



# **Latent Transition Analysis of Strengths' Pattern among Youth at Risk for Suicide Attempt**

**Saahoon Hong, PhD  
Betty Walton, PhD, LCSW  
Hea-Won Kim, PhD, MSSW**

**Indiana University School of Social Work**

## Indiana CANS and ANSA Training, Technical Assistance, & Research Team

- Saahoon Hong, Ph.D., Assistant Research Professor
- Hea-Won Kim, Ph.D., Associate Professor
- Betty Walton, Ph.D., LCW, Associate Research Professor
- Stephanie Moynihan, MEd, Project Coordinator

In collaboration with the Division of Mental Health & Addiction, Indiana Family & Social Services Administration



SCHOOL OF  
**SOCIAL WORK**  
GIVING HOPE *and* CHANGING LIVES

# Poll example

## What brings you here today?

### I want to learn more about:

- Strengths Pattern/Strength-Based Approach
- Latent Transition Analysis
- CANS Data Utilization
  - Implications (e.g., Decrease Suicide Risk & other applications)
- Other (please specify in chat box)

## What is your experience with CANS/ANSA data utilization (multiple choice)?

- None – minimal
- Occasionally use
- Regularly use
- Frequently use

## What best describes your role in your organization?

- Service Provider
- Researcher
- Professor
- State Administrator

Other \_\_\_\_\_

# Let's get acquainted!

- ✓ Introduce yourself
- ✓ What kind of experiences or challenges you have in using the CANS/ANSA data?
- ✓ What do you want to learn in this session?



# Indiana's TCOM Implementation

- Following the implementation of the CANS (2006) by the state mental health and addiction authority as an initiative to **transform** the behavioral health system
- Consistent with the recovery model, ANSA was implemented in 2007 following a cross-system interdisciplinary workgroup study of options. Parallel framework with CANS fit recently developed data collection platform.
- Phased in over one year beginning with all new adult clients and adding persons in ongoing services as treatment plans were updated
- Decision models utilized to prior-authorize Medicaid service packages
- Additional state funding linked to outcomes (performance measures)



# Overview

- Suicide: What **do** we know?
- Strengths' Pattern: What **is it and Why is it** important?
- Strengths' Pattern analysis for suicide prevention: What **is it and Why is it** important?
- Latent Profile Transition Analysis (LPTA): What is it and How **does** it work?
- LPTA of Strengths' Pattern among Youth at Risk for Suicide Attempt
- Summary and Discussion

# Learning Goals

- **To understand** the variability of strengths' patterns among youth at risk for suicide by identifying unobserved subgroups
- **To understand** subgroup changes during the mental health recovery process
- **To understand** the benefit of Latent Transition Analysis in the CANS dataset

**Suicide: What do we know about it?**



# Suicide

Table 1. Suicide is a Leading Cause of Death in the United States in 2018

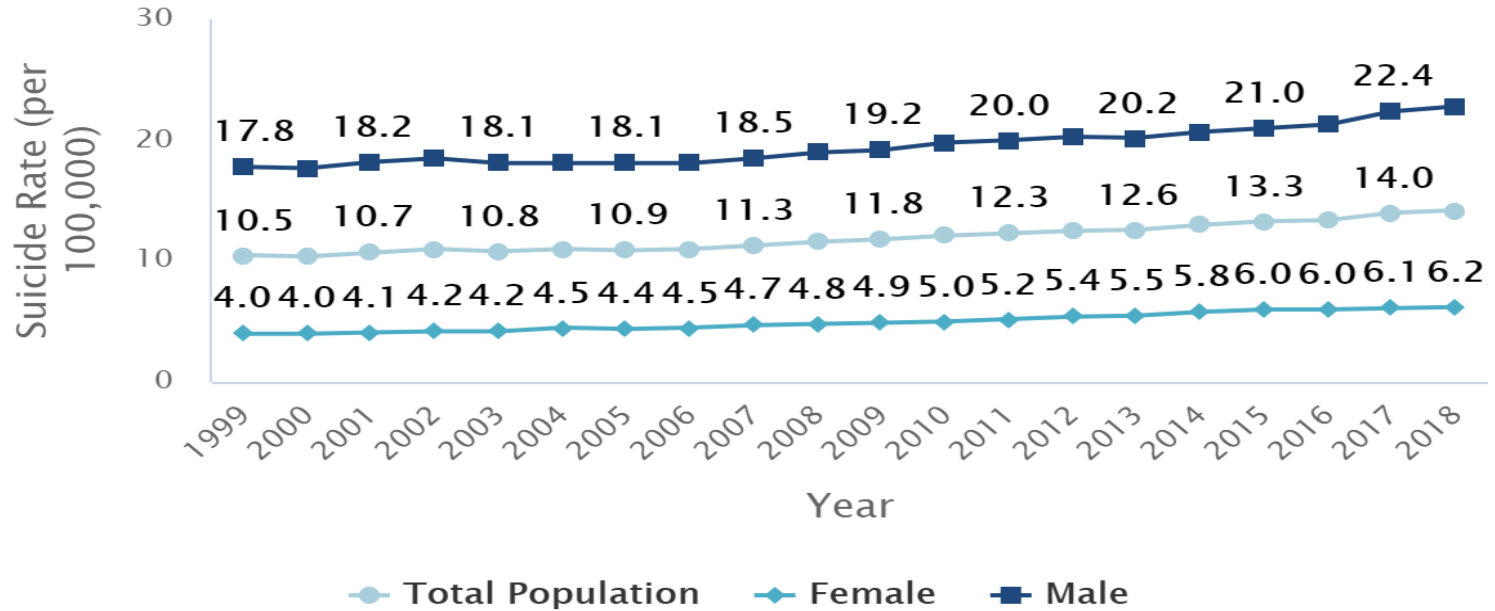
|      | Age Groups                        |                               |                             |                             |                                |                                |                                |                                |   |  |  |
|------|-----------------------------------|-------------------------------|-----------------------------|-----------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|---|--|--|
| Rank | <1                                | 1-4                           | 5-9                         | 10-14                       | 15-24                          | 25-34                          | 35-44                          | 45-54                          | 55-64                                     | 65+  | All Ages                                   |
| 1    | Congenital Anomalies<br>4,473     | Unintentional Injury<br>1,226 | Unintentional Injury<br>734 | Unintentional Injury<br>692 | Unintentional Injury<br>12,044 | Unintentional Injury<br>24,614 | Unintentional Injury<br>22,667 | Malignant Neoplasms<br>37,301  | Malignant Neoplasms<br>113,947            | Heart Disease<br>526,509                   | Heart Disease<br>655,381                   |
| 2    | Short Gestation<br>3,679          | Congenital Anomalies<br>384   | Malignant Neoplasms<br>393  | Suicide<br>596              | Suicide<br>6,211               | Suicide<br>8,020               | Malignant Neoplasms<br>10,640  | Heart Disease<br>32,220        | Heart Disease<br>81,042                   | Malignant Neoplasms<br>431,102             | Malignant Neoplasms<br>599,274             |
| 3    | Maternal Pregnancy Comp.<br>1,358 | Homicide<br>353               | Congenital Anomalies<br>201 | Malignant Neoplasms<br>450  | Homicide<br>4,607              | Homicide<br>5,234              | Heart Disease<br>10,532        | Unintentional Injury<br>23,056 | Unintentional Injury<br>23,693            | Chronic Low Respiratory Disease<br>135,560 | Unintentional Injury<br>167,127            |
| 4    | SIDS<br>1,334                     | Malignant Neoplasms<br>326    | Homicide<br>121             | Congenital Anomalies<br>172 | Malignant Neoplasms<br>1,371   | Malignant Neoplasms<br>3,684   | Suicide<br>7,521               | Suicide<br>8,345               | Chronic Low Respiratory Disease<br>18,804 | Cerebrovascular<br>127,244                 | Chronic Low Respiratory Disease<br>159,486 |
| 5    | Unintentional Injury<br>1,168     | Influenza & Pneumonia<br>122  | Influenza & Pneumonia<br>71 | Homicide<br>168             | Heart Disease<br>905           | Heart Disease<br>3,561         | Homicide<br>3,304              | Liver Disease<br>8,157         | Diabetes Mellitus<br>14,941               | Alzheimer's Disease<br>120,658             | Cerebrovascular<br>147,810                 |

