

Modeling Anxiety Disorders Among Adolescent Working Women Across Various Sectors in Coimbatore: A Nano Topological Space Theory Approach

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Abstract: Anxiety disorders are the most common mental illness among teenagers occurring in 4.4 percentage of 10-14 year olds and 5.5 percentage of 15-19 year olds. Depression affects this population as well with shared symptoms including mood swings and withdrawal from others, tending to interfere with school attendance and heighten risk of suicide. Classical statistical approaches are not adequate to capture overlapping interwoven nature of these factors. This research presents a new application of nano topological space theory to simulate fine grained interrelations between variables for anxiety risk in young and adult women. We employ nano open sets and boundaries to chart fine grained uncertainties associated with hormone changes, stress at work, trauma and social support. Our aim is to delineate high risk zones and hotspots to facilitate more individualized and targeted intervention.

Keywords: Significant Factors in Anxiety, Nano Topological Approach, Attribute Reduction.

1. Introduction and preliminaries

Adolescence is a sensitive development phase characterized by profound bodily, emotional, and social changes, which tend to increase the risk of mental health problems. Estimated, one in seven adolescents worldwide suffers from mental health conditions, which remain undetected and untreated. Poverty, abuse, and stigma expose the adolescents to further risk of exclusion and chronic psychological problems. In order to get a better insight into anxiety in adult women, we conducted an online survey of 85 working women with a focus on cognitive, physical, emotional, and behavioral symptoms. Initial results indicate that most symptoms like emotional exhaustion and sleep disturbance trace their origins back to adolescence, which underscores the importance of early intervention and supportive settings. Considering the heterogeneity of anxiety disorders and the limitations of conventional analytical methods, novel mathematical frameworks such as nano topology provide hopeful directions for psychological phenomena modeling. This cross disciplinary endeavor has the potential to deepen our understanding and inform more efficient interventions, especially among vulnerable groups like working women in urban India.

At the very beginning of the work, we conducted an online survey among the 85 working women in various field and asked them few questions. The questions we ask from them are as follows:

- (1) Do you feel emotionally drained or fatigued after a regular workday?
- (2) Do you find yourself unable to concentrate or make decisions due to anxious thoughts?
- (3) Do you feel muscle tension, tightness, or pain when under stress?
- (4) Have you experienced a dry mouth when nervous or stressed?
- (5) Do you have trouble sleeping due to racing thoughts or restlessness?
- (6) Do you often feel panic about job performance or deadlines?
- (7) Do you often experience shortness of breath when feeling anxious?

Answer for ten questions asked on working women in various field:

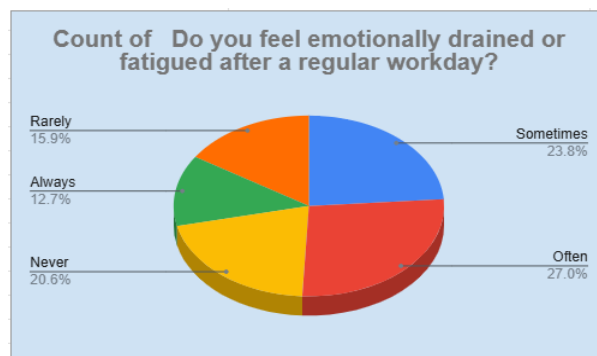


Figure 1. Do you feel emotionally drained or fatigued after a regular workday?

Interpretation: The data reveals that 79% of respondents experience emotional fatigue after work, with 44.4% feeling this "Always" or "Often" suggesting high levels of burnout or work stress. "Sometimes" was the most common response (34.4%) indicating occasional fatigue. Only 27.8% reported "Rarely" or "Never" implying better stress management or a healthier work environment. These findings highlight the need for stress reduction strategies and mental wellness programs to prevent long term burnout.



Figure 2. Do you find yourself unable to concentrate or make decisions due to anxious thoughts?

Interpretation: The results show that 44.4% of individuals often struggle with worry indicating moderate to high persistent anxiety. The largest group (34.4%) experiences worry sometimes, reflecting occasional stress. Only 21.1% rarely or never worry, suggesting good stress management. Overall many face frequent or occasional worry, highlighting a need for mental health support and stress management.

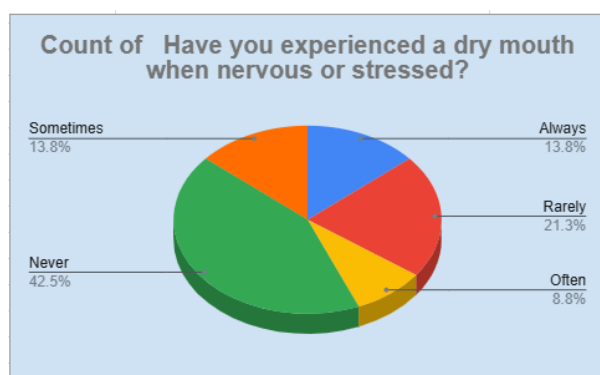


Figure 3. Have you experienced a dry mouth when nervous or stressed?

