

# 國立交通大學

統計學研究所

碩士論文

以潛在類別方法評估精神分裂症  
活性與負性症狀之潛在結構與轉變

Evaluation of Latent and Transition Structures of Positive and  
Negative Syndrome Scale (PANSS) in Schizophrenia using  
Regression Extension of Latent Class Analysis and Latent  
Transition Analysis

研究生：蔡秀慧  
指導教授：黃冠華 博士

中華民國九十五年六月

以潛在類別方法評估精神分裂症  
活性與負性症狀之潛在結構與轉變

Evaluation of Latent and Transition Structures of Positive and  
Negative Syndrome Scale (PANSS) in Schizophrenia using  
Regression Extension of Latent Class Analysis and Latent  
Transition Analysis

研究生：蔡秀慧  
指導教授：黃冠華

Student : Hsiu-Hui Tsai  
Advisor : Dr. Guan-Hua Huang

國立交通大學  
統計學研究所  
碩士論文

A Thesis  
Submitted to Institute of Statistics  
College of Science  
National Chiao Tung University  
in Partial Fulfillment of the Requirements  
for the Degree of  
Master  
in  
Statistics  
June 2006

Hsinchu, Taiwan, Republic of China  
中華民國九十五年六月

# 以潛在類別方法評估精神分裂症活性與負性 症狀之潛在結構與轉變

研究生：蔡秀慧

指導教授：黃冠華 博士

國立交通大學統計學研究所

## 摘要

本研究有兩個主要目的：一是探討精神分裂症之活性與負性症狀評量表(PANSS)的結構，一是深入研究在不同階段下結構的轉變。我們以潛在類別迴歸方法找出 219 位急性期精神分裂症患者可分為五種類別：混合、負性、解組性思考、妄想及活性/少數混合，並找出 225 位慢性期精神分裂症患者可區分為四種類別：少數混合、負性、妄想及無症狀，根據研究發現慢性期的症狀結構是附屬在急性症狀期的症狀結構之下。另外，以潛在變遷分析探討 115 位精神分裂症患者在急性與慢性期的結構轉變，我們發現兩階段的症狀結構皆有負性類別，且大多數在急性期屬於負性類別的病患，在慢性期仍會保留在負性類別中，顯示負性症狀不易治癒的可能性。

關鍵字：結構、症狀、精神分裂症、活性與負性症狀評量表、急性期、慢性期、潛在類別  
迴歸、潛在變遷分析

# Evaluation of Latent and Transition Structures of Positive and Negative Syndrome Scale (PANSS) in Schizophrenia using Regression Extension of Latent Class Analysis and Latent Transition Analysis.

**Student: Hsiu-Hui Tsai    Advisor: Dr. Guan-Hua Huang**

**Institute of statistics**

**National Chiao Tung University**

## **Abstract**

The main aim of the study is to examine the structure of the PANSS items by using the regression extension of latent class analysis (RLCA) and focuses mainly on the changes in latent class of the PANSS over time. The RLCA identified five-class labeled as mixed, negative, disorganized thought, delusion and positive/a little mixed on 219 acute patients, and identified four-class labeled as a little mixed, negative, delusion and no-symptoms on 225 chronic patients. Based on the research, it was indicated that the symptom structure on the chronic schizophrenia was nested within the symptom structure on the acute schizophrenia. In addition, the latent transition analysis (LTA) was carried out to examine the changes of latent class on 115 patients who had assessed PANSS in both two phases. We found that the component of the negative class was stability over time and most patients who belonged to the negative class in the acute phase would still retain in the negative class in the chronic phase. It shows the possibility that the negative symptoms are difficult to cure.

*Key words:* Structure, Symptoms, Schizophrenia, PANSS, Regression extension of latent class analysis (RLCA), Latent transition analysis (LTA), Acute, Chronic.

## 誌 謝

在統研所兩年，有快樂也有痛苦的事，許許多多的回憶點滴在心頭，快樂的事就是一群可愛的同學，痛苦的事莫過於生論文與念看不懂的 paper；在此非常感謝黃冠華老師在這兩年內不辭辛勞的指導，老師雖然很忙，但是仍盡力幫我找答案，適時給我鼓勵與支持，讓我不至於像我研究的主題一樣得精神分裂症，讓我能順利的撐過這兩年，一切都是老師您的幫助，所以，在此要跟您說一聲，「老師，謝謝您，您辛苦了。」也要謝謝所上的老師們在這兩年內的指導，讓我對統計有更深入的研究與瞭解；更謝謝台大醫院精神科提供資料讓我們研究分析，沒有可貴的資料，就沒有這份研究；還有要謝謝口試委員在口試時給我意見與建議，讓我的論文能更完整、更充實。

另外，也要謝謝陪我走過這兩年的好姐妹們，薰筑、大宛、孟樺、小宛、沛君、婉文與小馬，讓我的研究生涯不至於被煩惱包圍，讓我生活增添許多樂趣，真的很高興與認識妳們。再來，要感謝與我同個指導教授的志強，謝謝你在我苦惱論文生不出、程式跑不完時，給我的鼓勵與支持，也謝謝你時常幫我翻譯英文，幫我計算一些複雜的數學式子。

我還要感謝我的五專同學-佩馨，辛苦的幫我校稿，修改我的英文論文，還有陪我走過許多日子的小玉、章魚、珮怡、佳永、偉孝及台北的朋友們：鍾阿姨、聿芯、曉蕾、伉嫻、佳玲、怡靜，感謝妳們總是陪在我身旁，陪我渡過無數個開心與挫折的日子，真的好感謝老天讓我認識了你們，因為你們讓我的生活更快樂也更充實。

在此，僅以此篇論文獻給我的好友們，謝謝你們。

蔡秀慧 謹誌于

國立交通大學統計研究所

中華民國九十五年六月

# Contents

<b>Abstract(in Chinese)</b>	<b>i</b>
<b>Abstract(in English)</b>	<b>ii</b>
<b>Acknowledgements(in Chinese)</b>	<b>iii</b>
<b>Contents</b>	<b>iv</b>
<b>List of Tables</b>	<b>vi</b>
<b>List of Figures</b>	<b>ix</b>
<b>1 Introduction</b>	<b>1</b>
<b>2 Model Literature Review</b>	<b>5</b>
2.1 Regression Extension of Latent Class Analysis (RLCA) . . . . .	5
2.2 Latent Variable Mixture Modeling for Categorical Data . . . . .	6
2.3 Latent Transition Analysis . . . . .	8
2.4 Model estimation and assessment . . . . .	9
<b>3 Latent Structure of PANSS</b>	<b>12</b>
3.1 Background . . . . .	12
3.2 Method . . . . .	14
3.2.1 Subjects . . . . .	14
3.2.2 Instruments . . . . .	16
3.2.3 Study Variables . . . . .	17
3.2.4 Regression Extension of Latent Class Analysis (RLCA) . . . . .	20
3.2.5 Analytic Strategy . . . . .	21
3.3 Results . . . . .	23

3.3.1	Selecting the Number of Latent Classes . . . . .	23
3.3.2	Results of the Latent Class Model . . . . .	24
3.3.3	Comparison of Component of Structure for the PANSS . . . . .	34
3.4	Discussion . . . . .	37
<b>4</b>	<b>Transition of Structure on PANSS</b>	<b>41</b>
4.1	Background . . . . .	41
4.2	Method . . . . .	43
4.2.1	Subjects . . . . .	43
4.2.2	Instruments . . . . .	45
4.2.3	Study Variables . . . . .	46
4.2.4	Latent Transition Analysis . . . . .	48
4.2.5	Analytic Strategy . . . . .	49
4.3	Results . . . . .	51
4.4	Discussion . . . . .	59
<b>5</b>	<b>Conclusion</b>	<b>61</b>
	<b>References</b>	<b>62</b>



