Latent Profile Analysis of Cyberchondria and its Relationship with Health Information Overload and Avoidance

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Introduction & Literature Review

- **Cyberchondria**
  - Cyberchondria is a multidimensional, syndrome-like condition characterized by responses to anxiety, compulsivity, and associated negative emotional states (Starcevic et al., 2020).
  - A **combination** of behavioral patterns and concurrent emotional states (McElroy et al., 2019).

- **Costs**
  - A lifetime prevalence of 5.7% for health anxiety/hypochondriasis (Hannah et al., 2023).
  - Cyberchondria severity was a significant predictor of the utilization (Kobryn & Duplaga, 2024).

Table 3 Ordinal regression modeling of variables reflecting the utilization of healthcare services and alternative medicine

Variable	Variable category	Visits to family physicians	Visits to specialists	Diagnostic procedures	Hospital admission	Emergency services	Alternative medicine
		OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)
Age		1.00 (0.99-1.01)	0.99 (0.985-0.998)	1.02 (1.01-1.02)	0.98 (0.98-0.99)	0.98 (0.97-0.99)	0.99 (0.98-1.00)
CSS score		1.01 (1.001-1.012)	1.01 (1.00-1.01)	1.00 (1.00-1.017)	1.01 (1.01-1.02)	1.02 (1.01-1.02)	1.02 (1.01-1.03)
SHAI_IL (illness likelihood)		1.07 (1.05-1.09)	1.05 (1.03-1.08)	1.08 (1.06-1.10)	1.04 (1.021-1.06)	1.04 (1.01-1.06)	1.02 (0.99-1.04)
SHAI-NC (negative consequences)		0.89 (0.85-0.94)	0.94 (0.90-0.98)	0.92 (0.88-0.97)	0.98 (0.93-1.03)	0.97 (0.92-1.02)	1.03 (0.97-1.10)

Introduction & Literature Review

- **Dimensions of Cyberchondria**
  - Cyberchondria may be better defined as a dimensional construct, on a continuum from a mild to severe behavioural and psychopathological pattern (Starcevic et al., 2020).

  - **Four Dimensions** (McElroy & Shevlin, 2014):
    - **Compulsion:** The degree to which internet searches for health information interfere with daily activities.
    - **Distress:** The tendency to experience anxiety while searching for health information online.
    - **Excessiveness:** The repetitive nature of the searches.
    - **Reassurance:** The need to seek reassurance from medical professionals or online sources.

- **Theories and Model**
  - Reassurance-Seeking Model (Doherty-Torstrick et al., 2016)
  - Metacognition of Health Anxiety (Airoldi et al., 2022; Fergus & Spada, 2018)

Introduction & Literature Review

- **Variable-Centered or Person-Centered Approach ?**

  - **Variable-Centered Approach** (McElroy & Shevlin, 2014; Jungmann & Witthöft, 2020)
    - Studying the relationships between variables across a population.

  - **Person-Centered Approach**
    - Instead of looking at the average effect of variables, it looks at how individuals with different profiles or patterns within the data might respond differently.

  - *Research Question 1: What latent profiles can be identified among individuals exhibiting diverse patterns of cyberchondria?*

Introduction & Literature Review

- **Health Information Overload, Avoidance and Cyberchondria**

  - **Health Information Overload**
    - Excessive intake of health information becomes a burden rather than a resource (Bawden & Robinson, 2015).

    - **Reassurance-Seeking Model**: Individuals with high health anxiety engage in excessive reassurance-seeking, which fails to alleviate anxiety, perpetuating distress (Doherty-Torstrick et al., 2016).

    - **Social Amplification of Risk Framework (SARF)**: Heightened exposure to health-related risks amplifies perceived risks (Li et al., 2023), contributing to health anxiety and cyberchondria.

Introduction & Literature Review

- **Health Information Overload, Avoidance and Cyberchondria**

  - **Health Information Avoidance**
    - behavior intended to prevent or delay the acquisition of available but potentially unwanted information (Howell & Shepperd, 2013).

