.14 ± 5.04	1,074	9.79 ± 4.86	-7.77	< .001	-1.65	-2.068	-1.23	-0.33

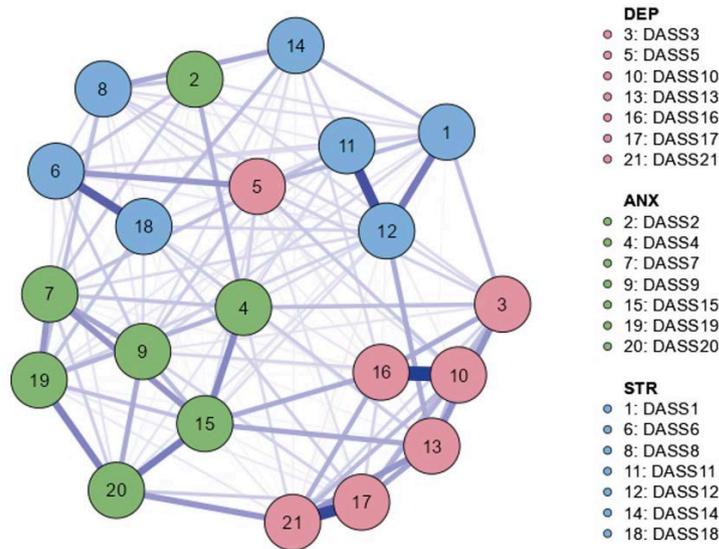


Figure 1. DASS-21 Variables Network.

Note. Blue lines represent positive associations. The thickness and brightness of an edge indicate the strength of the association. DEP = depression (3 = no positive feeling, 5 = lack of motivation, 10 = nothing to live for, 13 = downhearted and blue, 16 = unable to get enthusiastic, 17 = self-depreciation, 21 = meaninglessness of life); ANX = anxiety (2 = dryness of mouth, 4 = breathing difficulty, 7 = trembling, 9 = worried about panicking, 15 = close to panic, 19 = sense of action of heart in absence of physical exertion, 20 = feel scared without any reason); STR = stress (1 = hard to wind down, 6 = overreaction to situations, 8 = nervousness, 11 = agitation, 12 = difficulty relaxing, 14 = intolerance of interruptions, 18 = touchy).

Table 3. Network Analysis Centrality Measures of DASS-21 Variables

Variable	Betweenness	Closeness	Strength	Expected Influence
DASS1	-0.151	-0.377	-0.354	-0.349
DASS2	-1.205	-1.823	-2.129	-2.299
DASS3	-0.602	0.133	0.279	0.456
DASS4	0.000	0.386	-0.116	0.031
DASS5	-0.602	-0.369	-1.054	-0.978
DASS6	-0.452	-0.656	-0.477	-0.465
DASS7	-0.452	0.612	0.252	0.168
DASS8	-0.753	-1.809	-1.134	-1.064
DASS9	-0.452	-0.031	0.199	-0.062
DASS10	0.151	0.163	0.707	0.915
DASS11	-1.054	-0.702	-0.594	-0.483
DASS12	1.205	0.386	1.526	1.444
DASS13	1.807	1.768	0.423	0.610
DASS14	-0.904	-1.709	-1.864	-1.849
DASS15	2.861	1.849	1.614	1.697
DASS16	-0.151	0.217	0.748	0.270
DASS17	-0.753	-0.061	0.795	0.845
DASS18	0.000	-0.288	-0.468	-0.541
DASS19	0.602	1.023	0.250	0.424
DASS20	0.904	0.710	0.133	0.298
DASS21	0.000	0.578	1.263	0.931

Table 3 shows the indices of centrality (betweenness, closeness, strength, and expected influence) for the items on the DASS-21 (nodes). Graphs were created of these measures to facilitate data interpretation (Figure 2).

As observed in Table 3 and Figure 2, the strongest nodes with a relatively high number of connections were: “close to panic” (DASS15), “close to panic” (DASS15), “difficult to relax” (DASS12) and “meaninglessness of life” (DASS21). Furthermore, the nodes with the lowest centrality of strength were “dryness of mouth” (DASS2), “intolerance of interruptions” (DASS14), and “nervousness” (DASS8). We focused on strength as the main indicator of centrality

because it shows reasonably accurate estimations for network analysis in psychology (Santos et al., 2018).

