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The Development of Mental Health Problems through Childhood and Adolescence: Analysis using **National Longitudinal Data**

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Mental Health in Canada

- In Canada, approximately 20% of children and youth struggle with mental health(Canadian Pediatric Society, 2011), and these rates are rising in North America (O'Connell, Boat, & Warner, 2009).
- Mental health problems interfere with children's healthy development and functioning in many contexts (e.g., home, school, and community), continuing into adulthood with considerable social, psychological, and fiscal costs (Institute of Medicine, 2004)
- Leaders and researchers in Canada have identified improving children's mental health as a top priority.

Research Questions / Goals

- Estimate prevalence rate of mental health problem during adolescence and early adulthood in Canada.
- Identify developmental trajectories of internalizing mental health problems.
- Examine the gender differences in trajectory shapes and distributions.
- Identify risk and protective factors during childhood and adolescence which help to differentiate trajectory groups.

Sample and Outcome Measure

- The National Longitudinal Survey of Children and Youth (Statistics Canada & Human Resources Development Canada, 1994-2011, NLSCY).
  - Household survey to develop a national database on Canadian children's life experience from infancy into adulthood: 8 biennial data-collection cycles (1994, 1996, 1998, 2000, 2002, 2004, 2006, and 2008).

- Outcome - Depression: Youth-self reported occurrence and severity of symptoms of depression (12 items from CES-D). Depression scores ranged from 0 to 36, with higher score indicating the presence of depression symptoms.
  - The depression scale was only asked for youth 16 years of age and older.

Multiple Cohort Data Structure

- The multiple age cohort data structure.
  - Sample selection: A minimum of two data points on depression scale (Male: 2180; Female: 2400).

	Age at Cycle 4 – 8 (N=4590)					
Age Cycle 1	C4	C5	C6	C7	C8	N
6			16	18	20	520
7			17	19	21	550
8		16	18	20	22	880
9		17	19	21	23	860
10	16	18	20	22	24	920
11	17	19	21	23	25	870

Approaches To Cohort Structures

- Single group – using y16 – y 25
  - Missing by design and missing by attrition in longitudinal study.

	Age									
Age Cycle 1	16	17	18	19	20	21	22	23	24	25
6	C6	.	C7	.	C8	.	.	.	.	.
7	.	C6	.	C7	.	C8	.	.	.	.
8	C5	.	C6	.	C7	.	C8	.	.	.
9	.	C5	.	C6	.	C7	.	C8	.	.
10	C4	.	C5	.	C6	.	C7	.	C8	.
11	.	C4	.	C5	.	C6	.	C7	.	C8
N	1360	1250	2040	1920	2060	1920	1460	1340	680	630

Mixed Model for Longitudinal Data

Multilevel model with two levels (HLM)

