Network Analysis to Prioritize Interventions for Improving the Health-Related Quality of Life of People with HIV in Spain

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Objective

This study aims **to assess the interconnectedness of a health-related quality of life (HRQoL) network among people with HIV (PHIV)**, which can identify key areas for which clinical interventions might improve HRQoL for this population.

Methods

A **cross-sectional study was conducted from 2021 to 2023** in the HIV Cohort of the Spanish Research Network (CoRIS cohort) using a questionnaire including the items in Table 1 and the validated clinic screening tool for HIV (CST-HIV), which includes three items in each of eight dimensions: anticipated stigma, psychological distress, sexuality, social support, material deprivation, sleep and fatigue, cognitive problems, and physical symptoms.

A weighted and undirected network analysis examined the betweenness, closeness, and strength centralities between the eight HRQoL dimensions measured by the CST-HIV.

Results

The study included 347 participants, predominantly male (93.1%), currently working (79.0%), men who have sex with men (72.6%), and college-educated (53.9%) (Table 1).

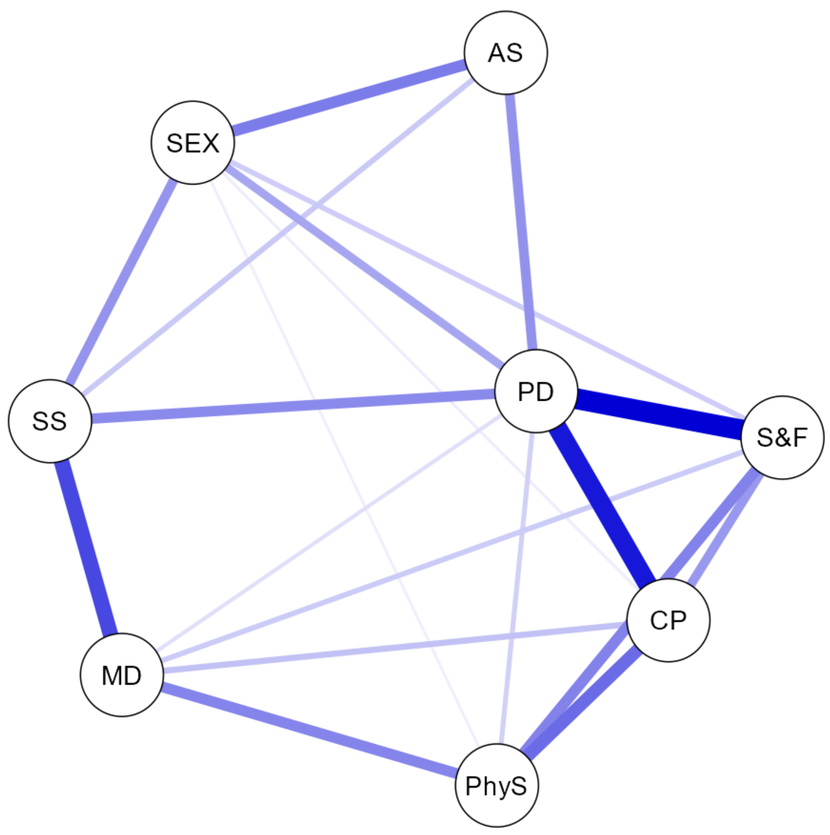
The network analysis revealed that **material deprivation and psychological distress had the most significant influence on general health perception among PHIV** (Figure 1). Psychological distress was found to have strong direct associations with several dimensions, including sleep and fatigue, cognitive problems, and social support. Material deprivation was also highly influential, closely connected with social support and physical symptoms. Notably, anticipated stigma and sexuality occupied more peripheral positions in the network, suggesting their relative lower impact on the overall HRQoL in this study.

Psychological distress showed the highest centrality in the network across all measures of strength, closeness, and betweenness (Figure 2; Z-scores shown), making it a critical target for interventions by healthcare providers. High centrality of sleep and fatigue, cognitive problems, and social support also indicates their significant influence on overall HRQoL, suggesting that addressing these areas can broadly improve well-being.