## List of Tables

<b>Table 1:</b> Characteristics of two groups of patients in the MPGRP project. ....	72
<b>Table 2:</b> Characteristics of the participants in the acute or chronic phase.....	73
<b>Table 3:</b> Characteristics of the PANSS for the acute or chronic phase.....	74
<b>Table 4:</b> AIC, BIC criteria and the number of fixed parameters in the acute and chronic phases under the latent class model without incorporated covariates. ....	75
<b>Table 5:</b> Final class proportions for the latent classes based on the estimated model. ....	76
<b>Table 6:</b> The summary results of the acute phase with the latent five-class model without covariates using our program. ....	77
<b>Table 7:</b> The summary results of the acute phase with the latent five-class model without covariates using Mplus. ....	78
<b>Table 8:</b> The summary results of the acute phase with the latent five-class model with demographic variables using our program. ....	79
<b>Table 9:</b> The summary results of the acute phase with the latent five-class model with demographic variables using Mplus.....	80
<b>Table 10:</b> The summary results of the acute phase with the latent five-class model with environmental factors adjusted significant demographic variables using our program. ...	81
<b>Table 11:</b> The summary results of the acute phase with the latent five-class model with environmental factors adjusted significant demographic variables using Mplus.....	82
<b>Table 12:</b> The summary results of the acute phase with the latent five-class model with the undegraded d' of the CPT performance adjusted significant demographic variables using our program. ....	83
<b>Table 13:</b> The summary results of the acute phase with the latent five-class model with the undegraded d' of the CPT performance adjusted significant demographic variables using Mplus.....	84
<b>Table 14:</b> The summary results of the acute phase with the latent five-class model with Table 4: the degraded d' of the CPT performance adjusted significant demographic variables using our program.....	85
<b>Table 15:</b> The summary results of the acute phase with the latent five-class model with the degraded d' of the CPT performance adjusted significant demographic variables using Mplus.....	86
<b>Table 16:</b> The summary results of the chronic phase with the latent four-class model without covariates using our program. ....	87
<b>Table 17:</b> The summary results of the chronic phase with the latent four-class model without covariates using Mplus. ....	88
<b>Table 18:</b> The summary results of the chronic phase with the latent four-class model with demographic variables using our program. ....	89
<b>Table 19:</b> The summary results of the chronic phase with the latent four-class model with	



demographic variables using Mplus.....	90
<b>Table 20:</b> The summary results of the chronic phase with the latent four-class model with environmental factors adjusted significant demographic variables using our program. ...	91
<b>Table 21:</b> The summary results of the chronic phase with the latent four-class model with environmental factors adjusted significant demographic variables using Mplus.....	92
<b>Table 22:</b> The summary results of the chronic phase with the latent four-class model with the undegraded d' of the CPT performance adjusted significant demographic variables using our program. ....	93
<b>Table 23:</b> The summary results of the chronic phase with the latent four-class model with the degraded d' of the CPT performance adjusted significant demographic variables using our program.....	94
<b>Table 24:</b> The summary results of the chronic phase with the latent four-class model with the number of categories completed of the WCST adjusted significant demographic variables using our program.....	95
<b>Table 25:</b> The summary results of the chronic phase with the latent four-class model with the perseverative errors of the WCST adjusted significant demographic variables using our program.....	96
<b>Table 26:</b> The summary results of the chronic phase with the latent four-class model with the perseverative errors of the WCST adjusted significant demographic variables using Mplus.....	97
<b>Table 27:</b> The summary results of the chronic phase with the latent four-class model with the full scale IQ of the WAIS-R adjusted significant demographic variables using our program.....	98
<b>Table 28:</b> The summary results of the chronic phase with the latent four-class model with the full scale IQ of the WAIS-R adjusted significant demographic variables using Mplus. ...	99
<b>Table 29:</b> The summary results of the chronic phase with the latent four-class model with the sum of WMS-R Logical Memory I and Logical Memory II adjusted significant demographic variables using Mplus. ....	100
<b>Table 30:</b> The summary results of the chronic phase with the latent four-class model with the TMT-A adjusted significant demographic variables using our program. ....	101
<b>Table 31:</b> The summary results of the chronic phase with the latent four-class model with the TMT-A adjusted significant demographic variables using Mplus.....	102
<b>Table 32:</b> The summary results of the chronic phase with the latent four-class model with the TMT-B adjusted significant demographic variables using our program. ....	103
<b>Table 33:</b> The summary results of the chronic phase with the latent four-class model with the TMT-B adjusted significant demographic variables using Mplus.....	104
<b>Table 34:</b> Comparison of structure for the PANSS items for the present study with other studies. ....	105
<b>Table 35:</b> Characteristics of the participants who assessed the PANSS in the both two phases.	

.....	109
<b>Table 36:</b> Characteristics of the PANSS for the participants who assessed the PANSS in the both two phases. ....	110
<b>Table 37:</b> The summary resulting from LTA without covariates. ....	111
<b>Table 38:</b> The summary resulting from LTA with demographic variables. ....	113
<b>Table 39:</b> The summary resulting from LTA with significant demographic variables and environmental factors. ....	115
<b>Table 40:</b> The summary resulting from LTA with significant demographic variables and the undegraded d' of the CPT performance.....	117
<b>Table 41:</b> The summary resulting from LTA with significant demographic variables and the degraded d' of the CPT performance.....	119



## List of Figures

**Figure 1:** AIC and BIC criteria for selecting the number of classes in the acute and chronic phases. .... 121



# 1 Introduction

Schizophrenia is a psychotic disorder characterized by several sets of symptoms, according to the criteria of the Diagnostic and Statistical Manual of Mental of Disorders (4th ed., DSM-IV; American Psychiatric Association, 1994). Many studies have examined the structure of symptoms in schizophrenia. Since Crow proposed the two-factor concept of schizophrenia in 1980 (Crow et al., 1980), researchers began to produce evidence for a syndromic dichotomy (negative-positive) (Bilder et al.,1985; Cornblatte et al., 1985; Andreasen and Grove, 1986; Kay and Sevy, 1990; Mortimer et al., 1990). The positive symptoms, such as hallucinations and delusions, represent a behavioral excess generally considered psychotic. In contrast, negative symptoms, such as blunted affect and passive social withdrawal, represent a deficiency in normal behavior. Although many of these investigations developed the symptom structures from Crow's original two-dimension distinction and others also found that more than two components are needed to describe the symptoms in Schizophrenia (Liddle, 1987; Arndt et al., 1991; Andreason et al.,1995; Lindenmayer et al., 1995; Lenzenweger and Dworkin, 1996; Johnstone and Frith, 1996), such as Liddle (1987) proposed the disorganization symptoms. A recent study suggested that a four-factor model fit as well as two- and three- factor models (Dollfus and Everitt, 1998). However, the study was limited by the heterogeneity of patients in acute and stabilized phases and its lack of validation by follow-up data.

Some instruments were developed for measuring and quantifying different symptom dimensions, such as the Assessment of Negative Symptoms (SANS; Andreasen, 1983), the Scale for the Assessment of Positive Symptoms (SAPS; Andreasen, 1984) and the Positive and Negative Syndrome Scale (PANSS; Kay et al., 1987). The SANS and SAPS were designed to measure Positive and Negative syndromes. These instruments may be limited in their potential to identify schizophrenia subtypes because of the prior selection of symptoms. The PANSS is a more extensive assessment of the symptom phenomenology

of schizophrenia. It was developed by Kay et al. used the Brief Psychiatric Rating Scale (BPRS; Overall and Gorham, 1962) and the Psychopathology Rating Schedule (PRS; Singh and Kay, 1979). The PANSS provides well-defined operational criteria for symptom assessment yielding good to excellent inter-rater reliability. It demonstrates better inter-rater reliability and greater predictive power than the BPRS (Bell et al., 1992) and has been an effective research tool in a wide range of studies (Kay, 1990).

A number of studies performed exploratory factor analyses (EFA; Lin et al., 1996, 1998), confirmatory factor analysis (CFA; Dollfus and Everitt, 1998), or cluster analysis (Dollfus et al., 1996) for unraveling the structure of the PANSS items. White et al. (1997) fitted 20 previously proposed models to data from a sample of 1,233 schizophrenics for attempt to reconcile the different research finds. They concluded that none of these models fitted the data adequately, then they derived a new "pentagonal" model retaining only 25 items of the PANSS, which were labeled: Positive, Negative, Dysphoric mood, Activation, and Autistic preoccupation, and it's presently proposed in the manual for the PANSS (Kay et al., 2000).

However, the study by White et al. did not finish the argument surrounding the factor structure of the PANSS. Critics argued that the structure of the PANSS items may not be best represented by five components (Emsley et al., 2003), and the proposed pentagonal model had inadequate goodness of fit in other samples (Lykouras et al., 2000; Fitzgerald et al., 2003). Differences in patient characteristics and symptom ensembles assessed might partly account for the discrepancies. In addition, the inclusion of patients at different stages of the disease may constitute another source of bias. This study was conducted in schizophrenic patients at various progressive stages of the disease. We conducted a study in two distinct populations of schizophrenic patients, one in the acute, and the other in the chronic stage.

On the other hand, most studies that examined the symptom components in schizophrenia suffered from the limitation that symptoms were measured only cross-sectionally.