$$y_{it} = \eta_{0i} + \eta_{1i} x_t + \eta_{2i} x_t^2 + e_{it}$$

$$\eta_{0i} = \alpha_0 + \gamma_0 w_i + \mu_{0i}$$

$$\eta_{1i} = \alpha_1 + \gamma_1 w_i + \mu_{1i}$$

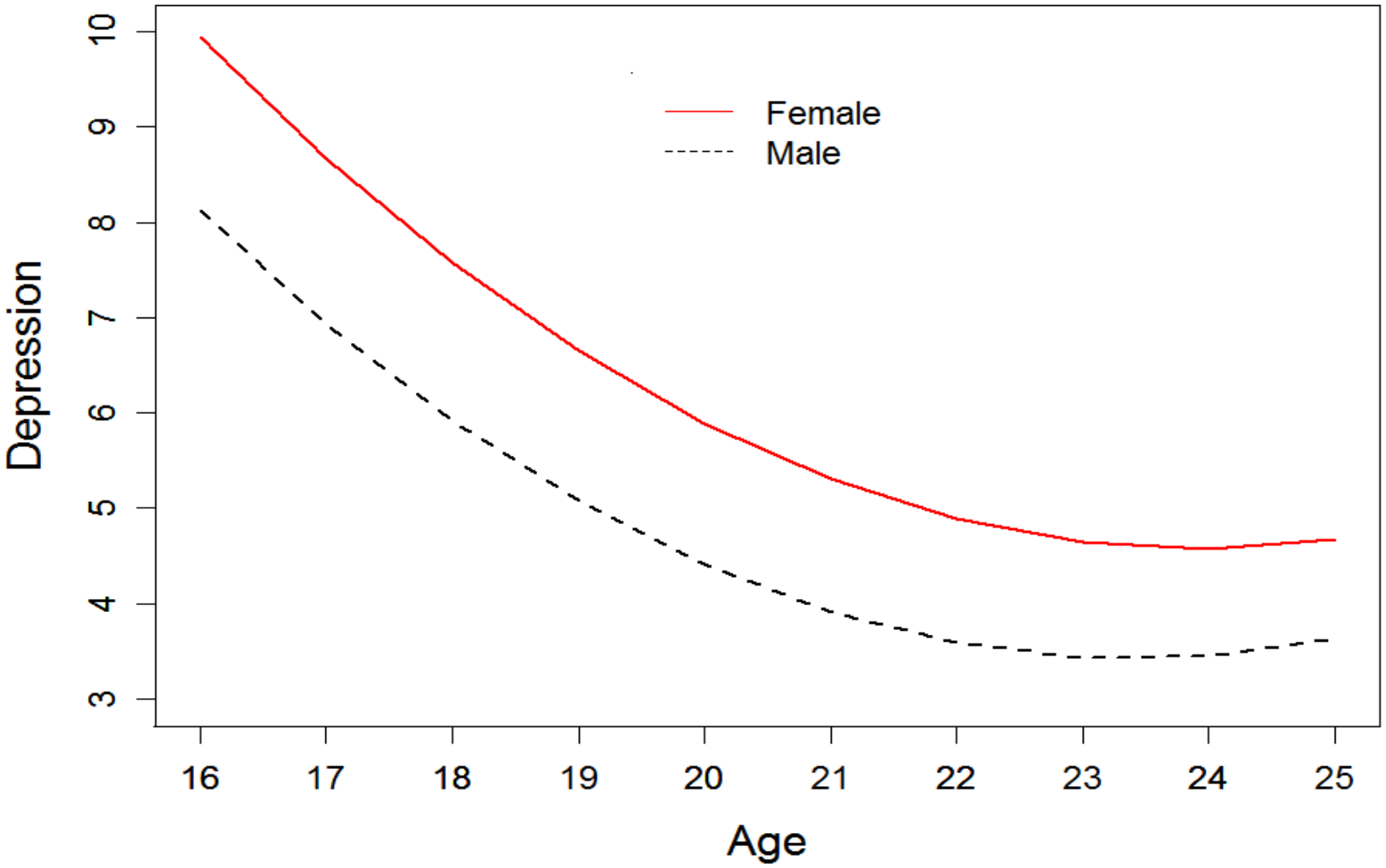
$$\eta_{2i} = \alpha_2 + \mu_{2i}$$

- Y: Depression
- X: Age – 16;
- W: Gender

Mixed linear model (SAS)

$$y_{it} = \alpha_0 + \gamma_0 w_i + (\alpha_1 + \gamma_1 w_i) x_t + \alpha_2 x_t^2 + \mu_{0i} + \mu_{1i} x_t + \mu_{2i} x_t^2 + e_{it}$$