Table 1. Participant (n=347) characteristics

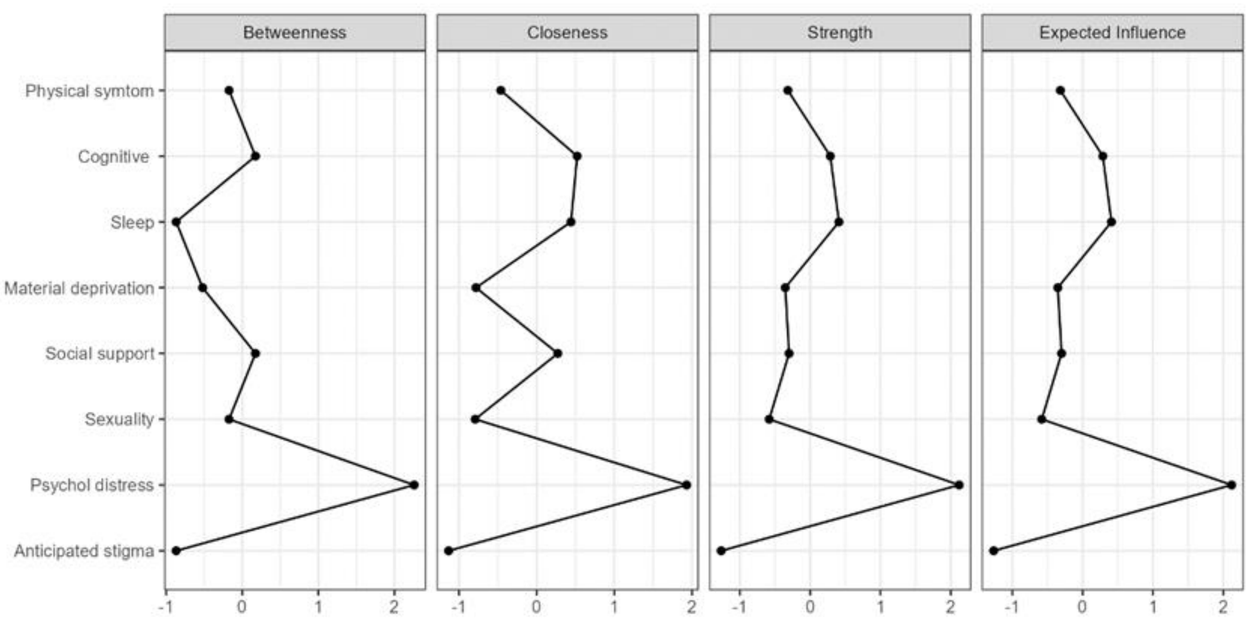
Id	Variable	Category	Value	%	n
1	Age (years)	Mean (SD)	43.4 (10.6)	--	347
		Minimum	19.0	--	--
		Maximum	81.0	--	--
2	Duration of infection (years)	Mean (SD)	9.7 (6.9)	--	347
		Minimum	0.0	--	--
		Maximum	41.0	--	--
3	Sex	Female	--	6.9	24
		Male	--	93.1	323
4	Gender	Woman	--	9.2	32
		Man	--	90.2	313
		Other	--	0.6	2
5	Marital status	Married or with a partner	--	42.4	147
		Divorced or separated	--	8.1	28
		Single	--	47.8	166
		Widowed	--	1.7	6
6	Sexual orientation	Heterosexual	--	13.3	46
		Homosexual	--	72.6	252
		Bisexual	--	8.9	31
		Other	--	1.4	5
		Prefer not to answer	--	3.7	13
7	Country of origin	Spain	--	71.8	249
		Other	--	28.2	98
8	Level of education	No education	--	0.9	3
		Elementary school	--	8.1	28
		High school	--	35.4	123
		University degree	--	53.9	187
		Other	--	1.7	6
9	Work situation	Working	--	79.0	274
		Retired	--	4.9	17
		Unemployed	--	8.9	31
		Student	--	3.2	11
		Others	--	4.0	14
10	Housing	Own or rent a home	--	77.5	269
		Family home	--	8.4	29
		Shared home	--	11.8	41
		Someone else's home	--	1.4	5
		Shelter/institution	--	0.3	1
		Other	--	0.6	2
11	Home monthly income	None	--	1.4	5
		≤ 300 €	--	2.6	9
		301 a 600 €	--	3.7	13
		601 a 900 €	--	5.2	18
		901 a 1.200 €	--	13.3	46
		1.201 a 1.800 €	--	17.6	61
		1.801 a 2.400 €	--	15.9	55
		2.401 a 3.000 €	--	13.3	46
		3.001 a 4.500 €	--	13.8	48
		4.501 a 6.000 €	--	6.3	22
		No answer	--	6.9	24
12	Personal monthly income	None	--	4.0	14
		≤ 300 €	--	6.6	23
		301 a 600 €	--	6.1	21
		601 a 900 €	--	7.5	26
		901 a 1.200 €	--	14.7	51
		1.201 a 1.800 €	--	23.9	83
		1.801 a 2.400 €	--	14.4	50
		2.401 a 3.000 €	--	8.4	29
		3.001 a 4.500 €	--	5.5	19
		4.501 a 6.000 €	--	2.3	8
		No answer	--	6.6	23
13	HIV transmission route	Sexual intercourse	--	85.0	295
		Sharing injection materials	--	1.4	5
		Blood transfusion	--	0.6	2
		Unknown	--	11.8	41
		Other	--	1.2	4
14	CD4+ T, cells/mL	Median (IQR)	732 (511 – 994)	--	266
		<200	--	2.3	6
		200 – 349	--	6.4	17
		350 – 499	--	14.7	39
		≥500	--	76.7	204
15	HIV RNA, copies/mL	≤50	--	92.6	249
		>50	--	7.4	20
16	Previous AIDS diagnosis	No	--	87.4	250
		Yes	--	12.6	20
17	Currently on ART	No	--	1.5	4
		Yes	--	98.5	270
19	Years on ART	Median (IQR)	6.9 (3.2 – 14.4)	--	347
20	Type of ART regimen	2 NRTI + 1 Integrase inhibitor	--	41.5	112
		2 NRTI + 1 NNRTI	--	13.3	36
		2 NRTI + 1 PI	--	3.0	8
		Dual therapy: DTG plus 3TC or RPV	--	35.6	96
		Other combinations	--	3.3	9
		Unknown	--	3.3	9