    - **A potential strategy?**
      - A coping mechanism to mitigate the negative effects of cyberchondria (Doherty-Torstrick et al., 2016; Laato et al., 2020).
      - Avoidance may help individuals with high health anxiety avoid further distress from online searches.

      - The complete avoidance of health information is unrealistic in an era where the Internet is a dominant source of medical knowledge (Starcevic et al., 2020).
      - Information avoidance can temporarily alleviate health anxiety, it is insufficient without concurrent efforts to improve health literacy and online information competency (Luo, 2019).

  - ***Research Question 2**: What is the relationship between health information overload, avoidance, and the subtypes of cyberchondria?*

Methodology

- **Participants**
  - Data was collected through a questionnaire, with participant recruitment facilitated by the Credamo (www.credamo.com), a member of the European Society for Opinion and Marketing Research (ESOMAR), which is recognized for adhering to international authoritative standards.

  - Data collection conducted from May 13th to May 17th, 2024.

  - 500 respondents (65.8% female, $N = 329$; $M_{age} = 30.16$, $SD = 6.78$).

Table 2. Demographic Variables Descriptive Statistics

Variables	M (SD) or N (%)
Age	30.16 (6.79)
Gender	
-Female	329 (65.8)
-Male	171 (34.2)
Hukou	
-Urban resident household	335 (67.0)
-Rural resident household	165 (33.0)
Educational Level	
-Technical school/High school or below	6 (1.2)
-Associate degree	28 (5.6)
-Bachelor's degree	377 (75.4)
-Graduate degree	89 (17.8)
Monthly Income	
-1000 RMB or less	8 (1.6%)
-1001-3000 RMB	73 (14.6%)
-3001-5000 RMB	63 (12.6%)
-5001-8000 RMB	141 (28.2%)
-8001-10000 RMB	98 (19.6%)
-More than 10000 RMB	117 (23.4%)

Methodology

- **Measurements**
  - **Cyberchondria**
    - Cyberchondria Severity Scale (CSS-12; McElroy et al., 2019);
    - 5-point Likert scale ($M \pm SD$ = 3.63 ± 0.63, Cronbach's a = 0.827)

  - **Health Information Overload and Avoidance**
    - Health information overload was measured using three items adapted from Song et al. (2021); Health information avoidance was assessed with four items from Howell & Shepperd's (2016) research.
    - 5-point Likert scale ($M_{overload} \pm SD_{overload}$ = 2.87 ± 1.17, Cronbach's $a_{overload}$ = 0.807; $M_{avoidance} \pm SD_{avoidance}$ = 2.36 ± 0.90, Cronbach's $a_{avoidance}$ = 0.882).

Table 3. Constructs Measurements

Constructs		Items	Cronbach's α
Health Information Overload (Song et al., 2021)	1	There was too much health information from media so that I was burdened in handling it.	0.807
	2	I could not effectively handle all the health information from the media.	
	3	Because of the plenty health information from the media, I felt it difficult to acquire all the information.	
Health Information Avoidance (Howell & Shepperd, 2016)	1	There is some health information I would rather not know.	0.882
	2	I think ignorance is bliss with respect to certain health information.	
	3	I avoid obtaining health information.	
	4	I can think of situations where I would avoid health information.	
Cyberchondria (McElroy et al., 2019)	1	If I notice an unexplained bodily sensation I will search for it on the internet.	0.827
	2	Researching symptoms or perceived medical conditions online distracts me from reading news/sports/entertainment articles online.	
	3	I read different web pages about the same perceived condition.	
	4	I start to panic when I read online that a symptom I have is found in a rare/serious condition.	
	5	Researching symptoms or perceived medical conditions online leads me to consult with my GP.	
	6	I enter the same symptoms into a web search on more than one occasion.	
	7	Researching symptoms or perceived medical conditions online interrupts my work (e.g., writing emails, working on word documents or spreadsheets).	
	8	I think I am fine until I read about a serious condition online.	
	9	I feel more anxious or distressed after researching symptoms or perceived medical conditions online.	
	10	Researching symptoms or perceived medical conditions online interrupts my offline social activities (e.g., reduces time spent with friends/family).	
	11	I suggest to my GP/medical professional that I may need a diagnostic procedure that I read about online (e.g., a biopsy/a specific blood test).	
	12	Researching symptoms or perceived medical conditions online leads me to consult with other medical specialists (e.g., consultants).	