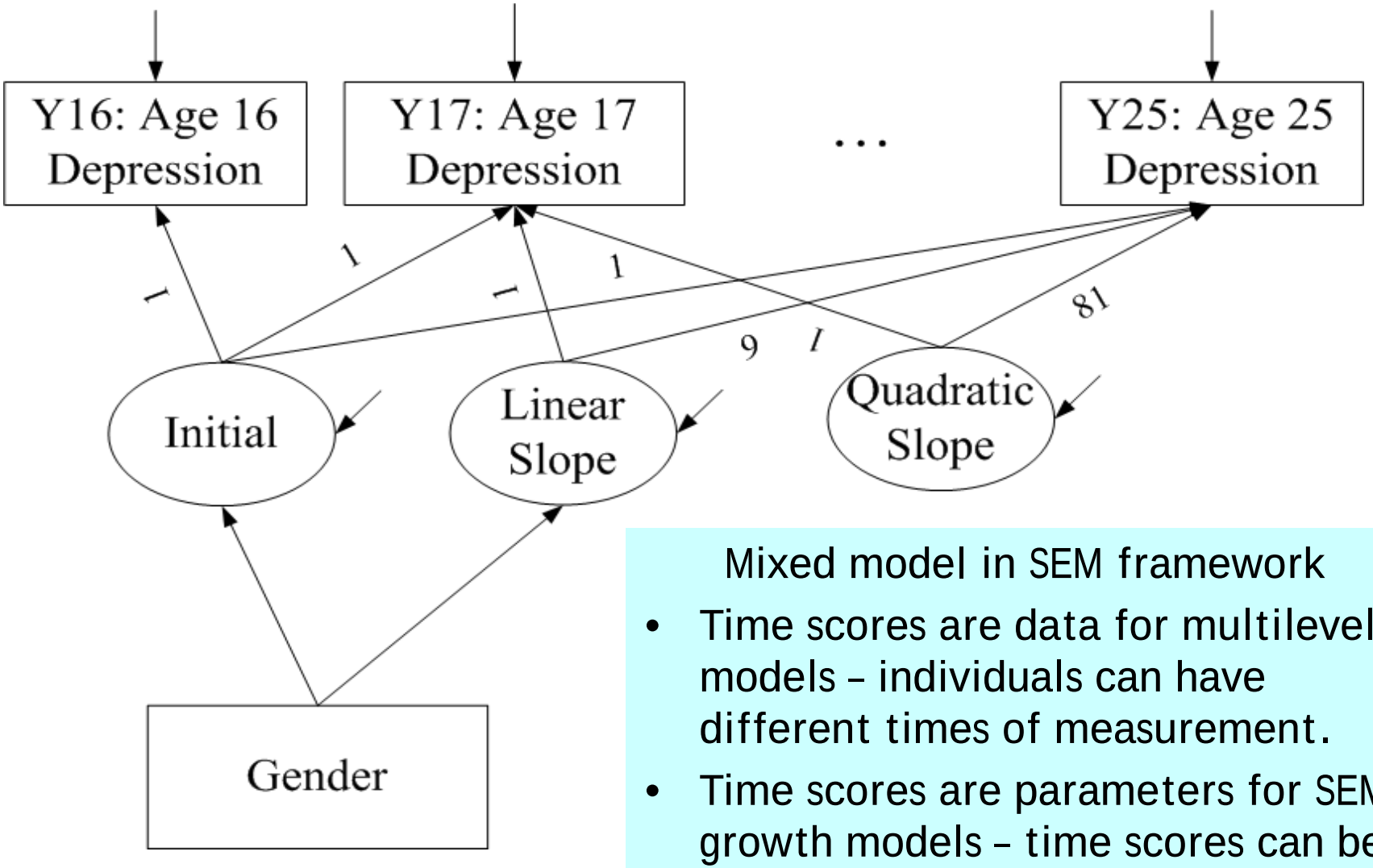
Estimated Mean Trajectories of Depression



Gender Difference From Mixed Model

- **Fixed part.**
  - Females has significant higher initial level of depression at Age 16 ($p < .001$)
  - There is significant gender difference in linear slope of change ($p = 0.008$).
  - The gender difference in quadratic slope is not statistically significant.
- **Random part.**
  - There are significant variations in both initial level and changes over time.
  - The changes over time is related the initial level.