<https://www.nimh.nih.gov/health/statistics/suicide.shtml>



# Age-Adjusted Suicide Rates in the United States (1999–2018)

Data Courtesy of CDC

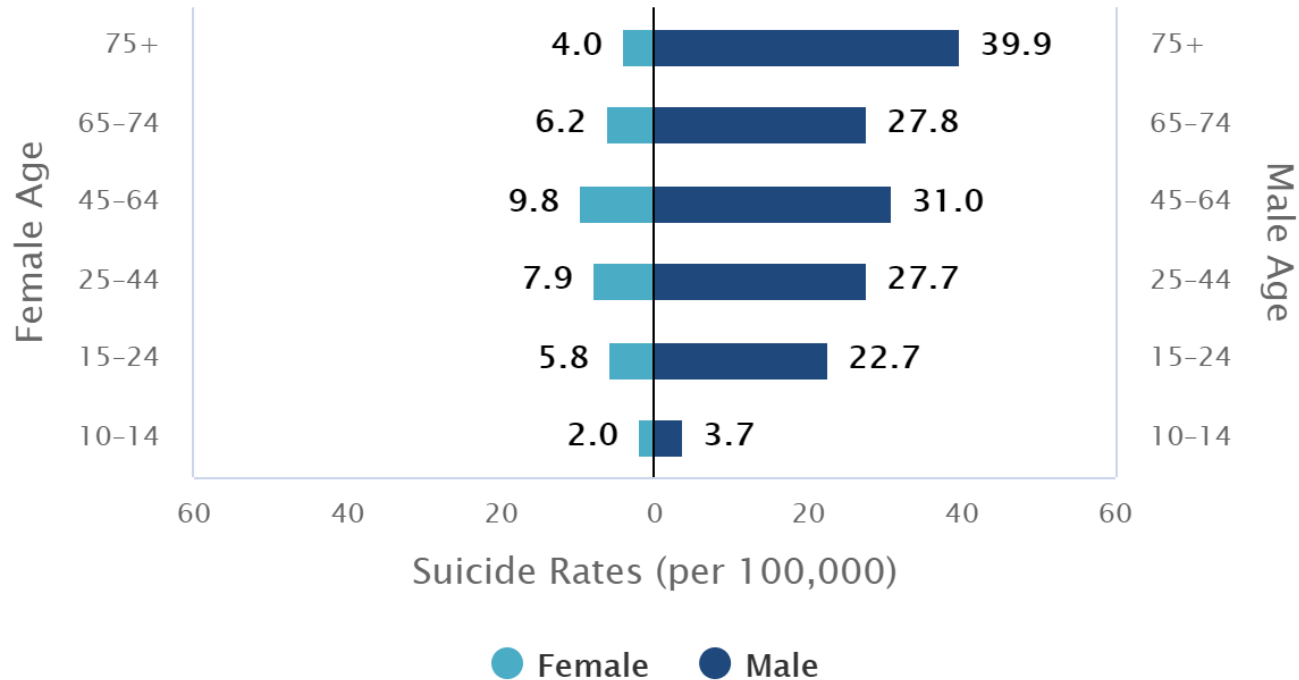


<https://www.nimh.nih.gov/health/statistics/suicide.shtml>



## Suicide Rates by Age (per 100,000; 2018)

Data Courtesy of CDC

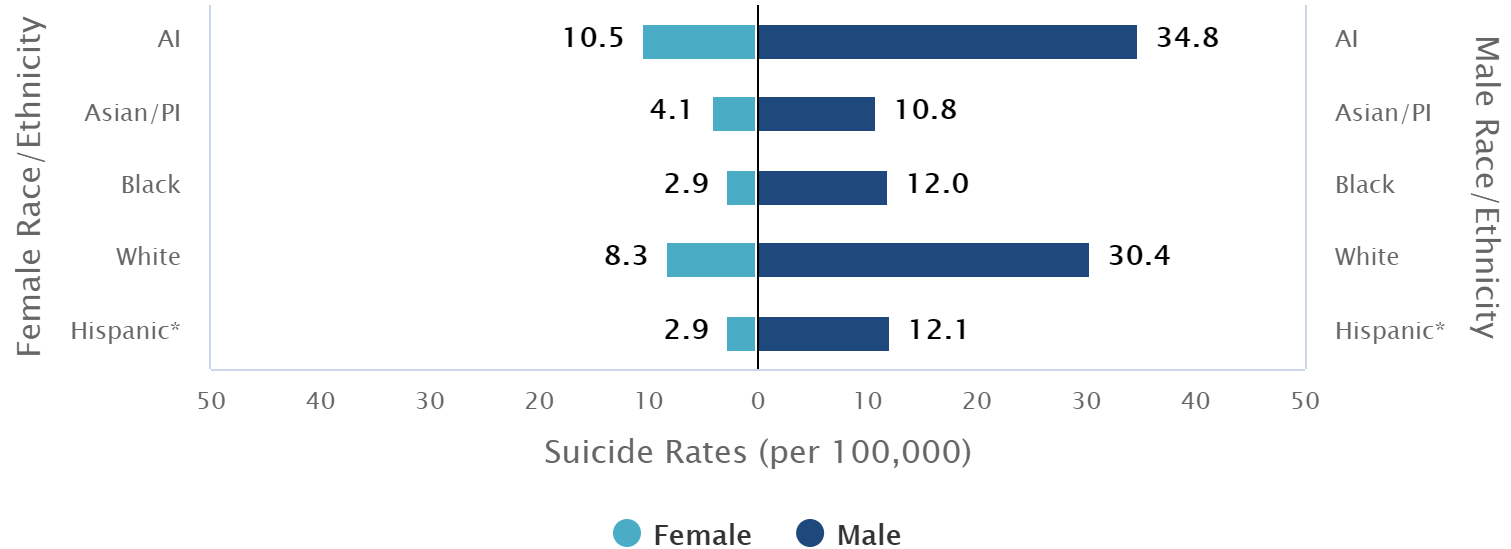


<https://www.nimh.nih.gov/health/statistics/suicide.shtml>



## Suicide Rates by Race (per 100,000; 2018)

Data Courtesy of CDC



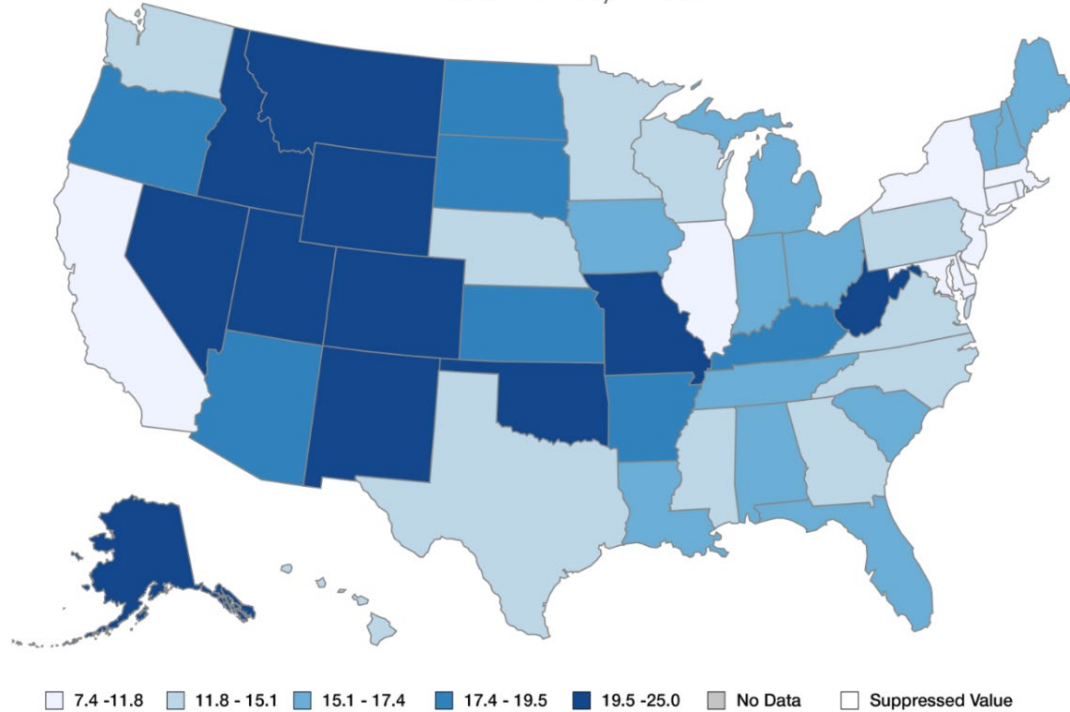
\*Persons of Hispanic origin may be of any race; all other racial/ethnic groups are non-Hispanic  
AI = American Indian, PI = Pacific Islander

<https://www.nimh.nih.gov/health/statistics/suicide.shtml>



## Suicide Rates in the United States (by state; per 100,000; 2018)

Data Courtesy of CDC



<https://www.nimh.nih.gov/health/statistics/suicide.shtml>



# Needs & Strengths associated with Acute Suicidal Ideation & Behavior for Adolescents in Treatment

“This study examined a comprehensive set of adolescent and family needs and strengths associated with acute suicidal ideation and/or behavior among youth using mental health services in Indiana (U.S.). Youth (n = 3292) were assessed with the Child and Adolescent Needs and Strengths.