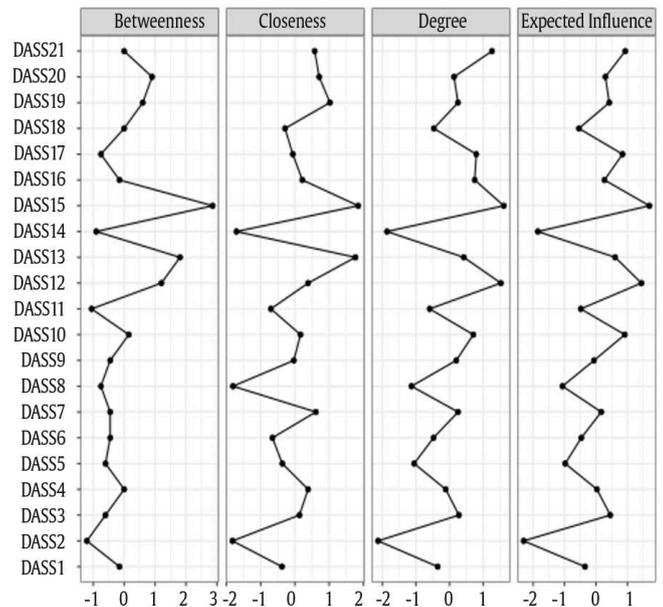


Figure 2. Centrality Plots for Association in Network 1 of Each Node (standardized values).

Note. DASS1 = hard to wind down; DASS2 = dryness of mouth; DASS3 = no positive feeling; DASS4 = breathing difficulty; DASS5 = lack of motivation; DASS6 = overreaction to situations; DASS7 = trembling; DASS8 = nervousness; DASS9 = worried about panicking; DASS10 = nothing to live for; DASS11 = agitation; DASS12 = difficulty relaxing; DASS13 = downhearted and blue; DASS14 = intolerance of interruptions; DASS15 = close to panic; DASS16 = unable to get enthusiastic; DASS17 = self-depreciation; DASS18 = touchy; DASS19 = sense of action of heart in absence of physical exertion; DASS20 = feel scared without any reason; DASS21 = meaninglessness of life.

Finally, the accuracy and stability of the network were evaluated. Confidence intervals around some of the edges estimated were large, which suggests that many of them probably did differ significantly from each other, and this could prevent interpretation of the order of the network edges.

Figure 2 shows graphically the stability of the centrality indices examined. Case-dropping bootstrap, which resamples with different data subsets, was used. The correlation stability coefficient of the data subset represents different percentages of the general sample. Associations between estimations decreased from the original sample to the subsample from 95% to 25%. The correlations for all the indices of centrality showed a certain stability, as they were above .50 (Epskamp et al., 2018), with strength above .70 (traditionally interpreted as an indicator of very large effect in behavior sciences; Cohen, 1988) (Figure 3).

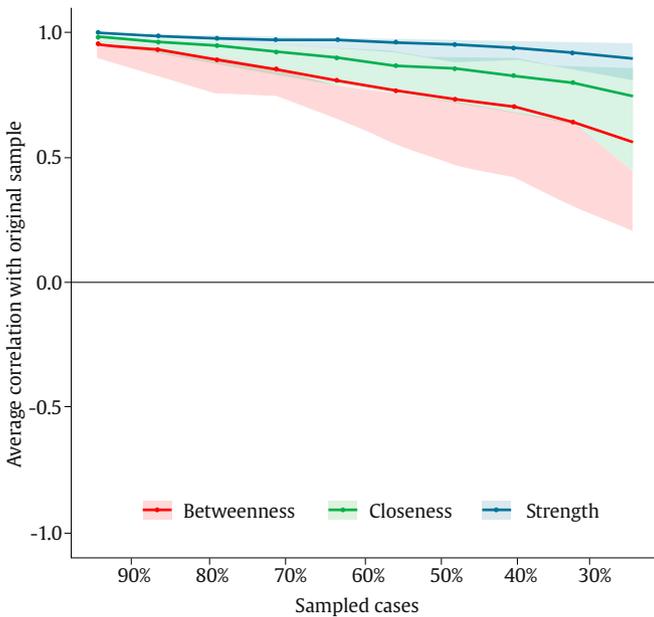


Figure 3. Stability of centrality indices in the DASS-21 emotional symptoms network.