Interpretation. Over 72% of respondents experience muscle tension or pain due to stress at least sometimes, with 38.9% feeling it frequently or always, indicating possible chronic stress. About one-third experience it occasionally, while 39% report little to no symptoms, suggesting good stress management or mental focused stress. These findings highlight the need for stress relief strategies like physical activity and relaxation techniques.

Interpretation. The data shows that 44.4% of respondents frequently struggle with worry, while 34.4% experience it sometimes. Only 21.1% report little or no worry. This indicates that worry is a common issue and may signal underlying anxiety or stress, suggesting a need for mental health support and stress management.

Interpretation. Sleep disturbances due to anxiety are very common, with 70.6% of women reporting frequent issues ("Always") and another 21.1% experiencing them "Often" or "Sometimes". Only a small minority (8.2%) rarely or never face sleep problems. This highlights the need to address sleep quality in anxiety related mental health support and workplace wellness programs.

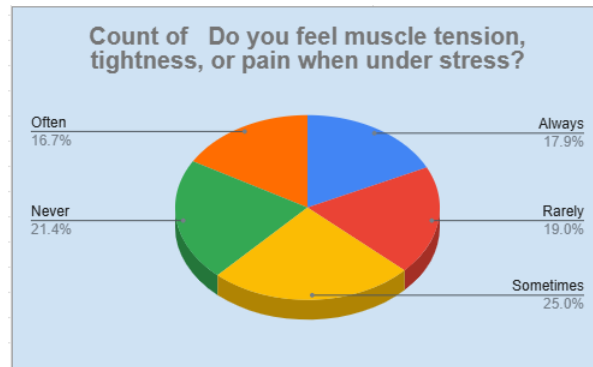


Figure 4. Do you feel muscle tension, tightness, or pain when under stress?

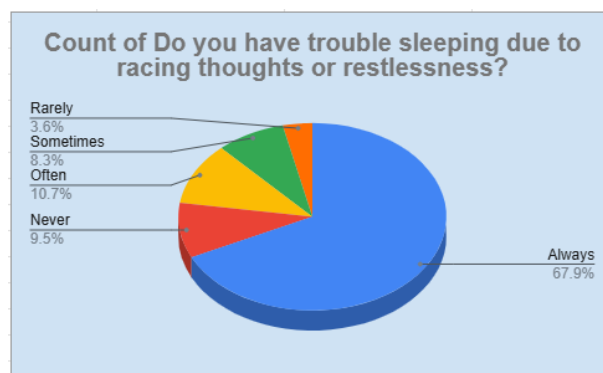


Figure 5. Do you have trouble sleeping due to racing thoughts or restlessness ?

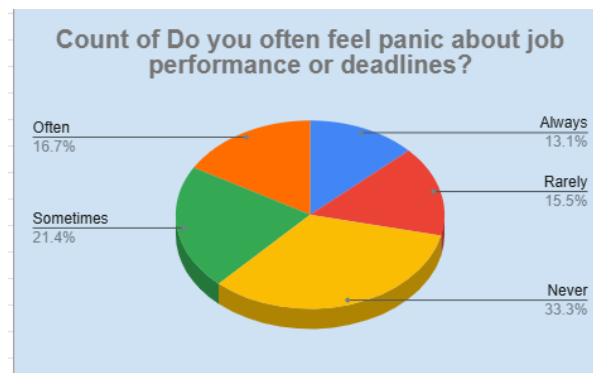


Figure 6. Do you often feel panic about job performance or deadlines ?

Interpretation. About 29.4% of women experience moderate anxiety ("Sometimes"), while 42.3% report little to no panic ("Rarely" or "Never"). However, nearly 30% face frequent or constant work related panic ("Often" or "Always"). This highlights the need for targeted mental health support and stress management in high-pressure workplaces.

Interpretation. Nearly 46% of women rarely or never experience shortness of breath from anxiety, while about 27% face this symptom frequently or always. Over 20% report occasional episodes. This shows anxiety often includes physical symptoms, emphasizing the need for mental health support addressing both mind and body.