Findings revealed that mental health issues (depression, psychosis) were the most important co-factors of acute suicidal ideation and/or behavior, followed by high-risk behaviors and psychosocial adjustment (non-suicidal self-injury, harmful behavior, aggression, sleep disruption), and strengths (optimism)....

Adolescents with a positive and optimistic outlook on life were significantly less likely than those with more negative views to have persistent suicidal ideations or to have attempted on their life, even after controlling for the effect of depression, and several other important cofactors (age, gender, psychopathology, and individual/family risk factors).” (Quiroga & Walton, 2014)



# Strengths' Pattern: What is it?

1. Strength-Based Approach for People with Mental Illness
2. Strengths items in Mental Health Recovery
3. Strengths items in Child and Adolescent Needs and Strengths (CANS)
4. Integrative Data System Utilization for Suicide Prevention



# Strengths' Pattern analysis for suicide prevention: What it is, and Why it is important?

1. Strengths Pattern by Latent Class/Profile Analysis
1. Strengths Pattern Changes over time: Latent Transition Analysis





# Latent Class/Profile Analysis

Figure 1. Factor Analysis vs. LCA/LPA

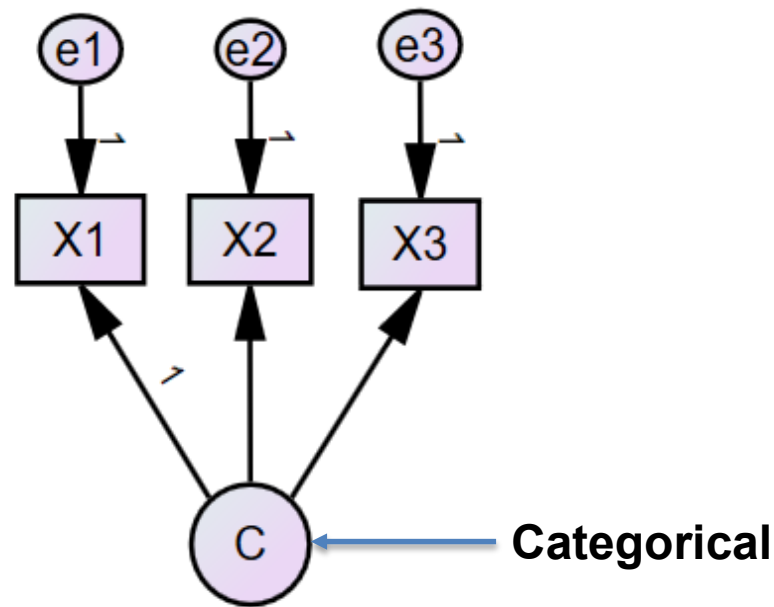
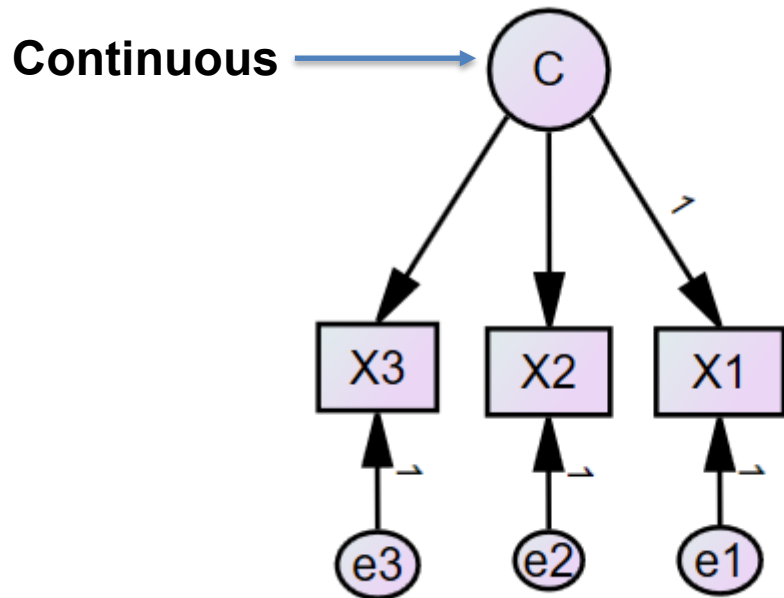
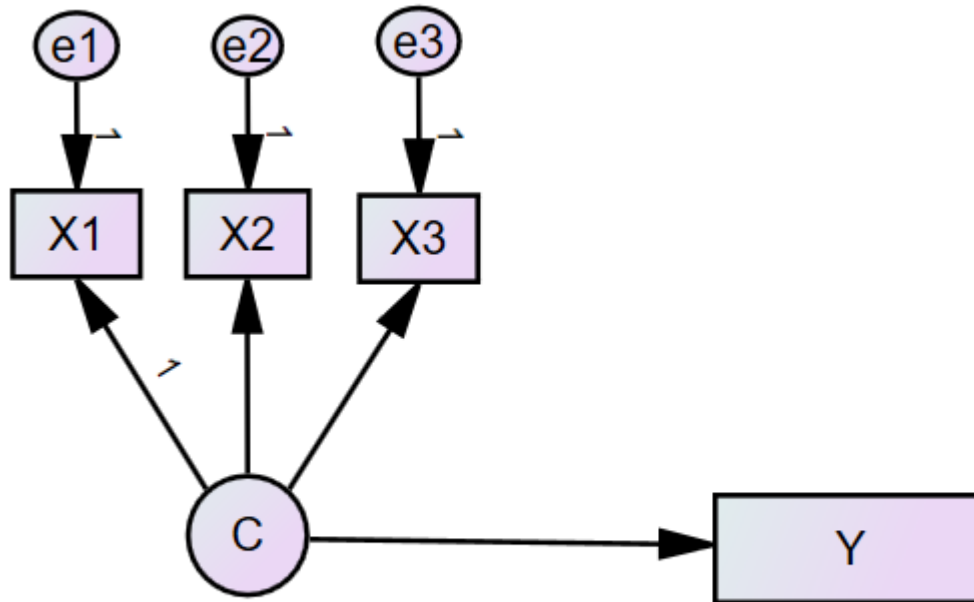