Latent Growth Modeling: Covariance Structure Analysis

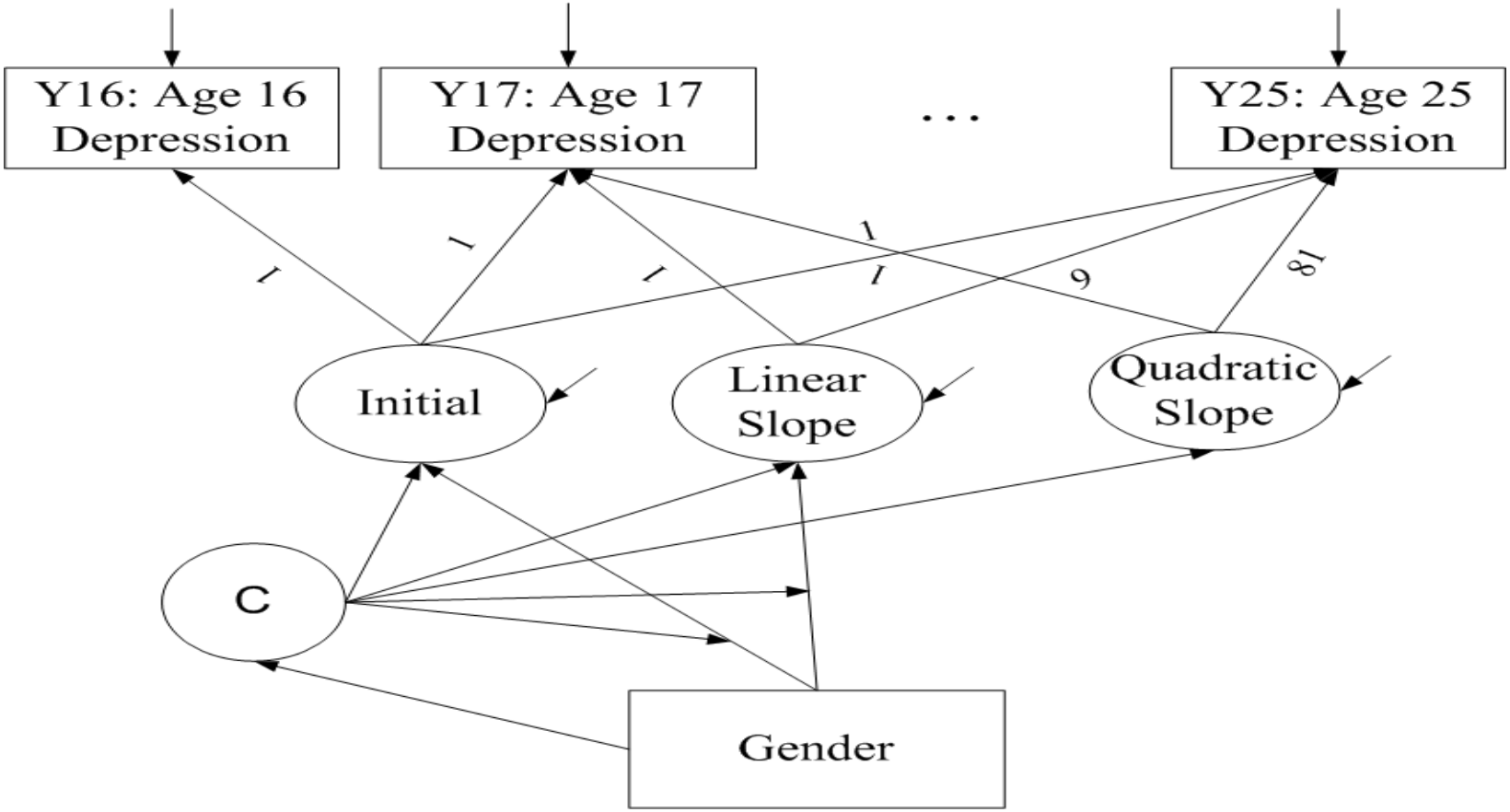


Mixed model in SEM framework

- Time scores are data for multilevel models – individuals can have different times of measurement.
- Time scores are parameters for SEM growth models – time scores can be estimated.

Latent Class Growth Model

- The latent class growth model (LCGM) seems to be the most appropriate method for taking into account unobserved heterogeneity (different groups) within a larger population.