Network Analysis 2: Emotional Symptoms (DASS-21 dimensions) and Different Types of Cybervictimization (CYVIC)

Figure 4 shows the combined network of the DASS-21 emotional symptom subscales (depression, anxiety, and stress) and the CYVIC dimensions, which represent different types of cybervictimization. This network had seven nodes, and the maximum number of edges was 21, with 16 remaining after EBICglasso estimation. In this case, the sparsity index was .23. Connectivity between cybervictimization nodes was stronger than with the emotional symptom scales.

Of the three DASS-21 scales, anxiety (2) had the most visible associations with the written-verbal (6) and online exclusion (7) cybervictimization modalities, with edge weights of .080 and .058, respectively. There was no association at all with other types of cybervictimization, such as impersonation or visual sexual.

All the connections with the different types of cybervictimization were positive, but with stronger edge weights between written-verbal (6) and online exclusion (7) with .350, followed by connections between impersonation (4) and written-verbal (6) and visual sexual cybervictimization (5), with weights of .316 and .308, respectively.

Other connections between CYVIC nodes showed associations between online exclusion (7) and impersonation (4) and visual sexual cybervictimization (5), and this one with written verbal (6), with edge weights of .165, .229, and .183, respectively.

Centrality indices of strength for impersonation (4), visual sexual cybervictimization (5), written-verbal (6), and online exclusion (7) were -0.684, -1.152, 1.196, and -0.299, respectively. Thus, written-verbal victimization may be considered the center node of the cybervictimization modalities in the combined network of emotional symptoms-cybervictimization.

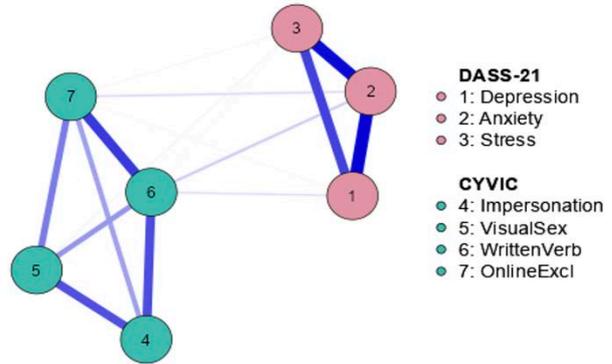


Figure 4. DASS-21 and Cybervictimization Type (CYVIC) Network.

Note. Blue lines represent positive associations. The thickness and brightness of an edge indicate the association strength.

With the estimation of Network 1 above, it was confirmed that the strongest nodes were DASS15, DASS12, and DASS21, represented by an element of each subscale: anxiety, stress, and depression, respectively. In this case, with the estimation of the combined network with different types of cybervictimization, the anxiety node was the strongest (1.552).

Finally, the same combined network was estimated by gender. Figure 5a shows the network for males and Figure 5b for females. In both cases, the network has seven nodes, with 14 edges other than 0 after estimating with EBICglasso, and a dispersion index of 0.33.

Of the DASS-21 subscales, anxiety (2) had associations with the written-verbal (6) and online exclusion (7) cybervictimization modalities, with edge weights of .077 and .057 for males and .080 and .074 for females, respectively. Depression (1) also was associated, although weaker, with written-verbal (6) and online exclusion (7), with weights of .044 and .033 for males, and .053 and .020 for females, respectively. Differences on the Stress (3) scale were in the edge weights of both networks, with no association with type of cybervictimization, except in the network estimated for females, where stress was associated with online exclusion (7) with a weight of .031.

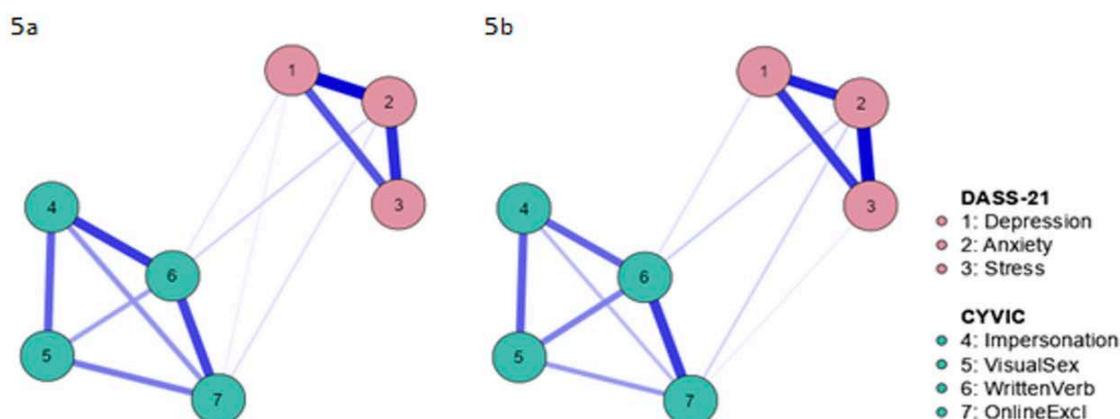
In the different types of cybervictimization in the network estimated for males, the edge weights were stronger (.364) between impersonation (4) and written-verbal (6), followed by the connection between written-verbal (6) and online exclusion (7) with .346. Moreover, looking at the network estimated for females, the connection between the written-verbal (6) and online exclusion (7) stands out, followed by impersonation (4) with visual sexual cybervictimization (5) with .285.