Figure 2. LCA/LPA with Distal Outcomes



Y: Observed Variables

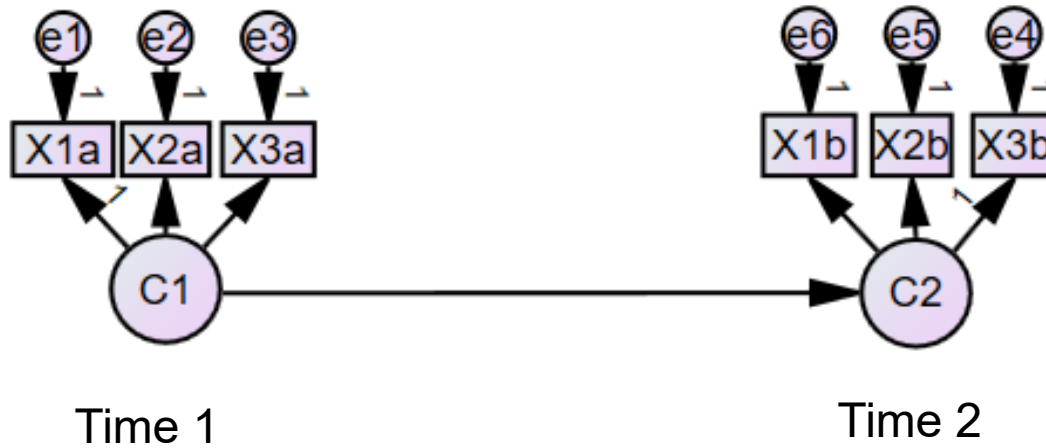
Figure 3. Four Different Latent Variable Models

|                    |             | Latent Variables     |                         |
|--------------------|-------------|----------------------|-------------------------|
|                    |             | Continuous           | Categorical             |
| Observed Variables | Continuous  | Factor Analysis      | Latent Profile Analysis |
|                    | Categorical | Item Response Theory | Latent Class Analysis   |



# Latent Transition Analysis

Figure 4. LTA



The transition in class memberships from T1 to T2 when C is a categorical variable.

Figure 5. LTA's Transition Probabilities

|        |     | Time 2   |          |
|--------|-----|----------|----------|
|        |     | LP1      | LP2      |
| Time 1 | LP1 | $p_{11}$ | $p_{12}$ |
|        | LP2 | $p_{21}$ | $p_{22}$ |

*LP1 stands for latent class 1.*

*Ps are transition probabilities. For example,  $p_{21}$  is the probability of changing latent class 2 at Time (1) to latent class 1 at Time (2).*



# **LPTA of Strengths' Pattern among Youth at Risk for Suicide Attempt**



# Study Aims

- To identify unobserved subgroups of strengths in a population for youth ending behavioral health treatment.
- To examine profiles of youth strengths that move into categories that are more/less usable.
- To determine whether subgroups changed during treatment for youth with suicide risks.



# Study Rationale

- Understanding the relationship of strengths to mental health disorders is critical as the strength-based approach supports mental health recovery (Gable & Haidt, 2005; Xie, 2013).
- Although recovery occurs for many youth, mental health problems are common and suicide rates continue to grow (Hedegaard, Curtin, & Warner, 2018).
- A few studies with mixed results have explored associations among trauma exposure, psychiatric symptoms, risk behaviors, and **strengths**.
- Few studies explored the changes in strengths over time.



# Methods

**Sample.** Of children and youth in one Midwestern state who received MH/addiction services and closed the episode of care during state fiscal year 2019 (N=8,877), those requiring intervention for suicide risk were selected (n=391).

**Analysis.** First analyzing youth strengths at Time 1 (baseline) and Time 2 (last assessment) via Latent Profile Analysis (LPA), respectively, and examining tenability and trajectories of different latent classes at the end of an episode via Latent Transition Analysis (LTA).