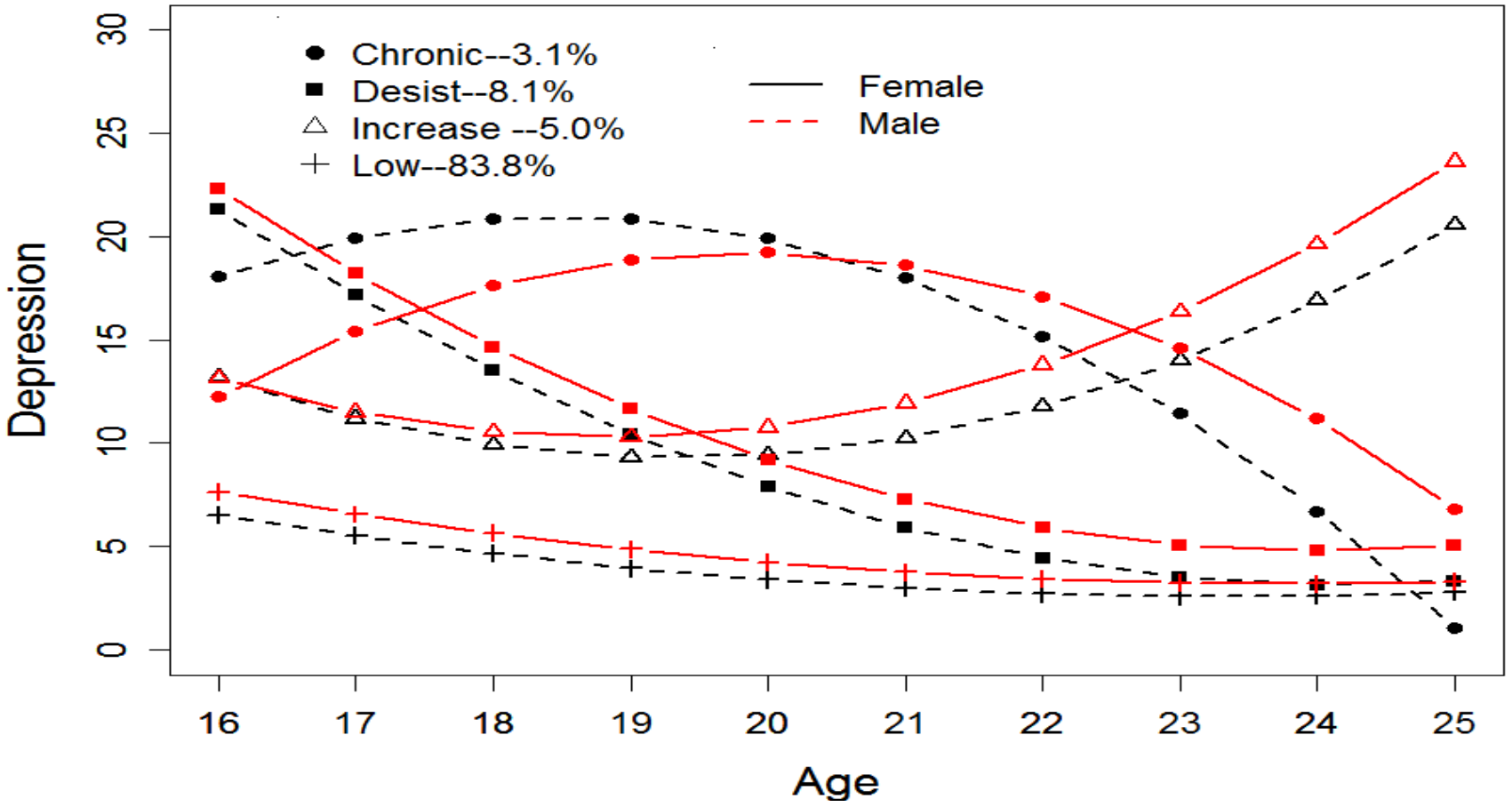
LCGM: Number of Classes

- **Find the number and shape of the different trajectory classes**
  - Determine the number of classes using latent class growth model (LCGM): no covariates, no within-class variances.
  - Based on BIC, classification quality, LMR-LRT (Lo, Mendell, and Rubin likelihood ratio test), and practical usefulness resulted in 4-class model.

# of classes	BIC	Entropy	LMR-LRT
2	87955.2	0.884	<.001
3	87279.4	0.844	0.477
4	**86796.5**	**0.855**	**0.001**
5	86580.3	0.805	0.432
6	86377.3	0.788	0.613

  - Extend LCGM to general mixture model by adding covariates and freely estimating the within-class variances.

Gender Difference by Trajectory Class



Odds ratios (95% CI) (Females vs. Males). (Reference: Low)

- Chronic: 2.1 (1.09-4.04); Desist: 2.12(1.35-3.33);
- Increase: 1.18 (0.77-1.80).

Prevalence of Mental Health Disorder

- 1000 bootstrap weights were used to estimate the prevalence rate of mental health disorder (SAS Macro Bootvar V3.2).
- It is estimated that about 271000 (166000 females and 105000 males) with mental health disorder during adolescence and early adulthood in Canada.