Data Analysis & Results

- **Latent Profile Analysis of Cyberchondria**

  - R version 4.3.1, tidyLPA package
  - **Akaike Information Criterion (AIC):** Lower values indicate a better model fit.
  - **Bayesian Information Criterion (BIC)**: Lower values indicate a better model fit.
  - **Log-Likelihood (LL):** Lower values indicate a better model fit.
  - **Bootstrap Likelihood Ratio Test (BLRT):** A p-value < 0.05 suggests that the k-class model provides a statistically superior fit compared to the k-1 class model.
  - **Entropy:** Values ≥ 0.8 indicate over 90% classification accuracy.

**Table 4**. Results of model fitting for potential latent analysis of cyberchondria

	1 class	2 class	3 class	4 class	5 class
Log-likelihood	- 8721.37	- 7724.25	- 7566.97	- 7366.35	- 7315.74
AIC	17490.74	15522.50	15233.94	14858.71	14783.49
BIC	17811.04	15678.44	15444.67	15124.23	15103.80
BLRT	N/A	1994.24	314.56	401.24	101.22
p-value for BLRT	N/A	< 0.01	< 0.01	< 0.01	< 0.01
Entropy		0.96	0.88	0.90	0.91
Smallest Class (%)		34 %	23 %	**3 %**	**3 %**

Note. AIC=Akaike Information Criterion, BIC=Bayesian Information Criterion, BLRT=Bootstrapped Likelihood Ratio Tests.

Data Analysis & Results

- **Latent Profile Analysis of Cyberchondria**

Research Question: What latent profiles can be identified among individuals exhibiting diverse patterns of cyberchondria?
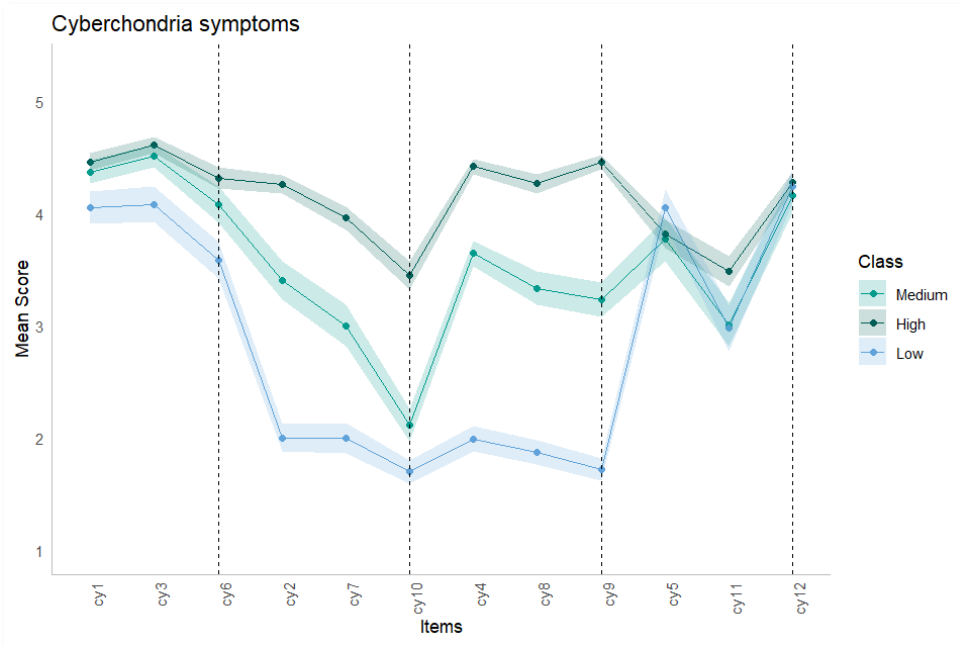
- **Medium Compulsion and Distress Group**
  - 22.6% of the sample ($N = 113$)
  - Scores around the mean on compulsion and distress dimensions
- **High Compulsion and Distress Group**
  - 48.2% of the sample ($N = 241$)
  - Higher-than-average scores on both compulsion and distress
- **Low Compulsion and Distress Group**
  - 29.2% of the sample ($N = 146$)
  - lower scores on excessiveness, compulsion, and distress dimensions