Therefore, how the composition of the symptom components changes over time remains unknown. Kulhara and Chandiramani (1990) found 98 schizophrenic inpatients could be divided into three symptom factors (negative symptoms, positive symptoms, thought disorder). However, 18-30 months later, 79 of these patients were reassessed and the composition of these symptom factors had changed, which was that a mixed symptom factor replaced the positive symptom factor. Goldman et al. (1991) reported that at both time, which were prior to intervention (medication-free baseline) and after 4 weeks of neuroleptic treatment, three symptom factors were evident (negative symptoms, positive symptoms, and unstable behavioral agitation) and that the pre- and post-treatment factor loading patterns were similar in 40 schizophrenic inpatients. Addington and Addington (1991) found two symptom factors having eigenvalues greater than unity (negative symptoms and thought disorder) in 41 schizophrenic inpatients at beginning of the study. However, after 6 months, the reality distortion factor appeared in place of the thought disorder. Van der Does et al. (1995) rated 65 schizophrenic patients at the acute phase, 3 months later, and 1 year after the second assessment. They found that there was a different factor structure at each assessment, but a four-dimensional structure (disorganization, negative symptoms, positive symptoms, and depression) was stable over time. According to a study of Nakaya et al. (1999) with 86 newly admitted schizophrenic patients, four symptom factors were observed in the acute phase (negative symptoms, excited, delusion/hallucinatory, and thought disorder). However, in the post-acute phase, three symptom factors were evident (negative symptoms, mixed symptoms, and thought disorder). They suggested that the negative symptom component is stable while the difference in the phase of illness has some effects on the symptom structure of schizophrenia. Therefore, each previous study produces different findings about the composition of symptom components over time and the sampling and assessment methods differed among the previous studies, making any comparison difficult. Although a part of previous studies explored the symptomatology of schizophrenia in different phase, but how the patients will change between the acute

phase and the chronic phase, that remains unknown.

In present, there are two main researches included in the study. One is to examine the structure of the PANSS items by using the regression extension of latent class analysis (RLCA, Huang and Bandeen-Roche, 2004), which is useful for classifying subjects based on their responses to a set of categorical items. Another focuses on the changes in latent class of the PANSS over time. First, the number of classes for two distinct phases of the disease will be selected based on AIC and BIC criteria. Second, according to the number of classes obtained in first step, the regression extension of latent class analysis (RLCA, Huang and Bandeen-Roche, 2004) will be performed to classify schizophrenic patients at two distinct phases (acute and chronic) of the disease. In addition, we will perform RLCA with demographic variables, environmental factors or neuropsychological variables to explore the relation between the latent class and demographic variables, environmental factors or neuropsychological variables. On the other hand, the structure of the PANSS in this study is compared with the structure of the PANSS in the previous studies. Third, the changes in the structure of the PANSS items in both the acute phase and the chronic phase will be examined by applying latent transition analysis (LTA). Besides, we will perform LTA with demographic variables, environmental factors or neuropsychological variables to explore the changes of the structure of the PANSS after adjusting demographic variables, environmental factors or neuropsychological variables.

## 2 Model Literature Review

### 2.1 Regression Extension of Latent Class Analysis (RLCA)

Let  $(Y_{i1}, \dots, Y_{iM})^T$  represent the  $M \times 1$  response vector and  $S_i$  denote the unobservable latent categorical variables, for the  $i$ th individual in a study sample of  $N$  persons.  $Y_{im}$  can take values  $\{1, \dots, K_m\}$ , where  $K_m \geq 2$ ,  $m = 1, \dots, M$ , and  $S_i$  can take values  $\{1, \dots, J\}$ . The LCA model is based on the concept of conditional independence in the sense that the measured indicators are assumed to be independent of one another within any category of the latent variable. Therefore, the distribution for  $(Y_{i1}, \dots, Y_{iM})$  can be expressed as

$$\Pr(Y_{i1} = y_1, \dots, Y_{iM} = y_m) = \sum_{j=1}^J \{Pr(S_i = j) \prod_{m=1}^M \prod_{k=1}^{K_m} [Pr(Y_{im} = k | S_i = j)]^{y_{mk}}\}, \quad (1)$$

where,  $y_{mk} = 1$  if  $y_m = k$ ; 0 otherwise. The LCA model assumes that

$$\Pr(Y_{im} = k | S_i = j) = p_{mkj}, \quad Pr(S_i = j) = \eta_j, \quad (2)$$

Thus,  $\eta_j$  are the “latent class probabilities” of each underlying variable category, and  $p_{mkj}$  are the “conditional probabilities” of the measured responses given the underlying variable category.

To incorporate covariate effects into LCA, let  $\mathbf{x}_i$  be the associated covariate vector for the  $i$ th person, where  $\mathbf{x}_i = (x_{i1}, \dots, x_{iP})^T$  are predictors associated with latent class  $S_i$ . The covariates may include any combination of continuous and discrete measures. The Regression Extension of Latent Class Analysis (RLCA) is then stated as

$$\Pr(Y_{i1} = y_1, \dots, Y_{iM} = y_m | \mathbf{x}_i) = \sum_{j=1}^J \{\eta_j(\mathbf{x}_i) \prod_{m=1}^M \prod_{k=1}^{K_m} [p_{mkj}]^{y_{mk}}\}, \quad (3)$$

with  $\eta_j(\mathbf{x}_i)$  defined as in the generalized linear framework (McCullagh and Nelder, 1989).

Often, (3) is implemented assuming generalized logit (Agresti, 1984) link functions:

$$\log\left[\frac{\eta_j(\mathbf{x}_i)}{\eta_J(\mathbf{x}_i)}\right] = \alpha_j + \beta_{1j}x_{i1} + \dots + \beta_{Pj}x_{iP} = \alpha_j + \boldsymbol{\beta}'_j \mathbf{x}_i, \quad (4)$$

and

$$\log\left[\frac{p_{mkj'}}{p_{mK_mj'}}\right] = \gamma_{mkj'}, \quad (5)$$



$i = 1, \dots, N; m = 1, \dots, M; k = 1, \dots, K_m - 1; j = 1, \dots, J - 1; j' = 1, \dots, J$ . Through (4), we can summarize the effects of risk factors on the underlying mechanism. Parameters in (4) and (5) can be estimated through the EM algorithm (Dempster, Laird and Rubin, 1977), which is a broadly applicable approach to the iterative computation of maximum likelihood estimates while the model can be viewed as an “incomplete-data” problem. Three assumptions complete the model (3):

(C1) Latent class membership is associated with  $\mathbf{x}_i$ , and their relationship can be stated as (4):

$$\Pr(S_i = j | \mathbf{x}_i) = \frac{\exp(\alpha_j + \boldsymbol{\beta}'_j \mathbf{x}_i)}{1 + \sum_{l=1}^{J-1} \exp(\alpha_l + \boldsymbol{\beta}'_l \mathbf{x}_i)}, \quad j = 1, \dots, J - 1.$$

(C2) The conditional probabilities of responses are independent of  $\mathbf{x}_i$  and can be stated as (5):

$$\Pr(Y_{i1} = y_1, \dots, Y_{iM} = y_m | S_i, \mathbf{x}_i) = \Pr(Y_{i1} = y_1, \dots, Y_{iM} = y_m | S_i), \text{ with}$$

$$\Pr(Y_{im} = k | S_i = j') = \frac{\exp(\gamma_{mkj'})}{1 + \sum_{s=1}^{K_m-1} \exp(\gamma_{msj'})},$$

$$m = 1, \dots, M; k = 1, \dots, K_m - 1; j' = 1, \dots, J.$$

(C3) Multiple measurements are conditionally independent given class membership:

$$\Pr(Y_{i1} = y_1, \dots, Y_{iM} = y_m | S_i) = \prod_{m=1}^M \Pr(Y_{im} = y_m | S_i).$$

For more detailed on model characteristics, parameter estimations and theoretical properties, readers may reference Huang and Bandeen-Roche (2004).