Table 4 shows the centrality indices in the network estimated for both genders. Both networks show stronger centrality indices for written-verbal cybervictimization, and the DASS-21 anxiety subscale, with values of 1.150 and 1.235 for males, and 1.191 and 1.419 for females, respectively.

Gender differences observed between the networks emphasized the impersonation and stress nodes. Even though the strength of the impersonation node has low-strength centrality indices in both networks, it is weaker for females (-1.079) than males (-0.092). In the network estimated for males, the stress node also has a weaker

Table 4. DASS-21 and Cybervictimization Type (CYVIC) Centrality Measurements from the Network Analysis, by Gender

Variable	Male				Female			
	Betweenness	Closeness	Strength	Expected influence	Betweenness	Closeness	Strength	Expected influence
Depression	-0.584	-0.899	0.108	0.108	-0.584	-1.051	-0.142	-0.142
Anxiety	1.340	-0.025	1.235	1.235	1.596	0.156	1.419	1.419
Stress	-0.584	-1.084	-1.214	-1.214	-0.584	-0.877	0.169	0.169
Impersonation	-0.584	0.564	-0.092	-0.092	-0.584	-0.211	-1.079	-1.079
VisualSex	-0.584	-0.704	-1.284	-1.284	-0.584	-0.525	-1.046	-1.046
WrittenVerb	1.581	1.743	1.150	1.150	1.323	1.818	1.191	1.191
OnlineExcl	-0.584	0.406	0.097	0.097	-0.584	0.690	-0.512	-0.512

**Figure 5.** DASS-21 and Cybervictimization type (CYVIC) Network by Sex (Fig. 5a male, Fig. 5b female).

Note. Blue lines represent positive associations. The thickness and brightness of an edge indicate the association strength.

centrality index (-1.214) than the same node in the female network (0.169). The contrary occurs with the depression node, where it is the network estimated for males which has a stronger centrality index (0.108) than females (-0.142).

Thus, observing the data presented in Table 4, it may be said that in the gender networks estimated, anxiety was the strongest node in both cases. However, differences were observed in the centrality of depression and stress nodes: the first one (depression) was stronger in the male network estimated and the second one (stress) was stronger in the female network.

Discussion

This study posed two objectives, to examine the negative emotional states in a sample of adolescents and to analyze their relationship with cybervictimization. For the first objective, to observe specific emotional symptoms, the results of the network structure showed that the different nodes of the three emotional states (anxiety, stress, and depression) were positively related to each other. Nevertheless, some of the relationships were stronger than others. This is of interest, because even though the DASS-21 is a useful questionnaire for constructing a general mental health index, its items cluster on factors that ignore the structure connecting them. Therefore, they do not approach the real complexity of the relationship between psychoemotional wellbeing and the symptoms that are observed in those who show their alteration. The most influential emotional symptoms were “close to panic”, “difficulty relaxing”, and “meaninglessness of life”. The relationship between these elements could indicate possible causal effects between these symptoms, or at least potential conditional relationships (Kossakowski et al., 2016). It should also be recalled that each of the symptoms mentioned above

pertains to a different negative emotional state (that is, depression, anxiety, or stress). The high comorbidity between these conditions is therefore not surprising (Panamerican Health Organization, 2017; Romero & Méndez, 2021). The existence of common factors within these disorders that share etiological processes and factors has even been postulated (Barlow et al., 2004; Carlucci et al., 2021).

Furthermore, taking the dimensions instead of the symptoms, middle-size gender differences were found. Specifically, women showed higher scores in depression, anxiety, and stress. This agrees with studies which mention gender differences in adolescent mental health, where girls show stronger prevalence of emotional disorders (Campbell et al., 2021; Mar et al., 2022). First descriptive results for the second objective indicated positive correlations between cybervictimization types and negative emotional states. The strongest associations were between anxiety and written-verbal and exclusion cybervictimization. Both types of cybervictimization have been identified as of the highest incidence in Spanish adolescents (Álvarez-García, Núñez, et al., 2017).