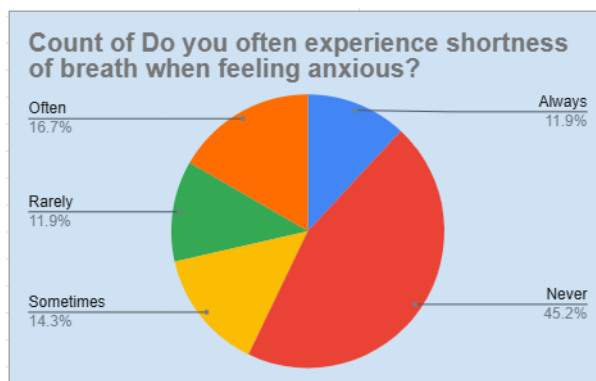


Figure 7. Do you often experience shortness of breath when anxious ?

2. A Nano Topological Space Based Approach to Modeling Anxiety Disorders in Adolescent Working Women

In this study we surveyed 85 working women from various fields to assess potential anxiety disorders based on their responses to a set of questions. For detailed analysis we selected a subset of 15 participants and applied nano topology techniques to identify the factors most significantly contributing to anxiety among them.

Working Women	Panic	Irritable	Shortness of Breath	Muscle Tension	Dry Mouth
W1	Yes	Yes	No	Yes	Yes
W2	Yes	No	No	Yes	No
W3	Yes	Yes	No	No	Yes
W4	Yes	No	Yes	No	No
W5	Yes	No	Yes	No	No
W6	Yes	Yes	Yes	Yes	No
W7	Yes	Yes	No	No	Yes
W8	Yes	No	Yes	No	No
W9	Yes	No	Yes	No	No
W10	Yes	Yes	Yes	Yes	No
W11	No	Yes	Yes	No	Yes
W12	No	Yes	No	No	Yes
W13	Yes	No	Yes	No	No
W14	No	Yes	Yes	No	Yes
W15	Yes	No	No	Yes	No
Working Women	Restless	Sweaty Hands			
W1	No	Yes			
W2	Yes	Yes			
W3	Yes	No			
W4	Yes	Yes			
W5	No	No			
W6	Yes	No			
W7	Yes	No			
W8	Yes	No			
W9	No	No			
W10	Yes	Yes			
W11	No	No			
W12	Yes	No			
W13	No	No			
W14	No	No			
W15	Yes	Yes			

CASE I:

Womens who are affected with anxiety disorder Assume $\ell c = \{W_1, W_2, W_4, W_6, W_{10}, W_{15}\}$ is the set of womens.

Let

$$\frac{U}{v(W)} = \{\{W_1, W_3, W_7\}, \{W_2, W_{15}, W_{15}\}, \{W_4, W_8\}, \{W_5, W_9, W_{13}\}, \{W_6, W_{10}\}, \{W_{11}, W_{14}\}, \{W_{12}\}\}$$

Then, the nanotopology is

$$\tau_v(\ell c)(W) = \{U, \emptyset, \{W_2, W_6, W_{10}, W_{15}\}, \{W_1, W_2, W_3, W_4, W_6, W_7, W_8, W_{10}, W_{15}\}, \{W_1, W_3, W_4, W_7, W_8\}\}$$

Step 1: Removal of Attribute “anxious thoughts”

Equivalence classes.

- $U_v(W - AT)(\ell_c) = \{W_1, W_3, W_7, W_{12}, \dots\}$
- $L_v(W - AT)(\ell_c) = \{W_2, W_6, W_{10}, W_{15}\}$
- $U_v(C - AT)(\ell_c) = \{W_1, W_2, W_3, W_4, W_6, W_7, W_8, W_{10}, W_{12}, W_{15}\}$
- $B_v(W - AT)(\ell_c) = \{W_1, W_3, W_4, W_7, W_8, W_{12}\}$

Nano Topology $\tau_v(\ell_c)(W - AT)$.

Index	Set
1	U
2	$\emptyset$
3	$\{W_2, W_6, W_{10}, W_{15}\}$
4	$\{W_1, W_2, W_3, W_4, W_6, W_7, W_8, W_{10}, W_{12}, W_{15}\}$
5	$\{W_1, W_3, W_4, W_7, W_8, W_{12}\}$

Conclusion.

$$\tau_v(\ell_c)(W - AT) = \tau_v(\ell_c)(W)$$

Step 2: Removal of Attribute “Irritable”

Equivalence Classes.

$$U/v(W - I) = \{W_1, W_3, W_7\}, \{W_2, W_{15}\}, \{W_4, W_8\}, \\ \{W_5, W_9, W_{13}\}, \{W_6, W_{10}\}, \{W_{11}, W_{14}\}, \{W_{12}\}$$

Approximations.