## 2.2 Latent Variable Mixture Modeling for Categorical Data

Consider the observed variables  $\mathbf{x}_i$  and  $Y$ , where  $\mathbf{x}_i$  denotes a  $P \times 1$  vector of covariates,  $Y$  denotes a  $M \times 1$  vector of ordered polytomous categorical outcome variables. Consider

the unobservable latent categorical variable  $S_i$  can take values  $\{1, \dots, J\}$ . The model relates  $S_i$  to  $\mathbf{x}_i$  by multinomial logistic regression can be written as

$$\Pr(S_i = j|\mathbf{x}_i) = \frac{\exp(\alpha_j + \boldsymbol{\beta}'_j \mathbf{x}_i)}{1 + \sum_{l=1}^{J-1} \exp(\alpha_l + \boldsymbol{\beta}'_l \mathbf{x}_i)}, \quad i = 1, \dots, N; j = 1, \dots, J - 1. \quad (6)$$

In Mplus (Muthén and Muthén, 1998-2001), the threshold parameter,  $\tau$ , enter into the mixture model with categorical responses. The concept of a latent response variable  $Y_{im}^*$  is useful for defining a categorical variable  $Y_{im}$  with  $k$  ordered categories, such as

$$Y_{im} = k, \text{ if } \tau_{m,j,k-1} < Y_{im}^* \leq \tau_{m,j,k} \quad (7)$$

where  $i = 1, \dots, N; m = 1, \dots, M; k = 1, 2, \dots, K_m$  and  $\tau_{m,j,0} = -\infty, \tau_{m,j,K_m} = \infty$ , As shown above, the logit regression models are usually presented in terms of the conditional probability of  $Y_{im}$  given  $S_i$ ,

$$\log\left[\frac{\Pr(Y_{im} > k|S_i = j)}{1 - \Pr(Y_{im} > k|S_i = j)}\right] = \log\left[\frac{\Pr(Y_{im}^* > \tau_{m,j,k}|S_i = j)}{1 - \Pr(Y_{im}^* > \tau_{m,j,k}|S_i = j)}\right] = -(\tau_k - Y_{im}^*), \quad (8)$$

Such that

$$\Pr(Y_{im} > k|S_i = j) = \frac{e^{-(\tau_k - Y_{im}^*)}}{1 + e^{-(\tau_k - Y_{im}^*)}}, \quad (9)$$

$$\Pr(Y_{im} \leq k|S_i = j) = F_k(Y_{im}^*|S_i = j) = \frac{1}{1 + e^{-(\tau_k - Y_{im}^*)}}, \quad (10)$$

Therefore, the conditional probabilities of categorical responses can be written as

$$\Pr(Y_{im} = k|S_i = j) = F_k(Y_{im}^*|S_i = j) - F_{k-1}(Y_{im}^*|S_i = j), \quad (11)$$

where  $i = 1, \dots, N; m = 1, \dots, M; k = 1, 2, \dots, K_m$ . Corresponding to the categorical case in (11), the latent response variable formulation defines a threshold  $\tau_{m,j,k}$  on  $Y_{im}^*$ . A linear regression equation is used to relate  $Y_{im}^*$  on class  $j$ ,

$$Y_{im}^* = \alpha_{mj} + \varepsilon_{mj}, \quad (12)$$

where  $\alpha_{mj}$  is a overall mean for the  $j$ th class, and  $\varepsilon_{mj}$  is a residual or measurement errors which is uncorrelated with other variables. In addition, normality is assumed for the  $\varepsilon_{mj}$

the residual,  $\varepsilon_{mj} \sim N(0, V(\varepsilon_{mj}))$ . Equation (12) does not include the order category (k) specific terms given the presence of the  $\tau_k$  parameters, and  $\tau_k$  parameters have opposite signs than  $Y_{im}^*$  in equation (12) because of their interpretation as thresholds or cutpoints that a latent continuous response variable  $Y_{im}^*$  exceeds or falls below (see also Agresti, 1990, pp. 322-324).

## 2.3 Latent Transition Analysis

Latent transition analysis is a form of latent class analysis where the multiple measures of the latent classes are repeated over time and where across-time transitions between classes are of particular interest. Suppose a sample of  $N_t$  individual are asked a series of  $M$  questions at occasion  $t$ . Let  $p_{mkjt}$  represent the conditional probability for members of the  $j$ th latent class ( $j = 1, \dots, J_t$ ) that each manifest item,  $m$  ( $= 1, \dots, M$ ), will at occasion  $t$  ( $= 1, \dots, T$ ) take value  $k$  ( $= 1, \dots, K_m$ ) and  $\eta_{jt}$  represent the latent class probability of a person belonging to the  $j$ th latent class at occasion  $t$ . The measured indicators,  $Y_{imt}$ , are assumed to be independent of future/past category of the latent variable given current category of the latent variable. From RLCA above, the logistic functions can be expressed as

$$\log\left[\frac{\eta_{jt}}{\eta_{J_t t}}\right] = \alpha_{jt}, \log\left[\frac{p_{mkj't}}{p_{mK_m j't}}\right] = \beta_{mkj't}, \quad (13)$$

where  $m = 1, \dots, M; k = 1, \dots, K_m - 1; j = 1, \dots, J_t - 1; j' = 1, \dots, J_t; t = 1, \dots, T$

Scientific interest focuses on changes in latent classes over time. This makes the modeling of transition probabilities between pairs of classes natural. We consider a first-order stationary transition model, the present occasion only depends on the immediately preceding occasion and this dependence is assumed constant over time. Suppose a sample of size  $N$  is asked  $M$  question at occasion  $t$  and  $t - 1$ . Therefore, the transition probability for the  $i$ th person can be expressed as

$$\tau_{ijl} = Pr(S_{it} = j | S_{i,t-1} = l), \quad (14)$$

where  $t = 2, \dots, T$ ;  $l = 1, \dots, J_{t-1}$  and  $j = 1, \dots, J_t$ . This is the probability that the  $i$ th person is in the  $j$ th latent class at the present time period given they were in the  $l$ th latent class at the preceding time period. The transition probability is assumed invariant over time, hence the absence of a  $t$  subscript on  $\tau_{ijl}$ . To add the covariate effect,  $\mathbf{x}_i$ , into the transition probabilities, one can use the multinomial logistic regressions for the  $i$ th person at occasion  $t$

$$\log\left[\frac{\tau_{ijl}(\mathbf{x}_i)}{\tau_{iJ_t l}(\mathbf{x}_i)}\right] = \gamma_j + \delta_{jl} + \zeta_j \mathbf{x}_{it}, \quad (15)$$

where  $i = 1, \dots, N$ ;  $j = 1, \dots, J_t - 1$ ;  $l = 1, \dots, J_{t-1} - 1$ ;  $t = 2, \dots, T$ . Note that the covariates,  $\mathbf{x}_{it} = (x_{i1t}, \dots, x_{iPt})^T$ , can be either discrete or continuous and possibly time-dependent. The reference class,  $J_t$ , is arbitrarily chosen, however, interpretation of the transition probabilities are not affected by the parameterization. The parameter  $\gamma_j$  is the log odds that an individual is in the  $j$ th latent class at the present time period given they were in the reference class at the preceding time period with covariates  $\mathbf{x}_{it} = 0$ . The parameter  $\delta_{jl}$  is a log odds ratio to be in the  $j$ th latent class at the present time period among individuals who were in the  $l$ th latent class at the preceding time period to the odds among individuals who were in the reference class at the preceding time period adjusting for covariates  $\mathbf{x}_i$ . The parameter  $\zeta_j$  is the effect of various covariates on the relative odds that a individual is in the  $j$ th latent class at the present time period adjusting for their prior state. Based on the model above, the transition probabilities are:

$$\tau_{ijl}(\mathbf{x}_i) = \frac{\exp(\gamma_j + \delta_{jl} + \zeta_j \mathbf{x}_{it})}{1 + \sum_{k=1}^{J_t-1} \exp(\gamma_k + \delta_{kl} + \zeta_k \mathbf{x}_{it})}, \quad (16)$$

Further technical details about parameter estimation and other aspects of LTA can be found in Collins et al. (1990).

## 2.4 Model estimation and assessment

All the above mixture model is estimated by maximum-likelihood. The EM algorithm (Muthén and Shedden, 1999) is implemented to obtain maximum-likelihood estimates.

The mixture model allows  $Y$  to be missing at random (Little and Rubin, 1987). It should be noted that mixture models in general are prone to have multiple local maxima of the likelihood and the use of several different sets of starting values in the iterative procedure is strongly recommended.

With maximum-likelihood estimation, we compute information criteria which are useful for comparing non-nested models. The Akaike information criterion (AIC) is defined as

$$AIC = -2 \log L + 2T, \quad (17)$$

where  $T$  is the number of free model parameters (Akaike, 1987) and  $\log L = \sum_{i=1}^N \log Pr(Y_i | \mathbf{x}_i)$ ,  $Y_i = (Y_{i1}, \dots, Y_{iM})^T$ , being the log likelihood function. The Bayesian information criterion (Schwartz, 1978) is defined as

$$BIC = -2 \log L + T \ln N. \quad (18)$$

where  $N$  is the number of observations. The model with the smallest AIC or BIC value is taken to be the best one.