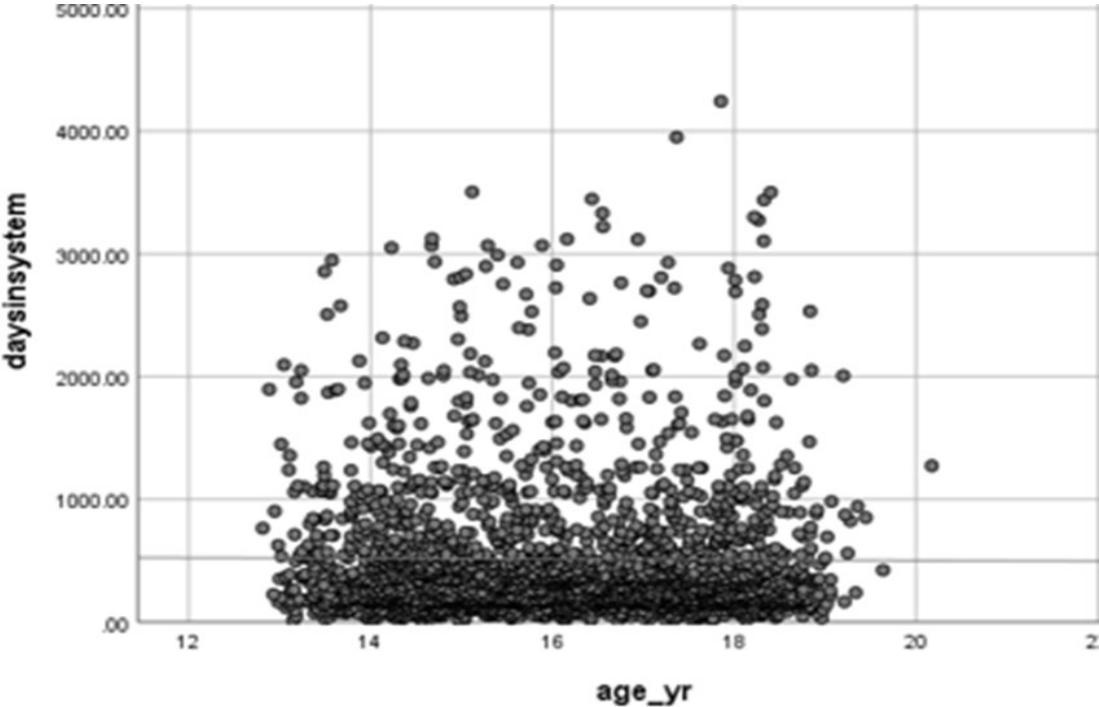


Table 1. *Demographic information*

|                    |                    | <b>N</b>    | <b>%</b>  |            |            |
|--------------------|--------------------|-------------|-----------|------------|------------|
| Gender             | F                  | 244         | 62.4      |            |            |
|                    | M                  | 145         | 37.1      |            |            |
|                    | Missing            | 2           | 0.5       |            |            |
| Race/Ethnicity     | Native American    | 1           | 0.3       |            |            |
|                    | Black              | 40          | 10.2      |            |            |
|                    | White              | 313         | 80.1      |            |            |
|                    | Other single races | 22          | 5.6       |            |            |
|                    | More than 1        | 13          | 3.3       |            |            |
|                    |                    | <b>Mean</b> | <b>SD</b> | <b>Min</b> | <b>Max</b> |
| Age                | 16.34              | 1.51        | 13.07     | 19.45      |            |
| Days in the system | 402.07             | 393.71      | 10        | 3119       |            |



Figure. Days in the CANS system by Age



# Results

Table 2. *Latent Profile Analysis: Model Fit Information/*

|                      | # of Classes |           |           |           |
|----------------------|--------------|-----------|-----------|-----------|
|                      | 1            | 2         | 3         | 4         |
| # of Free Parameters | 22           | 34        | 46        | 58        |
| Wave 1               |              |           |           |           |
| Loglikelihood        | -5772.059    | -5495.641 | -5433.088 | -5389.99  |
| AIC                  | 11588.117    | 11059.281 | 10958.175 | 10895.98  |
| BIC                  | 11675.259    | 11193.955 | 11140.381 | 11125.719 |
| ABIC                 | 11605.455    | 11086.076 | 10994.427 | 10941.69  |
| Entropy              |              | 0.766     | 0.744     | 0.789     |
| LRT                  |              | 545.214** | 123.381*  | 85.006    |
| Wave 2               |              |           |           |           |
| Loglikelihood        | -7804.698    | -7452.541 | -6470.94  | -6391.209 |
| AIC                  | 15653.395    | 14973.083 | 13033.88  | 12898.418 |
| BIC                  | 15740.537    | 15107.757 | 13216.086 | 13128.156 |
| ABIC                 | 15670.733    | 14999.878 | 13070.132 | 12944.127 |
| Entropy              |              | 0.805     | 0.879     | 0.817     |
| LRT                  |              | 694.602** | 698.492   | 157.698   |