- Lower Approximation: $L_v(W - I)(c) = \{W_2, W_6, W_{10}, W_{15}\}$
- Upper Approximation: $U_v(W - I)(c) = \{W_1, W_2, W_3, W_4, W_6, W_7, W_8, W_{10}, W_{15}\}$
- Boundary Region: $B_v(W - I)(c) = \{W_1, W_3, W_4, W_7, W_8\}$

Nano Topology $\tau_v(c)(W - I)$.

Index	Set
1	U
2	$\emptyset$
3	$\{W_2, W_6, W_{10}, W_{15}\}$
4	$\{W_1, W_2, W_3, W_4, W_6, W_7, W_8, W_{10}, W_{15}\}$
5	$\{W_1, W_3, W_4, W_7, W_8\}$

Conclusion.

$$\tau_v(c)(W - I) = \tau_v(c)(W)$$

Step 3: Removal of Attribute “Shortness of Breath”

Equivalence Classes.

$$U/v(W - SB) = \{W_1, W_3, W_7\}, \{W_2, W_{15}\}, \{W_4, W_8\}, \\ \{W_5, W_9, W_{13}\}, \{W_6, W_{10}\}, \{W_{11}, W_{14}\}, \{W_{12}\}$$

Approximations.

- Lower Approximation: $L_v(W - SB)(c) = \{W_2, W_6, W_{10}, W_{15}\}$
- Upper Approximation: $U_v(W - SB)(c) = \{W_1, W_2, W_3, W_4, W_6, W_7, W_8, W_{10}, W_{15}\}$
- Boundary Region: $B_v(W - SB)(c) = \{W_1, W_3, W_4, W_7, W_8\}$

Nano Topology $\tau_v(c)(W - SB)$.

Index	Set
1	U
2	$\emptyset$
3	$\{W_2, W_6, W_{10}, W_{15}\}$
4	$\{W_1, W_2, W_3, W_4, W_6, W_7, W_8, W_{10}, W_{15}\}$
5	$\{W_1, W_3, W_4, W_7, W_8\}$

Conclusion.

$$\tau_v(c)(W - SB) = \tau_v(c)(W)$$

Step 4: Removal of Attribute “Muscle Tension”

Equivalence Classes.

$$U/v(W - MT) = \{W_1, W_3, W_7\}, \{W_2, W_{15}\}, \{W_4, W_8\}, \\ \{W_5, W_9, W_{13}\}, \{W_6, W_{10}\}, \{W_{11}, W_{14}\}, \{CW 2\}$$

Approximations.

- Lower Approximation: $L_v(W - MT)(c) = \{W_2, W_6, W_{10}, W_{15}\}$
- Upper Approximation: $U_v(W - MT)(c) = \{W_1, W_2, W_3, W_4, W_6, W_7, W_8, W_{10}, W_{15}\}$
- Boundary Region: $B_v(W - MT)(c) = \{W_1, W_3, W_4, W_7, W_8\}$

Nano Topology $\tau_v(c)(W - MT)$.

Index	Set
1	U
2	$\emptyset$
3	$\{W_2, W_6, W_{10}, W_{15}\}$
4	$\{W_1, W_2, W_3, W_4, W_6, W_7, W_8, W_{10}, W_{15}\}$
5	$\{W_1, W_3, W_4, W_7, W_8\}$

Conclusion.

$$\tau_v(c)(W - MT) = \tau_v(c)(W)$$

Step 5: Removal of Attribute “Dry Mouth”

Equivalence Classes.

$$U/v(W - DM) = \begin{matrix} \cdot \\ \{W_1, W_3, W_7\}, \{W_2, W_{15}\}, \{W_4, W_8\}, \\ \{W_5, W_9, W_{13}\}, \{W_6, W_{10}\}, \{W_{11}, W_{14}\}, \{W_{12}\} \end{matrix}$$

Approximations.

- Lower Approximation: $L_v(W - DM)(c) = \{W_2, W_6, W_{10}, W_{15}\}$
- Upper Approximation: $U_v(W - DM)(c) = \{W_1, W_2, W_3, W_4, W_6, W_7, W_8, W_{10}, W_{15}\}$
- Boundary Region: $B_v(W - DM)(c) = \{W_1, W_3, W_4, W_7, W_8\}$

Nano Topology $\tau_v(c)(W - DM)$.

Index	Set
1	U
2	$\emptyset$
3	$\{W_2, W_6, W_{10}, W_{15}\}$
4	$\{W_1, W_2, W_3, W_4, W_6, W_7, W_8, W_{10}, W_{15}\}$
5	$\{W_1, W_3, W_4, W_7, W_8\}$

Conclusion.

$$\tau_v(c)(W - DM) = \tau_v(c)(W)$$

Step 6: Removal of Attribute “Restless”

Equivalence Classes.

$$U/v(W - CV) = \begin{matrix} \cdot \\ \{W_1, W_3, W_7\}, \{W_2, W_{15}\}, \{W_4, W_5, W_8, W_9, W_{13}\}, \\ \{W_6, W_{10}\}, \{W_{11}, W_{14}\}, \{W_{12}\} \end{matrix}$$

Approximations.