On the other hand, we performed latent class analysis (LCA) with number of latent classes varying from two to eleven for selecting the best number of classes by AIC and BIC criteria. We selected the best model to consider how the AIC and BIC value to change, when the number of latent classes of LCA varied from two to eleven, and consider the stability of the model, which is the number of fixed parameters and the latent prevalence of each class, with number of latent classes varying from two to eleven.

The degree to which the latent classes are clearly distinguishable by the data and the model can be assessed by using the estimated posterior probabilities for each individual in each class. By classifying each individual into his/her most likely class, a  $J \times J$  table can be constructed with rows corresponding to individuals who have the highest probability for that class and the entries are average probabilities in each class. For individuals in each row, the column entries give the average and conditional probabilities. This will be

referred to as a classification table (Nagin, 1999). High diagonal is given by the entropy measure (Ramaswamy et al., 1993),

$$E_J = 1 - \frac{\sum_{i=1}^N \sum_{j=1}^J (-\hat{p}_{ij} \ln \hat{p}_{ij})}{N \ln J}, \quad (19)$$

where  $\hat{p}_{ij}$  denotes the estimated posterior probability for individual  $i$  in class  $j$ . Entropy values range from zero to one, where entropy values close to one indicate clear classifications in that the entropy decreases for probability values that are not close to zero or one.



## 3 Latent Structure of PANSS

### 3.1 Background

According to the criteria of the Diagnostic and Statistical Manual of Mental of Disorders (4th ed., DSM-IV; American Psychiatric Association, 1994), schizophrenia is a psychotic disorder characterized by several sets of symptoms. Many studies have examined the structure of symptoms in schizophrenia. Since Crow proposed the two-factor concept of schizophrenia in 1980 (Crow et al., 1980), researchers began to produce evidence for a syndromic dichotomy (negative-positive) (Bilder et al., 1985; Cornblatte et al., 1985; Andreasen and Grove, 1986; Kay and Sevy, 1990; Mortimer et al., 1990; Dollfus et al., 1991; Peralta et al., 1992; Bell et al., 1994a; White et al., 1994). Positive symptoms, such as hallucinations and delusions, represent a behavioral excess generally considered psychotic. In contrast, negative symptoms, like blunted affect and passive social withdrawal, represent a deficiency in normal behavior. Till now, many of these investigations have developed the symptom structures from Crow's original two-dimension distinction, and researchers have found that more than two components are required to describe the symptoms in Schizophrenia (Liddle, 1987; Arndt et al., 1991; Andreason et al., 1995; Lindenmayer et al., 1995; Lenzenweger and Dworkin, 1996; Johnstone and Frith, 1996). For instance, Liddle (1987) has proposed the disorganization symptoms. A recent study suggested that a four-factor model fit as well as two- and three- factor models (Dollfus and Everitt, 1998). However, the study was limited by the heterogeneity of patients in acute and stabilized phases and its lack of validation by follow-up data.

Some instruments were developed for measuring and quantifying different symptom dimensions, such as the Assessment of Negative Symptoms (SANS; Andreasen, 1983), the Scale for the Assessment of Positive Symptoms (SAPS; Andreasen, 1984) and the Positive and Negative Syndrome Scale (PANSS; Kay et al., 1987). The SANS and SAPS were designed to measure Positive and Negative syndromes. These instruments may be

limited in their potential to identify schizophrenia subtypes because of the prior selection of symptoms. The PANSS is a more extensive assessment of the symptom phenomenology of schizophrenia. It was developed by Kay et al. using the Brief Psychiatric Rating Scale (BPRS; Overall and Gorham, 1962) and the Psychopathology Rating Schedule (PRS; Singh and Kay, 1975). The PANSS provides well-defined operational criteria for symptom assessment yielding good to excellent inter-rater reliability. It demonstrates better inter-rater reliability and greater predictive power than the BPRS (Bell et al., 1992) and has been an effective research tool in a wide range of studies (Kay and Sevy, 1990).

A number of studies performed exploratory factor analyses (EFA; Lin et al., 1996, 1998), confirmatory factor analysis (CFA; Dollfus and Everitt, 1998), or cluster analysis (Dollfus et al., 1996) for unraveling the structure of the PANSS items. White et al. (1997) fitted 20 previously proposed models to data from a sample of 1,233 schizophrenics for attempt to reconcile the different research finds. They concluded that none of these models fitted the data adequately, then they derived a new "pentagonal" model retaining only 25 items of the PANSS, which were labeled: Positive, Negative, Dysphoric mood, Activation, and Autistic preoccupation, and it's presently proposed in the manual for the PANSS (Kay et al., 2000).

However, the study by White et al. did not finish the argument surrounding the factor structure of the PANSS. Critics argued that the structure of the PANSS items may not be best represented by five components (Emsley et al., 2003), and the proposed pentagonal model had inadequate goodness of fit in other samples (Lykouras et al., 2000; Fitzgerald et al., 2003). Differences in patient characteristics and symptom ensembles assessed might partly account for the discrepancies. In addition, the inclusion of patients at different stages of the disease may constitute another source of bias. This study was conducted in schizophrenic patients at various progressive stages of the disease. We conducted a study in two distinct populations of schizophrenic patients, one in the acute, and the other in the chronic stage.



The aim of the study reported in this article is to examine the structure of the PANSS items by using the regression extension of latent class analysis (RLCA, Huang and Bandeen-Roche, 2004), which is useful for classifying subjects based on their responses to a set of categorical items. First, the number of classes for two distinct phases of the disease will be selected based on AIC and BIC criteria. Second, according to the number of classes obtained in first step, the regression extension of latent class analysis (RLCA, Huang and Bandeen-Roche, 2004) will be performed to classify schizophrenic patients at two distinct phases (acute and chronic) of the disease. In addition, we will perform RLCA with demographic variables, environmental factors or neuropsychological variables to explore the relation between the latent class and demographic variables, environmental factors or neuropsychological variables. On the other hand, the structure of the PANSS in this study is compared with the structure of the PANSS in the previous studies.

## **3.2 Method**

### **3.2.1 Subjects**

The subjects were composed of three projects, the Multidimensional Psychopathology Group Research Projects (MPGRP), the Multidimensional Psychopathological Study on Schizophrenia (MPSS) and the Study on Etiological Factors of Schizophrenia (SEFOS). The initial project started as the MPGRP from July 1993 till June 1998. The subsequent project following the initial MPGRP, was the MPSS started in July 1998 till June 2001. Both MPGRP and MPSS were successfully carried out from July 1993 to March 2001, and up to the time of sending this SEFOS proposal as the subsequent study on the pathogenesis of schizophrenia, a further step of psychopathological study on schizophrenia.

The focus of the MPGRP was to study the clinical manifestations of schizophrenia and the family situation in a cohort of schizophrenia patients. The MPGRP also concentrated on the phenotype definition of schizophrenia using CPT manifestation in the schizophrenia family. In the MPSS project, the focus was on the follow-up neuropsycho-

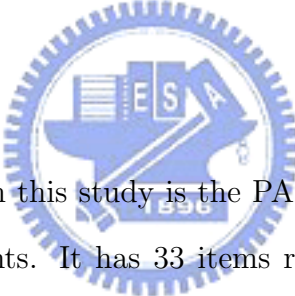
logical evaluation of the schizophrenia cohort collected in the MPGRP, other than the descriptive follow-up clinical data collection. The Program Project Grant (PPG) entitled SEFOS from January 2002 till December 2005, which aimed to search for the separate etiological factors under the understanding that schizophrenia is a complex disorder. The PPG of SEFOS formulated a dynamic etiological hypothesis of schizophrenia and was a retrospective/prospective study. The PPG of SEFOS designs 3 projects of: (1) A Study on Neurobiology of Schizophrenia; (2) A Study on Environmental insults/stress of schizophrenia; and (3) Molecular Genetics Study of Schizophrenia. The main purpose of these projects is to find different levels of neurobiological and anatomical abnormalities, to discover different levels of environmental insults/stress, and to locate vulnerability genes in different chromosome regions respectively.