Table 5. Descriptive statistics and test of difference for each latent category of cyberchondria on different dimensions

Cyberchondria symptoms	Total ($N = 500$)	Class 1 ($N = 113$)	Class 2 ($N = 241$)	Class 3 ($N = 146$)	F-value	p-value
Excessiveness	4.27 ± 0.63	4.32 ± 0.45	4.46 ± 0.46	3.90 ± 0.81	36.90	< 0.001
Compulsion	3.07 ± 1.02	2.84 ± 0.56	3.89 ± 0.54	1.90 ± 0.54	94.03	< 0.001
Distress	3.42 ± 1.15	3.40 ± 0.44	4.38 ± 0.38	1.86 ± 0.43	214.2	< 0.001
Reassurance	3.78 ± 0.74	3.65 ± 0.73	3.86 ± 0.66	3.76 ± 0.86	0.98	0.321

Data Analysis & Results

- **The relationship between health information overload, avoidance and subtypes of cyberchondria**
  - Logistic Regression, R version 4.3.1, nnet package

  - **Gender Differences:**
    - Females are more likely than males to belong to the medium compulsion and distress group (OR = 0.46, p < 0.01).

  - **Hukou Status:**
    - Urban residents are less likely than rural residents to belong to the medium (OR = 0.48, p < 0.05) or high compulsion and distress group (OR = 0.42, p < 0.05).

  - **Health Information Overload:**
    - Participants with higher levels of information overload are significantly more likely to be in the medium (OR = 2.14, p < 0.001) or high compulsion and distress group (OR = 3.60, p < 0.001).

  - **Health Information Avoidance:**
    - Avoidance behaviors do not significantly impact classification into the medium (OR = 1.32, p > 0.05) or high compulsion and distress group (OR = 1.35, p > 0.05).

Table 6. Results of multinomial logistic regressions on the three latent category groups

	Group with medium compulsion and distress				Group with high compulsion and distress			
	b (SE)	OR	p	95% CI	b (SE)	OR	p	95% CI
Age	-.00 (.02)	1.00	.94	[.95, 1.05]	-.01 (.02)	.99	.60	[.95, 1.03]
Gender	-.77 (.30)	.46	< .01	[.26, .84]	-.31 (.27)	.73	.26	[.43, 1.26]
Highest education degree	-.09 (.28)	.92	.76	[.53, 1.59]	-.09 (.26)	.91	.73	[.54, 1.53]
Monthly salary	-.22 (.13)	.80	.10	[.62, 1.04]	-.10 (.13)	.91	.44	[.71, 1.16]
Hukou	-.74 (.34)	.48	< .05	[.24, .93]	-.86 (.33)	.42	< .05	[.22, .80]
Health information overload	.76 (.18)	2.14	< .001	[1.52, 3.02]	1.28 (.17)	3.60	< .001	[2.60, 4.99]
Health information avoidance	.28 (.20)	1.32	.17	[.89, 1.96]	.30 (.19)	1.35	.11	[.93, 1.95]

Note. reference group for multinominal logistic regression is group with Low Compulsion and Distress'; reference category for gender is 'female'; for highest education degree is 'primary school and below'; for monthly salary is '1000 yuan and below'; for hukou is 'rural population'.

Conclusion & Discussion

- **Heterogeneity within cyberchondria**
  - Different combinations of psychological dimensions.
  - Personized Interventions

- **Key Intervention Targets**
  - **Compulsion**
    - Reduce excessive health-related search behaviors.
    - Provide health information management skills and guide users toward balanced information-seeking behaviors.