- Lower Approximation: $L_v(W - CV)(c) = \{W_2, W_6, W_{10}, W_{15}\}$
- Upper Approximation: $U_v(W - CV)(c) = \{W_1, W_2, W_3, W_4, W_5, W_6, W_7, W_8, W_9, W_{10}, W_{13}, W_{15}\}$
- Boundary Region: $B_v(W - CV)(c) = \{W_1, W_3, W_4, W_5, W_7, W_8, W_9, W_{13}\}$

Nano Topology $\tau_v(c)(W - CV)$.

Index	Set
1	U
2	$\emptyset$
3	$\{W_2, W_6, W_{10}, W_{15}\}$
4	$\{W_1, W_2, W_3, W_4, W_5, W_6, W_7, W_8, W_9, W_{10}, W_{13}, W_{15}\}$
5	$\{W_1, W_3, W_4, W_5, W_7, W_8, W_9, W_{13}\}$

Conclusion.

$$\tau_v(c)(W - CV) = \tau_v(c)(W)$$

Step 7: Removal of Attribute “Sweaty Hand”

Equivalence Classes.

$$U/v(W - SH) = \begin{matrix} \cdot \\ \{W_1, W_3, W_7\}, \{W_2, W_{15}\}, \{W_4, W_8\}, \\ \{W_5, W_9, W_{13}\}, \{W_6, W_{10}\}, \{W_{11}, W_{14}\}, \{W_{12}\} \end{matrix}$$

Approximations.

- Lower Approximation: $L_u(W - SH)(c) = \{W_2, W_6, W_{10}, W_{15}\}$
- Upper Approximation: $U_u(W - SH)(c) = \{W_1, W_2, W_3, W_4, W_6, W_7, W_8, W_{10}, W_{15}\}$
- Boundary Region: $B_u(W - SH)(c) = \{W_1, W_3, W_4, W_7, W_8\}$

Nano Topology $\tau_u(c)(W - SH)$.

Index	Set
1	U
2	$\emptyset$
3	$\{W_2, W_6, W_{10}, W_{15}\}$
4	$\{W_1, W_2, W_3, W_4, W_6, W_7, W_8, W_{10}, W_{15}\}$
5	$\{W_1, W_3, W_4, W_7, W_8\}$

Conclusion

$$\tau_u(c)(W - SH) = \tau_u(c)(W)$$

$$\text{CORE} = \{\text{Anxious Thought, Restlessness}\}$$

Case I: Women Affected with Anxiety Disorder

Assume $\ell_c = \{W_1, W_2, W_4, W_6, W_{10}, W_{15}\}$

Nano Topology before removing any attribute

$$\tau_u(\ell_c)(W) = \{U, \emptyset, \{W_2, W_6, W_{10}, W_{15}\}, \{W_1, W_2, W_3, W_4, W_6, W_7, W_8, W_{10}, W_{15}\}, \{W_1, W_3, W_4, W_7, W_8\}\}$$

Nano Topology Table After Removing Each Attribute

Step	Attribute Removed	Lower Approximation $L_u(c)$
1	Anxious Thought	$\{W_2, W_6, W_{10}, W_{15}\}$
2	Irritable	$\{W_2, W_6, W_{10}, W_{15}\}$
3	Shortness of Breath	$\{W_2, W_6, W_{10}, W_{15}\}$
4	Muscle Tension	$\{W_2, W_6, W_{10}, W_{15}\}$
5	Dry Mouth	$\{W_2, W_6, W_{10}, W_{15}\}$
6	Restlessness	$\{W_2, W_6, W_{10}, W_{15}\}$
7	Sweaty Hand	$\{W_2, W_6, W_{10}, W_{15}\}$