Figure 1. HRQoL network analysis of the CST-HIV



Legend: AS: Anticipated stigma. PD: Psychological distress. SEX: Sexuality. SS: Social support. MD: Material deprivation. S&F: Sleep and fatigue. CP: Cognitive problems. PhyS: Physical symptoms

Figure 2. Centrality measures of each node in the network analysis



Legend: Betweenness centrality measures the extent to which a node lies on the shortest paths between other nodes; high betweenness indicates the node is a strong connector in the network. Closeness centrality quantifies how close a node is to all other nodes in the network, defined as the reciprocal of the sum of the shortest path distances from a node to all other nodes; High closeness means the node is highly accessible and influential. Strength centrality indicates the total connection capacity of a node in its network; high strength means strong and numerous direct connections.

Conclusions

Psychological distress, sleep and fatigue, cognitive issues, and social support were identified as key factors in an HRQoL problem network. Interventions focused on these dimensions may therefore influence HRQoL more efficiently than other dimensions. Prioritizing psychological distress as a central intervention target could lead to improvements in other interconnected areas, such as sleep, cognitive function, and social support. Addressing material deprivation is also crucial, as it influences multiple dimensions, including physical symptoms and social support. Although anticipated stigma and sexuality were less central, they still play a role in the overall HRQoL and should not be neglected. Tailored interventions that address these interconnected issues in a holistic manner are essential for improving the quality of life for people with HIV in Spain. **These findings highlight the need for comprehensive care strategies that consider the complex interplay of various HRQoL dimensions.**