The recruitment procedures have been described in detail in earlier reports of MPGRP project (Liu et al., 1997; Chen et al., 1998b; Chang et al., 2001). Briefly, from August 1, 1993 to June 30, 1998, all patients consecutively admitted to the acute inpatient wards of three hospitals, National Taiwan University Hospital, Taipei City Psychiatric Center, and Taoyuan Psychiatric Center, were included in MPGRP if they met DSM-IV (American Psychiatric Association, 1994) criteria for schizophrenia and consented to participate. The diagnoses were re-evaluated at discharge by consensus among three senior psychiatrists using all information available from clinical observations, medical records, and key informants. Up to 1998, the final year of MPGRP and the starting point for MPSS study, the MPGRP cohort would have been in their 2-5 years' of follow-up period. On this ground, further follow-up of the MPGRP cohort into the long term course, supplemented by neuropsychological evaluations, would provide unusual opportunities for an integrated clinical and neuropsychological approach. The MPSS project thus recruit MPGRP patients who agree to receive further follow-ups. Averagely, patients in the MPSS project were also included in the MPGRP for three follow-up years. In addition, the family which had two schizophrenia sib-paired children - one schizophrenia parent and the other one

should be normal - was the inclusion criteria for SEFOS.

This study included the 219 acute patients who had complete information from the PANSS at admission in the MPGRP project. The 122 chronic patients were assessed the PANSS in the first year of MPSS project and the 103 chronic patients had complete assessment of PANSS in the SEFOS project. Thus this study included the 225 chronic patients who participated in the MPSS or SEFOS project. On the other hand, the 115 subjects among these patients included were both assessed the PANSS in the MPGRP and MPSS projects. Thus, the patients in the MPGRP project was divided two groups, which one was follow-up into the MPSS project and the other was loss to follow-up into the MPSS project. Table 1 shows that the characteristics of two groups of patients. In the Table 1, it seems that the characteristics of the dropout patients were non-different from the non-dropout patients.

### 3.2.2 Instruments



The main applied instrument in this study is the PANSS, which is an assessment of the clinical symptoms of the patients. It has 33 items rated from 1 to 7 based on a semi-structured interview with detailed descriptions for symptom ratings, and it consists of four subscales: positive (seven symptoms: P1-P7), negative (seven symptoms: N1-N7), general psychopathology (sixteen symptoms: G1-G16), and supplementary excitability (three symptoms: S1-S3). Each item on the PANSS is accompanied by a complete definition as well as detailed anchoring criteria for all seven rating points, which represent increasing levels of psychopathology: 1 = absent, 2 = minimal, 3 = mild, 4 = moderate, 5 = moderate-severe, 6 = severe, 7 = extreme. The subscales of positive and negative syndromes are assumed to cover the core symptoms in these two dimensions (Kay et al., 1991). The subscales of general psychopathology and supplement items for the aggression risk profiles are considered to be the separated index of severity of illness (Kay et al., 1986). The Chinese version of the PANSS, the PANSS-CH, was translated from the English ver-

sion specifically for the MPGRP. The details of development of the PANSS-CH and the reliability test were published in earlier literature (Cheng et al., 1996). Psychopathology was further evaluated by a semi-structured interview using the PANSS-CH within 1 week after admission by attending psychiatrists who had completed the PANSS-CH reliability training. In an inter-rater reliability study, the coefficients of agreement (Kay, 1991) were satisfactory: 12 items were above 0.80, 17 items between 0.70 and 0.79, and the remaining four items between 0.66 and 0.69 (Cheng et al., 1996).

All subjects on admission of the MPGRP project have received psychiatrists' clinical assessments with the PANSS. After their condition stabilized during the index hospitalization, subjects were tested with the Continuous Performance Test (CPT; Rosvold et al., 1956). At each follow-up projects (MPSS and SEFOS), besides the PANSS ratings and CPT, the other neuropsychological tests were also completed by the Wisconsin Card Sorting Test (WCST), Wechsler Adult Intelligence Scale-Revised (WAIS-R), and Trail Making Tests A and B.



### **3.2.3 Study Variables**

#### **Demographic Variables**

Demographic variables include variables of age, gender, years of education, marital status (single versus married), occupation (with versus without occupation), and age of onset of psychotic symptom. Note that the married marital status consists of people living together and people getting married; housewives, students, people who never worked, who are unemployed or who already retired are included in people without occupation.

#### **Environmental Factors**

In this study, the environmental factors are related to obstetric complications, prenatal growth retardation, special personal behavior, the psychological problem, and so on. There are three environmental factors, described as follows separately.

- (1) The patient has brain injury in the growth, such as prenatal growth retardation, brain damage, retarded intelligence and so on.
- (2) Before getting disease, the patient had the unstable mood or abnormal behavior to interfere with adapting to the daily life, including angry, timid, depressed, inactive, having behavior problems, and so on.
- (3) Before getting disease, the patient had the psychological problems to interfere with adapting to life in their infancy, including bad relation between parents, getting along badly with sibling or parents, getting disease about body, unforeseen happenings of family, and so on.

The first environmental factor was rated by a 3-point scale with 0 as no circumstance, 1 as slight (have not obviously heart body obstacle) and 2 as obvious (have obviously heart body obstacle). Due to the ratio of obvious subjects with the first environmental factor was too low, we combined the slight subjects with the obvious subjects in the first environmental factor. The others were rated by a 3-point scale with 0 as no circumstance, 1 as slight (have not obviously influenced routine life) and 2 as obvious (have obviously influenced routine life). There were one dummy variable for the first environmental factor, two dummy variables for the others.

### **Neuropsychological Variables**

The neuropsychological battery assessed reaction time, attention, speed of information processing, and active problem solving. Specifically, the test battery included several standard neuropsychological instruments with demonstrated reliability and validity, including CPT, WCST, WAIS-R, WMS-R and Trail Making Tests A and B. These tests are briefly described below.

- **Continuous Performance Task** (CPT; Rosvold et al., 1956).

We used a CPT machine from Sunrise Systems, version 2.20 (Pembroke, MA, USA).

The procedure has been described in detail elsewhere (Liu et al., 1997; Chen et al., 1998a). Briefly, numbers from zero to nine were randomly presented for 50ms each, at a rate of one per second. Each subject undertook two CPT sessions: the undegraded 1-9 task and the degraded 1-9 task. During the undegraded session, subjects responded to the target stimulus (the number 9 preceded by the number 1) by pressing a button. A total of 331 trials, 31 of them targets, were presented over 5 min for each session. During the degraded session a pattern of snow was used to toggle background and foreground dots so that the image was not distinct. The sensitivity index ( $d'$ ) of the CPT performance reflects the subject's sustained attention. Hence the CPT  $d'$  was employed in this study as an external validation indicator of the subjects.

- **Wisconsin Card Sorting Test (WCST; Heaton et al., 1993)**

The Wisconsin Card Sorting Test is a commonly administered neuropsychological test sensitive to frontal lobe impairment, difficulties in information processing, concept formation, and flexibility of abstract thought. For the purposes of this study the perseverative error score and the number of categories completed were used.

- **Wechsler Adult Intelligence Scale-Revised (WAIS-R; Wechsler, 1982)**

The WAIS-R is a standardized measurement of adult general intelligence. For this study was used the Full Scale IQ to explain the correlation between the structures and intelligence.

- **Wechsler Memory Scales-Abbreviated (WMS-R; Wechsler, 1987)**

The overall WMS-R battery is a comprehensive set of tasks designed to quantify encoding and retrieval processes. This study used a Total score which is the sum of WMS-R Logical Memory I and Logical Memory II.

- **Trail Making Test (TMT)**

The TMT provides information on visual search, scanning, speed of processing, mental flexibility, and executive functions. Originally, it was part of the Army Individual Test Battery (1994) and subsequently was incorporated into the Halstead-Reitan Battery

(Reitan & Wolfson, 1985). It consists of two parts. TMT-A measures the speed at which a subject to draw lines sequentially connecting 25 encircled numbers distributed on the sheet of paper. TMT-B measures the speed at which a subject can connect 13 numbers and letters in alternating sequence (1, A, 2, B, 3, C, etc.). The time needed to complete each task is recorded.

### **3.2.4 Regression Extension of Latent Class Analysis (RLCA)**

Latent Class Analysis (LCA) is a statistical method for finding subtypes of related cases (latent classes) from multivariate categorical data. It can be used to find distinct diagnostic categories given presence/absence of several symptoms, types of attitude structures from survey responses, consumer segments from demographic and preference variables, or examinee subpopulations from their answers to test items. As with other latent variable models, like factor analysis, LCA is a procedure that attempts to explain covariation among a set of observed variables, by modeling the covariation of observed variables with unobserved (and hence latent) variables, that are fewer in number than observed ones. The results of LCA can also be used to classify cases to their most likely latent class. RLCA (Huang and Bandeen-Roche, 2004) extended the latent class model to allow both the distribution of the underlying class variable and the within-class distributions of measured indicators to be functionally related to individual-level independent variables. It is assumed that the observed indicators are related to each other only through the latent variables. For example, within a latent class that corresponds to a distinct medical syndrome, the presence/absence of one symptom is viewed as unrelated to presence/absence of all others.