Upper Approximation $U_u(c)$	Boundary Region $B_u(c)$	Topology Changed
$\{W_1, W_2, W_3, W_4, W_6, W_7, W_8, W_{10}, W_{12}, W_{15}\}$	$\{W_1, W_3, W_4, W_7, W_8, W_{12}\}$	Yes
$\{W_1, W_2, W_3, W_4, W_6, W_7, W_8, W_{10}, W_{15}\}$	$\{W_1, W_3, W_4, W_7, W_8\}$	No
$\{W_1, W_2, W_3, W_4, W_6, W_7, W_8, W_{10}, W_{15}\}$	$\{W_1, W_3, W_4, W_7, W_8\}$	No
$\{W_1, W_2, W_3, W_4, W_6, W_7, W_8, W_{10}, W_{15}\}$	$\{W_1, W_3, W_4, W_7, W_8\}$	No
$\{W_1, W_2, W_3, W_4, W_6, W_7, W_8, W_{10}, W_{15}\}$	$\{W_1, W_3, W_4, W_7, W_8\}$	No
$\{W_1, W_2, W_3, W_4, W_5, W_6, W_7, W_8, W_9, W_{10}, W_{13}, W_{15}\}$	$\{W_1, W_3, W_4, W_5, W_7, W_8, W_9, W_{13}\}$	Yes
$\{W_1, W_2, W_3, W_4, W_6, W_7, W_8, W_{10}, W_{15}\}$	$\{W_1, W_3, W_4, W_7, W_8\}$	No

Conclusion

$$\text{CORE} = \{\text{Anxious Thought, Restlessness}\}$$

Case II: Women who are not affected with anxiety disorder

Let $c = \{W_3, W_5, W_7, W_8, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}$ be the set of college students not aware of Covid-19 safety measures.

Given:

$$U/v(W) = \{\{W_1, W_3, W_7\}, \{W_2, W_{15}\}, \{W_4, W_8\}, \{W_5, W_9, W_{13}\}, \{W_6, W_{10}\}, \{W_{11}, W_{14}\}, \{W_{12}\}\}$$

$$\tau_u(W) = \{U, \emptyset, \{W_5, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}, \{W_1, W_3, W_4, W_5, W_7, W_8, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}, \{W_1, W_3, W_4, W_7, W_8\}\}$$

Step 1: Removal of Attribute “Anxious Thought”

Equivalence Classes.

$$U/v(W - AT) = \begin{cases} \{W_1, W_3, W_7, W_{12}\}, \{W_2, W_{15}\}, \{W_4, W_8\}, \\ \{W_5, W_9, W_{13}\}, \{W_6, W_{10}\}, \{W_{11}, W_{14}\} \end{cases}$$

Approximations.

- Lower Approximation: $L_u(W - AT)(c) = \{W_5, W_9, W_{11}, W_{13}, W_{14}\}$
- Upper Approximation: $U_u(W - AT)(c) = \{W_1, W_3, W_4, W_5, W_7, W_8, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}$
- Boundary Region: $B_u(W - AT)(c) = \{W_1, W_3, W_4, W_7, W_8, W_{12}\}$

Nano Topology $\tau_v(c)(W - AT)$.

Index	Set
1	U
2	$\emptyset$
3	$\{W_5, W_q, W_{11}, W_{13}, W_{14}\}$
4	$\{W_1, W_3, W_4, W_5, W_7, W_8, W_q, W_{11}, W_{12}, W_{13}, W_{14}\}$
5	$\{W_1, W_3, W_4, W_7, W_8, W_{12}\}$

Conclusion.

$$\tau_v(c)(W - AT) = \tau_v(c)(W)$$

Step 2: Removal of Attribute “Irritable”

Equivalence Classes.

$$U/v(W - I) = \{ \{W_1, W_3, W_7\}, \{W_2, W_{15}\}, \{W_4, W_8\}, \{W_5, W_q, W_{13}\}, \{W_6, W_{10}\}, \{W_{11}, W_{14}\}, \{W_{12}\} \}$$

Approximations.

- Lower Approximation: $L_v(W - I)(c) = \{W_5, W_q, W_{11}, W_{12}\}$
- Upper Approximation: $U_v(W - I)(c) = \{W_1, W_3, W_4, W_5, W_7, W_8, W_q, W_{11}, W_{12}, W_{13}, W_{14}\}$
- Boundary Region: $B_v(W - I)(c) = \{W_1, W_3, W_4, W_7, W_8\}$

Nano Topology $\tau_v(c)(W - I)$.

Index	Set
1	U
2	$\emptyset$
3	$\{W_5, W_q, W_{11}, W_{12}\}$
4	$\{W_1, W_3, W_4, W_5, W_7, W_8, W_q, W_{11}, W_{12}, W_{13}, W_{14}\}$
5	$\{W_1, W_3, W_4, W_7, W_8\}$

Conclusion.

$$\tau_v(c)(W - I) = \tau_v(c)(W)$$

Step 3: Removal of Attribute “Shortness of Breath”

Equivalence Classes.

$$U/v(W - SB) = \{ \{W_1, W_3, W_7\}, \{W_2, W_{15}\}, \{W_4, W_8\}, \{W_5, W_q, W_{13}\}, \{W_6, W_{10}\}, \{W_{11}, W_{14}\}, \{W_{12}\} \}$$

Approximations.