Examining the network analysis of emotional states and types of cybervictimization, written-verbal victimization was the central node in the various types of cyberbullying and this, in turn, showed the strongest link to the anxiety node. Previous studies have reported that victims of cyberbullying have worse quality of life in their physical, social, and mental wellbeing (González-Cabrera et al., 2018). In this regard, cyberbullying has been linked to increased child depression and anxiety (Evangelio et al., 2022). Our results emphasize mainly anxiety as the negative emotional state most closely related to cybervictimization.

Nonetheless, there were some gender differences in the network analysis between emotional states and cybervictimization. In particular, anxiety was the emotional state that had the strongest

link to written-verbal and online exclusion modalities for both sexes. However, for boys, there was also a relationship, although weaker, of depression with the abovementioned modalities, while for girls an association was found between depression and written-verbal cyberbullying (but not online exclusion). And furthermore, a relationship between the stress scale and online exclusion was identified. These findings are along the line of [Álvarez-García, Barreiro-Collazo, et al., \(2017\)](#), who showed that written-verbal and online exclusion were the most frequent, or at least the most important types of cyberbullying, undifferentiated between boys and girls. What our results add is that there is a gender difference in the relationship of these types of cybervictimization with certain mental states. We should also add that in girls there was a higher tendency to connection between the DASS-21 nodes and the CYVIC (that is, the three negative emotional states were related to a cybervictimization type, compared to two in boys). In turn, the networks estimated between the different manifestations of cybervictimization show their complex interaction. Finally, we could suggest that, as previously established, women have a stronger tendency to emotional problems from online bullying and how they cope with it ([McLoughlin, 2021](#)).

This study had some limitations, including the accuracy of the edges. The estimates of network accuracy, with large confidence intervals around most of the edge weights, suggest a problematic interpretation of the order of many of the network edges, which should be taken with caution. However, differences in centrality indices may be accurate even when there are large ICs for edge weights ([Epskamp et al., 2018](#)). In addition, as cutoff points were previously established by the authors ([Álvarez et al., 2017](#)) for cybervictimization, it was not possible to differentiate between youths who had not undergone online bullying, or had been at some time, from those who were attacked more frequently.

Practical Applications and Future Lines of Research

This study enabled the most important nodes in the structure of emotional states to be identified and, therefore, assisted in elucidating the specific symptoms of greatest importance to the emotional wellbeing of adolescents. This could be used to set up specific programs to curtail the psychoemotional symptoms that could develop into mental health problems. In particular, feelings of being about to have a panic attack, difficulties relaxing, or thinking that life is meaningless are major symptoms affecting their psychoemotional wellbeing and could trigger negative circular structural emotional thinking. Therefore, schools could work on emotional intelligence to palliate these symptoms in adolescents. This in turn would enable work with youths who show comorbid symptoms affecting their psychoemotional wellbeing, but not meeting diagnostic criteria for a specific category of affective disorders. Another possible application of the findings of this study would be in promoting intervention addressing anxiety in adolescents who are cyberbullying victims.

Future lines of research could find out whether the emotional symptom network structure differs between populational groups (e.g., at-risk adolescents, preadolescents, and emerging adults). Secondly, in line with the limitations mentioned, measures enabling the identification of specific manifestations of difficulties experienced by adolescents who have been the object of cybervictimization should be continued. Thus, finding out whether the emotional symptom network of youths who experience cyberbullying is similar to the rest of adolescents could help understand its effects.

Conclusions

The new technologies have meant unprecedented progress for society, but they also pose new problems. Cyberbullying is highly

prevalent among youths and, therefore, attention must necessarily be given to its consequences. The results of this study show that negative emotional states and types of cybervictimization are related in a complex network where the efforts to approach reduction of emotional symptoms associated with it could be of lasting benefit to the emotional wellbeing of youths. Thus, focusing attention on the central nodes (such as anxiety) in the network could be essential to preventing a cascade of negative emotional symptoms in young people who suffer from cyberbullying. This could put an end to early forms of cybervictimization or provide adolescents with strategies for coping with them to slow down or head off the appearance of other forms of cyberbullying.

Conflict of Interest

The authors of this article declare no conflict of interest.

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