Unlike factor analysis, RLCA is designed for use with dichotomous (or polychotomous) variables and assumes that the latent variables are also categorical. RLCA is used in way analogous to cluster analysis. That is, given a sample of cases (subjects, objects, respondents, patients, etc.) measured on several variables, one wishes to know if there

is a small number of basic groups into which cases fall. Briefly, RLCA works as follows: The data required for input consist of the frequencies of all possible cross-classifications of the observed. RLCA then uses maximum likelihood estimation to fit one or a series of hypothesized models to explain covariance patterns among the observed indicators. The parameters of RLCA are: (1) the prevalence of each of  $J$  latent classes, which are  $\eta_j(\mathbf{x}_i)$  where  $\mathbf{x}_i$  is a  $P \times 1$  vector of covariate and  $j = 1, \dots, J; i = 1, \dots, N$ , and (2) conditional probabilities for each combination of latent class, item or variable (the items or variables are termed the manifest variables), and response level for the item or variable, which are  $p_{mkj}$  where  $m (= 1, \dots, M)$  is the  $m$ th items or variables and  $k (= 1, \dots, K_m)$  is the  $k$ th level of the  $m$ th items or variables, that a randomly selected member of that class will make that response to that item/variable. The latent class probabilities provide information about the frequency of occurrence of each latent class. The latent conditional probabilities provide information about the degree of association between each of the observed variables and the latent classes, and are analogous to factor loadings in factor analysis (McCutcheon, 1987). Conditional probabilities give the sensitivity of the observed variables for indicating a particular latent class. Further technical details about parameter estimation and other aspects of RLCA can be found in Huang and Bandeen-Roche (2004).

### 3.2.5 Analytic Strategy

Table 2 shows the demographic, environmental factor and neuropsychological characteristics description which was done with frequencies and percentages for categorical variables and with means and standard deviations for continuous variables. In the Table 2, it seems that the characteristics of demographic variables of the acute patients were non-different from the chronic patients.

A regression extension of latent class analysis (RLCA) was performed on the 30 PANSS-CH, Positive, Negative and General psychosocial scale items to explore the underlying latent structures. The supplement items were not included in this study because the



ratio of subjects who were assessed on the supplement items was too low, and the majority of researches about explaining the factor structures of the PANSS were using the 30 items to analyze. In addition, because the latent class analysis with 7-point scale is too complex and has large number of parameters, we reduced the 7-point scale on PANSS-CH to the binary scale (no symptom and having symptom) to analyze. Note that no symptom was composed of 1(absent) and 2 (minimal) scales, because the patients who were diagnosed with the minimal scale by psychiatrists had almost no symptom. The frequencies and percentages of the PANSS items and the characteristics of positive, negative and general psychosocial items were shown in Table 3. In the Table 3, the frequencies and percentages of the PANSS items of the acute patients were more than of the chronic patients, except the guilt feelings (G3) item. The means of positive, negative and general symptoms in the acute phase were also more than in the chronic phase.

In this study, first, we preformed RLCA without covariates to select number of class by the AIC and BIC criteria to explore the latent structures of PANSS. Second, we preformed RLCA with the demographic variables to explore the correlation between the structures and demographic variables. Third, after looking for the significant demographic variables, we preformed RLCA with environment factors or neuropsychological variables, which were adjusted the significant demographic variables, to explore the correlation between the structures and environment factors or neuropsychological variables. The neuropsychological variables were interrelated, hence we performed RLCA with each one neuropsychological variable specifically. The statistic analysis was used our program (written by R statistical computing software and C program) and Mplus version 3 (Muthén and Muthén, 2004).

## 3.3 Results

### 3.3.1 Selecting the Number of Latent Classes

The literature on the classification of schizophrenic symptomatology included models that use between two and five dimensions to explain the heterogeneity of schizophrenic symptoms. Some of the earlier models were theory-driven, whereas the recent models were based on the results of exploratory factor analysis (EFA). However, factor analysis is used for continuous and usually normally distributed observed variables, where the PANSS items are all categorical. Therefore, we performed latent class analysis (LCA) with number of latent classes varying from two to eleven for selecting the best number of classes by AIC and BIC criteria using our program. We tried different seeds for obtaining various results to find the trend of unstable model. In the present study, the average AIC and BIC values were shown. On the other hand, we used Mplus version 3 to obtain results again to contrast our results. Results of AIC and BIC values for LCA in two phases were shown in Figure 1 and Table 4.

Figure 1 shows that, in the acute phase, the AIC and BIC values based on our program both decreased from the two- to five-class, but began to arise at the six-class. However, the AIC and BIC values based on Mplus both decreased from the two- to six-class and began to smooth from the six-class. In the chronic phase, the AIC and BIC values based on our program both decreased from the two- to four-class, but began to arise at the five-class. However, the AIC and BIC values based on Mplus both decreased from the two- to five-class and began to smooth from the five-class. According to the result based on our program, we could select the five- and four- class in the acute and chronic phases, respectively. However, according to the results of Mplus, the chosen numbers of classes in two phases were one class more than our results. Furthermore, we found that in the acute phase, the number of fixed parameters at the six-class model was twice more than that at the five-class model, and in chronic phase, the number of fixed parameters at the four-class

model was also twice more than that at the five-class model. These findings were the same in our results and results of Mplus as shown in Table 4. In addition, the lowest latent prevalence in the six-/five-class model in the acute/chronic phase was under ten percent (Table 5). These results implied that the five-/six-class model with the large number of fixed parameters in the chronic/acute phase were more unstable than the four-/five-class model. In fact, in the previous study, the five factors were generally identified in patients in the acute phase (Bell et al., 1994b), and four or five main factors had been reported in chronic-disease patients (Loas et al., 1997). Therefore, we determined to choose the five- and four-class in acute and chronic phase, respectively, for further analysis.

### **3.3.2 Results of the Latent Class Model**

The AIC and BIC criteria were suggestive of five- and four-class in the acute and chronic phase. We used latent class regression with the selected number of class to explore the latent structure of PANSS. There are two types of parameters in the latent class model: latent class probabilities and latent conditional probabilities. The results of the two phases were described as follows.

#### **Results of the Acute Phase**

Table 6 shows that the summarized results of the acute phase with the latent five-class model without covariates which was run by our program. The first class was the mixed class because of high conditional probabilities on the most positive, negative, and general psychopathological items of the PANSS. In the second class, the conditional probabilities of a positive item (P1), six negative items (N1-N6), and a general psychopathological item (G12) were greater than or equal to 0.8. Since the patients of the second class were diagnosed with the most negative symptoms, we labeled it as the negative class. In the third class, there were delusions (P1), conceptual disorganization (P2), hallucinatory behavior (P3), suspiciousness/persecution (P6), difficulty in abstract thinking (N5), unusual thought content (G9) and lack of judgment and insight (G12) with high conditional

probabilities. These majority symptoms related with thought, therefore the disorganized thought was labeled to the third class. In the fourth class, the patients had the significant symptoms, delusions (P1), hallucinatory behavior (P3), suspiciousness/persecution (P6), unusual thought content (G9) and lack of judgment and insight (G12). Ninety percent of the patients in the fourth class had delusions (P1) symptom, therefore we labeled the fourth class as the delusion class. The fifth class could be labeled as the positive class, because the patients had the likelihood of eighty percent or higher to have six positive items (P1-P4, P6, P7) and the four general psychopathological items (G9, G12, G14, G15). In addition, five latent class probabilities of each class were about equal with the disorganized thought class (the third class) having the lowest prevalence 0.15.

In addition, we also performed the latent class model of the acute phase using Mplus version 3, and the results were concluded in Table 7. The first class was similar to the first class of results based on our program, and it was labeled as the mixed class. The second class was also similar to the second class of results based on our program, which had the high conditional probabilities on the blunted affect (N1), emotional withdrawal, passive/apathetic social withdrawal (N4), difficulty in abstract thinking (N5), and lack of judgment and insight (G12). We also labeled the negative class to the second class of resulting from Mplus. In the third class, the conditional probabilities of the delusions (P1), hallucinatory behavior (P3), suspiciousness/persecution (P6), unusual thought content (G9) and lack of judgment and insight (G12) were greater than eighty percent. It was similar to the third class of results based on our program, thus we also labeled it as the disorganized thought. In the fourth class, there were only two significant symptoms, delusions (P1) and lack of judgment and insight (G12). The delusion was labeled to the fourth class, which was similar to the fourth class of resulting from our program. In the fifth class, the conditional probabilities of four positive items (P1-P3, P7), five negative items (N1, N3-N6), and five general psychopathological items (G1, G7, G11, G12, G15) were greater than or equal to eighty percent. The patients of the fifth class were diagnosed

as having several positive, negative and general psychopathological symptoms. However, the number of symptoms diagnosed of the fifth class was less than of the mixed class, thus we labeled it as the a little mixed class. The fifth class resulting from our program was nested within the fifth class resulting from Mplus, where the conditional probabilities of negative items (N1, N3-N6) based on our program were not as significant as the ones based on Mplus.