- Lower Approximation: $L_v(W - SB)(c) = \{W_5, W_q, W_{11}, W_{12}, W_{13}, W_{14}\}$
- Upper Approximation: $U_v(W - SB)(c) = \{W_1, W_3, W_4, W_5, W_7, W_8, W_q, W_{11}, W_{12}, W_{13}, W_{14}\}$
- Boundary Region: $B_v(W - SB)(c) = \{W_1, W_3, W_4, W_7, W_8\}$

Nano Topology $\tau_v(c)(W - SB)$.

Index	Set
1	U
2	$\emptyset$
3	$\{W_5, W_q, W_{11}, W_{12}, W_{13}, W_{14}\}$
4	$\{W_1, W_3, W_4, W_5, W_7, W_8, W_q, W_{11}, W_{12}, W_{13}, W_{14}\}$
5	$\{W_1, W_3, W_4, W_7, W_8\}$

Conclusion.

$$\tau_v(c)(W - SB) = \tau_v(c)(W)$$

Step 4: Removal of Attribute “Muscle Tension”

Equivalence Classes.

$$U/v(W - MT) = \{ \{W_1, W_3, W_7\}, \{W_2, W_{15}\}, \{W_4, W_8\}, \{W_5, W_q, W_{13}\}, \{W_6, W_{10}\}, \{W_{11}, W_{14}\}, \{W_{12}\} \}$$

Approximations.

- Lower Approximation: $L_v(W - MT)(c) = \{W_5, W_q, W_{11}, W_{12}, W_{13}, W_{14}\}$
- Upper Approximation: $U_v(W - MT)(c) = \{W_1, W_3, W_4, W_5, W_7, W_8, W_q, W_{11}, W_{12}, W_{13}, W_{14}\}$
- Boundary Region: $B_v(W - MT)(c) = \{W_1, W_3, W_4, W_7, W_8\}$

Nano Topology $\tau_v(c)(W - MT)$.

Index	Set
1	U
2	$\emptyset$
3	$\{W_5, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}$
4	$\{W_1, W_3, W_4, W_5, W_7, W_8, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}$
5	$\{W_1, W_3, W_4, W_7, W_8\}$

Conclusion.

Step 5: Removal of Attribute “Dry Mouth”

Equivalence Classes.

$$U/v(W - DM) = \{W_1, W_3, W_7\}, \{W_2, W_{15}\}, \{W_4, W_8\}, \\ \{W_5, W_9, W_{13}\}, \{W_6, W_{10}\}, \{W_{11}, W_{14}\}, \{W_{12}\}$$

Approximations.

- Lower Approximation: $L_v(W - DM)(c) = \{W_5, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}$
- Upper Approximation: $U_v(W - DM)(c) = \{W_1, W_3, W_4, W_5, W_7, W_8, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}$
- Boundary Region: $B_v(W - DM)(c) = \{W_1, W_3, W_4, W_7, W_8\}$

Nano Topology $\tau_v(c)(W - DM)$.

Index	Set
1	U
2	$\emptyset$
3	$\{W_5, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}$
4	$\{W_1, W_3, W_4, W_5, W_7, W_8, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}$
5	$\{W_1, W_3, W_4, W_7, W_8\}$

Conclusion.

$$\tau_v(c)(W - DM) = \tau_v(c)(W)$$

Step 6: Removal of Attribute “Restlessness”

Equivalence Classes.

$$U/v(W - R) = \{W_1, W_3, W_7\}, \{W_2, W_{15}\}, \{W_4, W_8\}, \\ \{W_5, W_9, W_{13}\}, \{W_6, W_{10}\}, \{W_{11}, W_{14}\}, \{W_{12}\}$$

Approximations.

- Lower Approximation: $L_v(W - R)(c) = \{W_{11}, W_{12}, W_{14}\}$
- Upper Approximation: $U_v(W - R)(c) = \{W_1, W_3, W_4, W_5, W_7, W_8, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}$
- Boundary Region: $B_v(W - R)(c) = \{W_1, W_3, W_4, W_5, W_7, W_8, W_9, W_{13}\}$

Nano Topology $\tau_v(c)(W - R)$.

Index	Set
1	U
2	$\emptyset$
3	$\{W_{11}, W_{12}, W_{14}\}$
4	$\{W_1, W_3, W_4, W_5, W_7, W_8, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}$
5	$\{W_1, W_3, W_4, W_5, W_7, W_8, W_9, W_{13}\}$

Conclusion.

$$\tau_v(c)(W - R) = \tau_v(c)(W)$$

Step 7: Removal of Attribute “Sweaty Hand”

Equivalence Classes.

$$U/v(W - SH) = \{W_1, W_3, W_7\}, \{W_2, W_{15}\}, \{W_4, W_8\}, \\ \{W_5, W_9, W_{13}\}, \{W_6, W_{10}\}, \{W_{11}, W_{14}\}, \{W_{12}\}$$

Approximations.

