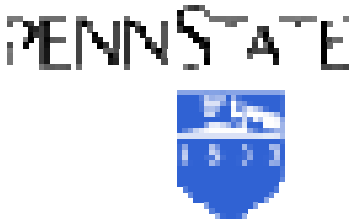

Latent Transition Analysis for Modeling Change Over Time: A Demonstration of SAS PROC LTA

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American Public Health Association
Washington, D.C.
November 5, 2007

Outline

- Goal: Model dating and sexual risk behavior over time
  - Research questions and approach
  - SAS PROC LTA
  - Basic model
  - Multiple groups LTA
  - LTA with covariate

- How to download software

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Research Questions

1. Describe change over time in dating and sexual risk behavior among adolescents and young adults
2. Are there gender differences in behavior?
3. Does drunkenness predict initial behavior and transitions over time?

Developmental model of dating and sexual risk behavior

- Behavior is multidimensional
- Underlying groups of individuals based on multiple aspects of behavior
- Development, or change over time, is stage-sequential

Approach

- Latent class analysis
  - Mutually exclusive and exhaustive unobserved subgroups
  - Categorical latent variable
  - True class membership unknown, inferred from multiple indicators
- Latent transition analysis (LTA)
  - Individuals can change latent class membership over time

Parameter sets in LTA

- Item-response probabilities
  - Latent structure of dating and sexual risk behavior
- Class membership probabilities
  - Prevalence of behavior at each time
- Transition probabilities
  - Time 1 to Time 2
  - Time 2 to Time 3…

Study participants

- Data: NLSY97
  - 2937 students age 17 or 18 at Time 1
  - Assessed in 1998, 1999, 2000

Indicators

DATING PARTNERS Number of dating partners in the past year

- **0 / 1 / 2 or more**

PAST-YEAR SEX

- **No / Yes**

SEXUAL PARTNERS Number of sexual partners in the past year

- **0 / 1 / 2 or more**

EXPOSED At least one instance of intercourse without use of a condom (i.e., exposed to STDs) in the past year

- **No / Yes**

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SAS PROC LTA

- Add-on SAS procedures
  - **PROC LCA** (latent class analysis)
  - **PROC LTA** (latent transition analysis)
- Downloadable
- Developed for SAS version 9 for Windows

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Five-class model, three times

```
proc lta data=pgm.sex;
  title1 'Dating and Sexual Behavior';
  nstatus 5;
  ntimes 3;
  items datepar_98 sex_yr_98 sexpar_98 expos_98
        datepar_99 sex_yr_99 sexpar_99 expos_99
        datepar_00 sex_yr_00 sexpar_00 expos_00;
  categories 3 2 3 2;
  measurement times;
  seed 592667;
run;
```

Item-response probabilities

Item	Non-daters	Daters	Monog-amous	Multi-part Safe	Multi-part Exposed
# Dating Partners	76% 0	79% 2+	66% 1	93% 2+	93% 2+
Past-year Sex	98% No	98% No	100% Yes	100% Yes	100% Yes
# Sex Partners	100% 0	100% 0	97% 1	64% 2+	91% 2+
Exposed to STD	100% No	100% No	60% Yes	82% No	81% Yes

Prevalence of behavior classes

	Non-Daters	Daters	Monog-amous	Multi-part Safe	Multi-part Exposed
Time 1	.19	.29	.12	.23	.18
Time 2	.13	.23	.22	.21	.21
Time 3	.11	.18	.29	.17	.25

Transitions in behavior (Time 1 to 2)

	Non-Daters	Daters	Monog-amous	Multi-part Safe	Multi-part Exposed
Non-Daters	.61	.18	.08	.09	.03
Daters	.01	.57	.16	.21	.05
Monog-amous	.05	.04	.68	.09	.14
Multi-part Safe	.04	.11	.21	.54	.11
Multi-part Exposed	.01	.03	.15	.00	.81

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Multiple-groups LTA

- **Item-response probabilities** may vary across groups
  - Measurement invariance
- **Class membership probabilities** may vary across groups
  - Prevalence differences
- **Transition probabilities** may vary across groups
  - Differences in rate of change

Time 1 gender differences in behavior

```
proc lta data=pgm.sex;
  title1 'Dating and Sexual Behavior, by Gender';
  nstatus 5;
  ntimes 3;
  items datepar_98 sex_yr_98 sexpar_98 expos_98
        datepar_99 sex_yr_99 sexpar_99 expos_99
        datepar_00 sex_yr_00 sexpar_00 expos_00;
  categories 3 2 3 2;
  groups gender;
  groupnames male female;
  measurement times groups;
  seed 592667;
run;
```

Time 1 gender differences in behavior

Behavior Class	Males	Females
Non-daters	.17	.20
Daters	.28	.30
Monogamous	.08	.18
Multi-partner safe	.30	.16
Multi-partner exposed	.18	.17

Time 1 gender differences in behavior

Behavior Class	Males	Females
Non-daters	.17	.20
Daters	.28	.30
Monogamous	.08	.18
Multi-partner safe	.30	.16
Multi-partner exposed	.18	.17

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LTA with covariates

- Predict Time 1 latent class membership
- Predict transition probabilities

- **Baseline-category logit model**
  - Specify reference group
  - If 5 classes, 4 odds ratios

Logistic regression

- Non-daters specified as reference group

Non-Daters	Daters	Monog-amous	Multi-part Safe	Multi-part Exposed
.19	.29	.12	.23	.18

Effect of drunkenness on initial behavior and transitions

```
proc lta data=pgm.sex start=sex_start;
  title1 'Drunkenness Predicting Time 1 Class and
          Transitions';
  nstatus 5;
  ntimes 3;
  items datepar_98 sex_yr_98 sexpar_98 expos_98
        datepar_99 sex_yr_99 sexpar_99 expos_99
        datepar_00 sex_yr_00 sexpar_00 expos_00;
  categories 3 2 3 2;
  covariates1 drunk_98;
  covariates2 drunk_98 drunk_98;
  reference1 1;
  reference2 1 2 3 4 5;
  measurement times;
run;
```

Drunkenness predicting initial behavior

Latent Class	Odds Ratio
Non-daters	---
Daters	3.4
Monogamous	3.7
Multi-partner safe	3.5
Multi-partner exposed	8.4

Those reporting past-year drunkenness are 8.4 times more likely than non-drinkers to be in the Multi-partner exposed latent class at Time 1 relative to the Non-daters.

(Risk of membership in High-risk class relative to Non-daters class is 8.4 times greater for those who report drunkenness)

Drunkenness predicting transitions

- **Among Non-daters:**

  4 x more likely to transition to Multi-partner exposed class relative to remaining in Non-daters

- **Among Daters:**

  3 x more likely to transition to Multi-partner exposed class relative to remaining in Daters

- **Among Multi-partner exposed:**

  Less likely to transition to Monogamous class relative to remaining in exposed class

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SAS PROC LTA and User's Guide available at:

http://methodology.psu.edu

Results are from…

Lanza, S. T., & Collins, L. M. (in press). A new SAS procedure for latent transition analysis: Transitions in dating and sexual risk behavior. *Developmental Psychology*.

PROC LTA: Software Features

- Multiple-groups LTA
- LTA with covariates
- Posterior probabilities saved to SAS data file
- Parameter estimates saved to SAS data file
- Optional Bayesian stabilizing prior