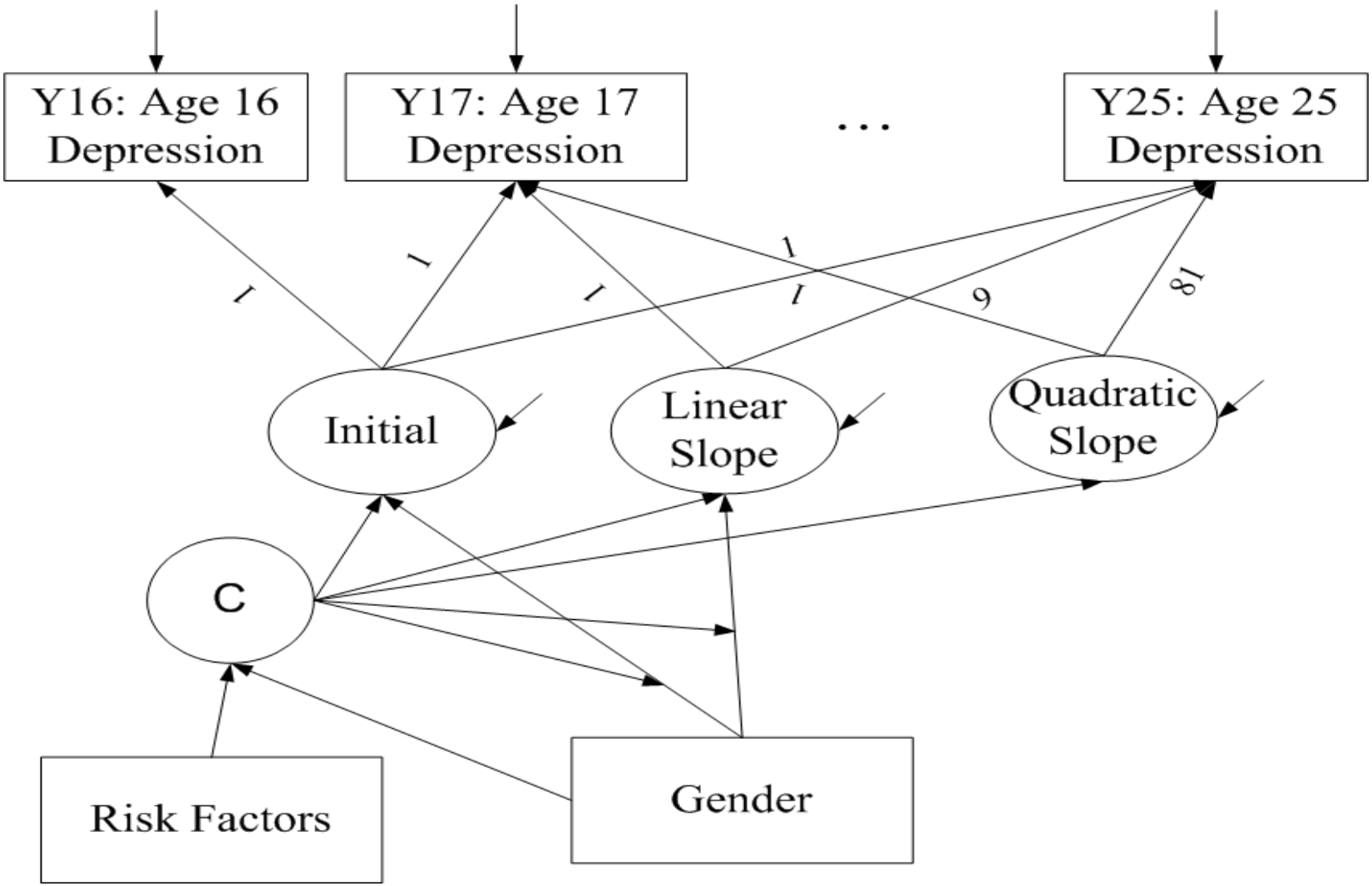
Estimated Prevalence rate (95% CI) using bootstrapped weights

	Female	Male	All
Mental health disorder	19.9(17.4-22.3)	12.9(10.4-15.4)	16.4(14.7-18.2)
Chronic	4.0(2.6-5.4)	2.1(1.2-2.9)	3.0(2.2-3.9)
Desist	10.6(8.8-12.5)	6.5(4.6-8.5)	8.6(7.3-9.9)
Increase	5.2(3.9-6.5)	4.3(2.8-5.8)	4.8(3.8-5.8)

Gender Difference in Trajectory Shape

Trajectory Class	Estimate(SE)	P-value
Chronic (3.1%)		
Initial on Female	**-5.81(3.00)**	0.051
Linear slope on Female	**1.28(0.37)**	<.001
Desist (8.1%)		
Initial on Female	**0.97(1.36)**	0.48
Linear slope on Female	**0.08(0.21)**	0.70
Increase (5.0%)		
Initial on Female	**-0.48(1.51)**	0.75
Linear slope on Female	**0.35(0.33)**	0.29
Low (83.8%)		
Initial on Female	**1.11(0.18)**	<.001
Linear slope on Female	**-0.07(0.03)**	0.034

Extended Growth Mixture Model



Summary

- Conventional growth model approaches (mixed model)
  - Individuals are allowed to vary only quantitatively, not qualitatively, in their latent initial status and latent rate of change, aside from groups defined by observed variables.

- Growth Mixture Model (GMM) and Latent Class Growth Model (LCGA) allow for qualitative mixture of latent classes with different functional forms.
  - The determination of latent trajectory classes;
  - Which model fit index to use;
  - The problem of convergence and local solutions.