  - **Distress**
    - Alleviate psychological stress.
    - Implement emotional management and psychological support interventions, such as Cognitive Behavioral Therapy (CBT) and relaxation training.
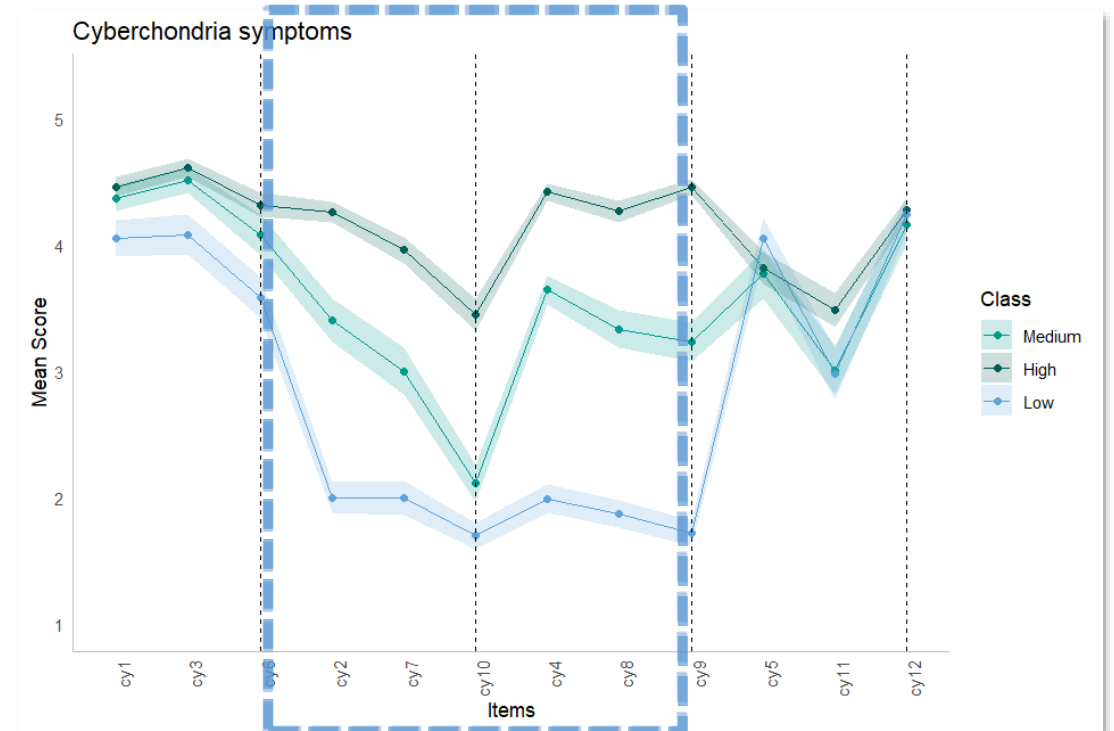
Conclusion & Discussion

- **Population Differences in Intervention Design**

  - **Gender Differences**
    - Women are more likely to belong to the medium Compulsion and Distress group.
    - Associated with higher health-related anxiety and more frequent health information-seeking behavior (Lagoe & Atkin, 2015; WHO, n.d.).

  - **Hukou Status Differences**
    - Rural residents are more likely to belong to the medium or high Compulsion and Distress groups.
    - Lower health literacy and socioeconomic factors contribute to higher health anxiety (Li et al., 2021).
    - Another Dimension of Digital and Health Inequality
      - Access to the internet, but problematic usage.
      - The digital divide is not fully bridged.

Conclusion & Discussion

- **Role of Information Behavior**

  - **Health Information Overload**
    - A significant predictor for the medium and high Compulsion and Distress groups.
    - Based on the Social Amplification of Risk Framework (SARF)
      - High exposure to risk-related information intensifies health anxiety and compulsive behaviors (Zheng et al., 2023; Li et al., 2023).

  - **Health Information Avoidance**
    - Not a significant predictor of cyberchondria subtypes.
    - While avoidance may temporarily reduce anxiety, it is insufficient for preventing cyberchondria (Starcevic et al., 2020; Roth & Cohen, 1986).

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Thank you

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