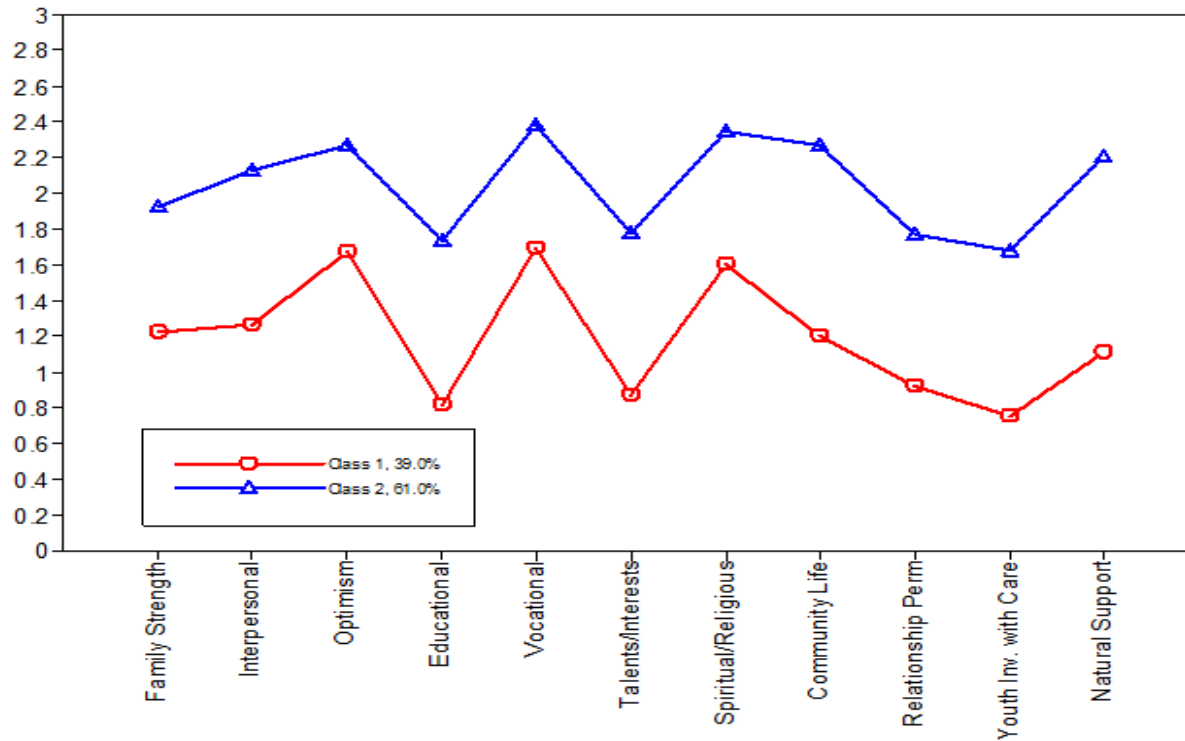


Figure 1. Two classes at Time 1 via Latent Profile Analysis



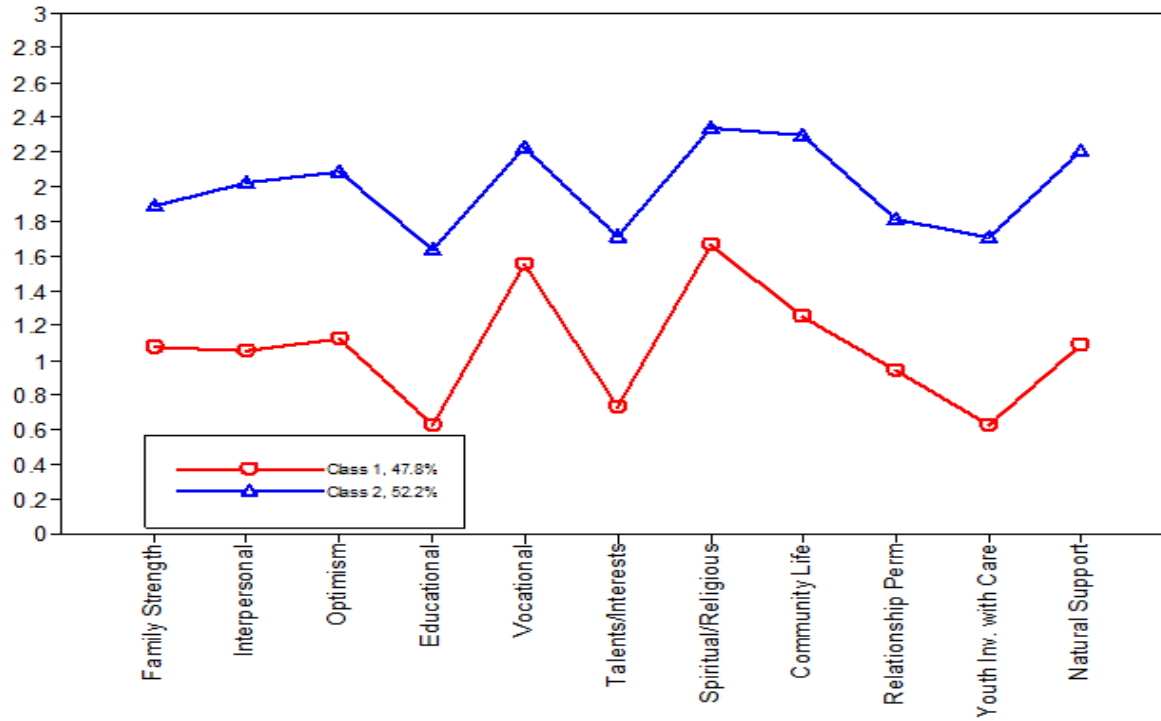


Figure 2. Two classes at Time 2 via Latent Profile Analysis





*FINAL CLASS COUNTS AND PROPORTIONS FOR THE LATENT CLASS PATTERNS  
BASED ON THEIR MOST LIKELY LATENT CLASS PATTERN*

|        |                             | Time 2                 |        |                          |        |
|--------|-----------------------------|------------------------|--------|--------------------------|--------|
|        |                             | Central Strengths (CS) |        | Buildable Strengths (BS) |        |
|        |                             | N                      | %      | N                        | %      |
| Time 1 | Central Strengths (N=140)   | 129                    | 92.14% | 11                       | 7.86%  |
|        | Buildable Strengths (N=248) | 70                     | 28.23% | 178                      | 71.77% |



## DEMOGRAPHIC INFORMATION BY MEMBERSHIP CHANGES

|                           |                          | Transition       |        |                 |        |                 |        |                  |        |
|---------------------------|--------------------------|------------------|--------|-----------------|--------|-----------------|--------|------------------|--------|
|                           |                          | CS->CS (N=129)   |        | CS->BS (N=11)   |        | BS->CS (N=70)   |        | BS->BS (N=168)   |        |
|                           |                          | N                | %      | N               | %      | N               | %      | N                | %      |
| <b>Race</b>               | <b>Native American</b>   | 0 <sub>a</sub>   | 0.0%   | 0 <sub>a</sub>  | 0.0%   | 1 <sub>a</sub>  | 1.4%   | 0 <sub>a</sub>   | 0.0%   |
|                           | <b>Black</b>             | 10 <sub>a</sub>  | 7.9%   | 1 <sub>a</sub>  | 9.1%   | 6 <sub>a</sub>  | 8.6%   | 22 <sub>a</sub>  | 13.1%  |
|                           | <b>White</b>             | 102 <sub>a</sub> | 81.0%  | 10 <sub>a</sub> | 90.9%  | 58 <sub>a</sub> | 82.9%  | 132 <sub>a</sub> | 78.6%  |
|                           | <b>Other single race</b> | 10 <sub>a</sub>  | 7.9%   | 0 <sub>a</sub>  | 0.0%   | 4 <sub>a</sub>  | 5.7%   | 6 <sub>a</sub>   | 3.6%   |
|                           | <b>More than 1</b>       | 4 <sub>a</sub>   | 3.2%   | 0 <sub>a</sub>  | 0.0%   | 1 <sub>a</sub>  | 1.4%   | 8 <sub>a</sub>   | 4.8%   |
| <b>Gender</b>             | <b>Female</b>            | 79 <sub>a</sub>  | 62.2%  | 6 <sub>a</sub>  | 54.5%  | 38 <sub>a</sub> | 54.3%  | 121 <sub>a</sub> | 68.0%  |
|                           | <b>Male</b>              | 48 <sub>a</sub>  | 37.8%  | 5 <sub>a</sub>  | 45.5%  | 32 <sub>a</sub> | 45.7%  | 57 <sub>a</sub>  | 32.0%  |
|                           |                          | M                | SD     | M               | SD     | M               | SD     | M                | SD     |
| <b>Days in the system</b> |                          | 354.57           | 268.87 | 379.18          | 303.41 | 635.33          | 592.11 | 350.16           | 347.19 |



Table 4.