- Lower Approximation: $L_v(W - SH)(c) = \{W_5, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}$
- Upper Approximation: $U_v(W - SH)(c) = \{W_1, W_3, W_4, W_5, W_7, W_8, W_9, W_{10}, W_{12}, W_{13}, W_{14}\}$
- Boundary Region: $B_v(W - SH)(c) = \{W_1, W_3, W_4, W_7, W_8\}$

Nano Topology $\tau_v(c)(W - SH)$.

Index	Set
1	U
2	$\emptyset$
3	$\{W_5, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}$
4	$\{W_1, W_3, W_4, W_6, W_7, W_8, W_9, W_{10}, W_{12}, W_{13}, W_{14}\}$
5	$\{W_1, W_3, W_4, W_7, W_8\}$

Conclusion.

$$\tau_v(c)(W - SH) = \tau_v(c)(W)$$

Result: Women who are not affected with anxiety disorder

Let $c = \{W_3, W_5, W_7, W_8, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}$ be the set of college students not aware of Covid-19 safety measures.

Nano Topology before removing any attribute:

$$\tau_v(c)(W) = \{U, \emptyset, \{W_5, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}, \{W_1, W_3, W_4, W_5, W_7, W_8, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}, \{W_1, W_3, W_4, W_7, W_8, W_{12}\}\}$$

Nano Topology Table After Removing Each Attribute

Step	Attribute Removed	Lower Approximation $L_v(c)$
1	Anxious Thought	$\{W_5, W_9, W_{11}, W_{13}, W_{14}\}$
2	Irritable	$\{W_5, W_9, W_{11}, W_{12}\}$
3	Shortness of Breath	$\{W_5, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}$
4	Muscle Tension	$\{W_5, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}$
5	Dry Mouth	$\{W_5, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}$
6	Restlessness	$\{W_{11}, W_{12}, W_{14}\}$
7	Sweaty Hand	$\{W_5, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}$

Upper Approximation $U_v(c)$	Boundary Region $B_v(c)$	Topology changed
$\{W_1, W_3, W_4, W_5, W_7, W_8, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}$	$\{W_1, W_3, W_4, W_7, W_8, W_{12}\}$	yes
$\{W_1, W_3, W_4, W_5, W_7, W_8, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}$	$\{W_1, W_3, W_4, W_7, W_8\}$	No
$\{W_1, W_3, W_4, W_5, W_7, W_8, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}$	$\{W_1, W_3, W_4, W_7, W_8\}$	No
$\{W_1, W_3, W_4, W_5, W_7, W_8, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}$	$\{W_1, W_3, W_4, W_7, W_8\}$	No
$\{W_1, W_3, W_4, W_5, W_7, W_8, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}$	$\{W_1, W_3, W_4, W_7, W_8\}$	No
$\{W_1, W_3, W_4, W_5, W_7, W_8, W_9, W_{11}, W_{12}, W_{13}, W_{14}\}$	$\{W_1, W_3, W_4, W_5, W_7, W_8, W_9, W_{13}\}$	Yes
$\{W_1, W_3, W_4, W_6, W_7, W_8, W_9, W_{10}, W_{12}, W_{13}, W_{14}\}$	$\{W_1, W_3, W_4, W_7, W_8\}$	No

Conclusion:

$$\text{CORE} = \{\text{Anxious Thought, Restlessness}\}$$

Conclusion

This study employed nano topology based rough set theory to analyze the prevalence and contributing factors of anxiety disorders among 85 working women. Through systematic attribute reduction and analysis of lower and upper approximations, the findings reveal that a majority of the 85 working women are affected by anxiety disorders. The most influential factors contributing to anxiety are {Anxious Thought, Restlessness}. These two attributes were identified as core elements (CORE) using the nanotopological approach. Their removal resulted in significant changes to the nano topology, confirming their essential role in the manifestation of anxiety symptoms. Through a systematic analysis of the structures and approximations of nanotopology, we conclude that the attributes 'Anxious thought' and 'Restlessness' are fundamental indicators of anxiety disorders among women in the data set. These findings are consistently consistent for both affected and unaffected groups, confirming the robustness and universality of these attributes in anxiety classification. This approach demonstrates the effectiveness of rough nanotopological sets in discerning significant patterns in psychological health data.

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