*LOGISTIC REGRESSION ODDS RATIO RESULTS*

|                    | <b>Estimate</b> | <b>SE</b> | <b>Est/SE</b> | <b>P-Value</b> |
|--------------------|-----------------|-----------|---------------|----------------|
| C2#1 ON            |                 |           |               |                |
| C1#1               | 3.784           | 0.706     | 5.356         | 0.000          |
| C1#1 ON            |                 |           |               |                |
| DAYS in the system | -0.001          | 0         | -1.864        | 0.062          |
| C2#1 ON            |                 |           |               |                |
| DAYS in the system | -0.311          | 0.001     | -428.558      | 0.000          |
| Intercepts         |                 |           |               |                |
| C1#1               | -0.377          | 0.211     | -1.792        | 0.073          |
| C2#1               | -1.509          | 0.332     | -4.553        | 0.000          |



*Logistic Regression Odds Ratio Results: Actionable on Suicide*

|                     |           | B     | S.E. | Wald  | df   | Sig. | Exp(B) |
|---------------------|-----------|-------|------|-------|------|------|--------|
| Step 1 <sup>a</sup> | Tansition |       |      | 26.16 | 3.00 | 0.00 |        |
|                     | CS-CS     | -1.10 | 0.29 | 14.30 | 1.00 | 0.00 | 0.33   |
|                     | CS-BS     | -1.87 | 1.08 | 3.00  | 1.00 | 0.08 | 0.15   |
|                     | BS-CS     | -2.33 | 0.62 | 13.94 | 1.00 | 0.00 | 0.10   |
|                     | Days      | 0.00  | 0.00 | 22.65 | 1.00 | 0.00 | 1.00   |
|                     | Constant  | 0.70  | 0.27 | 6.95  | 1.00 | 0.01 | 2.02   |

a. Variable(s) entered on step 1: transition, days.



# Summary

- The strength class remains unchanged (93% in central strengths group and 72% in buildable strength group) between Time 1 and Time 2. However, subgroups showed significant movements: 28% moved to a positive direction.
- People with membership changes in the positive direction are less likely to being rated “2” or “3” at the end of episode.
- Length of stay in the system showed significant effects on latent classes across time.



# Discussion

- What might be some benefits of using this type of data analysis?
- Disadvantages?
- What might be some possible challenges in rolling out this approach?



MPlus Code:  
Latent Profile Transition Analysis with  
Covariates



```
TITLE: LPTA analysis with Covariates
DATA: FILE IS C:\Users\hong0\Box\CANS_Tampa\LTA_T1ab.txt;
VARIABLE:
NAMES ARE ID AGE DAYS SEX RACE TERM SF SI SO SE SV ST SS SC SR SY SN F2 I2 O2 E2 V2 T2 S2 CA2 R2 Y2 N2;
IDVARIABLE = ID;
MISSING ARE ALL(-999.0,-999, 999); ! Missing values
USEVAR = AGE DAYS SF SI SO SE SV ST SS SC SR SY SN F2 I2 O2 E2 V2 T2 S2 CA2 R2 Y2 N2;
CLASSES = C1(3) C2(3);
ANALYSIS:
TYPE = MIXTURE; ! A mixture model
PROCESSORS = 2;
MODEL:
%Overall% !The overall model specification
C2 ON C1; ! regresses c2 on c1 (for the latent transition probabilities)
C1 ON AGE DAYS; !Tests the covariate's influence on c1 (on which the transition probability is dependent)
MODEL C1:!Specification/ measurement model for each class at Time 1
%C1#1% !Time 1, class 1
[SF SI SO SE SV ST SS SC SR SY SN] (1-11);
C2 ON AGE DAYS; !Tests the interaction of the transition and the covariate for those starting in class 1
%C1#2% !Time 1, class 2
[SF SI SO SE SV ST SS SC SR SY SN] (12-22);
C2 ON AGE DAYS; !Tests the interaction of the transition and the covariate for those starting in class 2
%C1#3% !Time 1, class 3
[SF SI SO SE SV ST SS SC SR SY SN] (23-33);
C2 ON AGE DAYS; !Tests the interaction of the transition and the covariate for those starting in class 3
MODEL C2:!Specification/ measurement model for each class at Time 2
%C2#1% !Time 2, class 1
[F2 I2 O2 E2 V2 T2 S2 CA2 R2 Y2 N2] (1-11);
%C2#2% !Time 2, class 2
[F2 I2 O2 E2 V2 T2 S2 CA2 R2 Y2 N2] (12-22);
%C2#3% !Time 2, class 3
[F2 I2 O2 E2 V2 T2 S2 CA2 R2 Y2 N2] (23-33);
OUTPUT: TECH1 TECH8;
```



# References

Gable, S. L., & Haidt, J. (2005). What (and why) is positive psychology?. *Review of general psychology*, 9(2), 103-110.

Hedegaard, H., Curtin, S. C., & Warner, M. (2018). Suicide mortality in the United States, 1999–2017.

National Institute of Mental Health. (2020, November 7). *Suicide*.

<https://www.nimh.nih.gov/health/statistics/suicide.shtml>

Quiroga, C. V., & Walton, B. (2014). Needs and strengths associated with acute suicidal ideation and behavior in a sample of adolescents in mental health treatment: youth and family correlates. *Residential Treatment for Children & Youth*, 31(3), 171-187.

Xie, H. (2013). Strengths-based approach for mental health recovery. *Iranian journal of psychiatry and behavioral sciences*, 7(2), 5.



Thank you!

For more information, please contact:

Hong, Saahoon <[saahong@iu.edu](mailto:saahong@iu.edu)>

Walton, Betty <[beawalto@iupui.edu](mailto:beawalto@iupui.edu)>

Kim, Hea-Won <[heakim@iupui.edu](mailto:heakim@iupui.edu)>