- **Demographic Variables**

We performed the latent class model with demographic variables to explore the relation between the latent class and demographic variables. In Table 8, the summary based on the resulting from our program was demonstrated, whereas the summary resulting from Mplus was shown in Table 9. The symptoms of each latent class were similar to the latent class without covariates. There were also five classes labeled: mixed, negative, disorganized thought, delusion and positive/a little mixed.

According to the result based on our program, the parameter estimate of gender in the negative class versus the positive class was significantly different from 0. The parameter estimate was the log odds ratio of having negative symptoms when comparing men with women. The odds ratio for association between gender and having negative symptoms was  $e^{0.9} = 2.47$ . The men were 2.47 times more likely to develop negative symptoms than women. In addition, the older patients would be having serious symptoms, because the log odds ratio of age in the mixed class versus the positive class was significantly different from 0. The patients with fewer years of education were more likely to be in the mixed class or the disorganized thought class because the log odds ratio of years of education in the mixed/disorganized thought class versus the positive class was negative. On the other hand, the odds ratio of years of education in the delusion class versus the positive class was  $e^{0.17} = 1.19$ , thus the patients with high years of education were more likely to develop delusion symptoms. The log odds ratio of occupation in the delusion class versus the positive class was significantly different from 0. The result expressed that the patients

with occupation had high probability to belong to the delusion class. In addition, the patients with the older age at onset would belong to the delusion class, because the odds ratio of age of onset of psychotic symptom in the mixed class versus the positive class was  $e^{0.15} = 1.17$ .

According to the conclusion based on Mplus, there was only one significant parameter estimate of gender in the delusion class versus the a little mixed class. The parameter estimate was the log odds ratio of having delusion symptom comparing men with women. The odds ratio for association between gender and having delusion symptoms was  $e^{-1.31} = 0.27$ . The women were 3.71 ( $=1/0.27$ ) times more likely to develop delusion symptom than men.

- **Environmental Factors**

We performed the latent class model with environmental factors after adjusting significant demographic variables to explore the relation between the latent class and environmental factors. The conclusion resulting from our program was shown in Table 10, and the result based on Mplus was shown in Table 11. The symptoms of each latent class were similar to the latent class without covariates. There were also the five classes labeled: mixed, negative, disorganized thought, delusion and positive/a little mixed.

Based on the conclusion resulting from our program, after the adjustment of significant demographic variables, i.e., gender, age, years of education, occupation and age of onset of psychotic symptom, the parameter estimate of the slight environmental factor 2 in the negative class versus the positive class was significantly different from 0. The result indicated that patients who had unstable mood or abnormal behavior to interfere with adapting to the daily life had higher tendency to be listed in the negative class than the patients without unstable mood or abnormal behavior, as compared with the positive class. In addition, patients who had no unstable mood or abnormal behavior to interfere with adapting to life had higher trend to be assigned to the mixed class than patients who had these characteristics, as compared with the positive class, because the parame-

ter estimate of the obvious environmental factor 2 in the mixed class versus the positive class was significant negative. Patients who had obvious psychological problems in their infancy were also more likely to belong to the delusion class than the patients without psychological problems, as compared with the positive class, because the parameter estimate of the obvious environmental factor 3 in the delusion class versus the positive class was significantly different from 0. However, according to the result based on Mplus, after the adjustment of significant demographic variable, i.e., gender, there were no significant parameter estimates of the environmental factors, as shown in Table 10.

- **Neuropsychological Variables**

In the acute phase, the neuropsychological variables only contained the sensitivity index ( $d'$ ) of the CPT performance to reflect the subject's sustained attention. According to both conclusions based on our program and Mplus, the symptoms of each latent class were similar to the latent class without covariates. According to the result based on the program (Table 12), the undegraded  $d'$  was significant in the negative class versus the positive class. The result elucidated that the patients who had low sustained attention were more likely to be in the negative class than the patients who had high sustained attention, as compared with the positive class. However, the parameter estimates of the undegraded  $d'$  by the latent class model using Mplus were non-significant, as shown in Table 13. In addition, Table 14 and 15 also shows the fact that the parameter estimates of degraded  $d'$  in the resulting from our program or Mplus were non-significant.

## **Results of the Chronic Phase**

In Table 16, the summary of the results of the chronic phase with the latent four-class model without covariates which was run by our program was demonstrated. The result based on our program indicated that the first class was labeled as the a little mixed class because of high conditional probabilities on three positive (P1-P3), two negative (N4-N5), and two general psychopathological (G9, G12) symptoms. The second class could

be labeled as a pure negative one, because there were only significant negative symptoms. In the third class, there were only two significant symptoms, delusions (P1) and lack of judgment and insight (G12). We thus labeled the third class as the delusion class. In the fourth class, the patients were diagnosed as being without any symptoms, thus the no-symptoms class was labeled to the fourth class. In addition, the latent class probabilities were equal to or greater than twenty-three percent. In Table 17, the conclusion based on Mplus showed that the symptoms of each latent class were similar to the conclusion resulting from our program. There were also four classes labeled: a little mixed, negative, delusion and no-symptoms.

#### • Demographic Variables

The symptoms of each latent class of adding the demographic variables were in common with the results without covariates, as shown in Table 18 and Table 19. The age variables in the a little mixed class versus the no-symptoms class were significant when our program and Mplus were applied. The result indicated that the older patients would have more serious symptoms. In addition, patients with higher years of education would have no symptoms because the log odds ratio of years of education of the conclusion based on our program in the a little mixed/negative/delusion class versus the no-symptoms class was negative. According to the conclusion based on Mplus, the odd ratio of years of education in the a little mixed/negative class versus the no-symptoms class was also negative, thus patients with high years of education were more likely to have no symptoms. In both conclusions based on our program and Mplus, the log odds ratio of occupation in the a little mixed/negative class versus the no-symptoms class was significantly different from 0, representing that the patients without occupation had high probability to belong to the a little mixed/negative class. In addition, the result based on our program also indicated that the single patients would belong to the a little mixed class, because the odds ratio of marital status in the a little mixed class versus the no-symptoms class was  $e^{1.39} = 4.03$ .

#### • Environmental Factors



The symptoms of each latent class of adding the significant demographic variables and the environmental factors were similar to the latent class without covariates. Table 20 demonstrates the result based on the program. After adjusting significant demographic variables, i.e., age, years of education, occupation and marital status, the parameter estimates of the two dummy variables of the environmental factor 2 in the a little mixed class versus the no-symptoms class were significantly different from 0. As displayed in the result, patients with unstable mood or abnormal behavior to interfere with adapting to the daily life had higher probability to be assigned to the a little mixed class than the patients without unstable mood or abnormal behavior, as compared with the no-symptoms class. Furthermore, the parameter estimate of the slight environmental factor 2 in the negative class versus the no-symptoms class was significantly different from 0. Based on the result, it was apparent that patients who had unstable mood or abnormal behavior to interfere with adapting to the daily life would have higher probability to be located in the negative class than the patients without unstable mood or abnormal behavior, as compared with the no-symptoms class. Patients without psychological problems in their infancy also had higher probability to be located in the negative class than patients with slight psychological problems, as compared with no-symptoms class, because the parameter estimate of the slight environmental factor 3 in the negative class versus the no-symptoms class was significant negative.

Table 21 shows the result based on Mplus after adjusting significant demographic variables, i.e., age, years of education, and occupation. According to the result, there were only the significant parameter estimates of the environmental factor 2. When comparing with patients without unstable mood or abnormal behavior, patients with these characteristics were more likely to be diagnosed as having symptoms.

- **Neuropsychological Variables**

In the chronic phase, the neuropsychological variables were mainly consisted of the sensitivity index ( $d'$ ) of the CPT performance, the perseverative error score and the num-

ber of categories completed of the WCST, the Full Scale IQ of the WAIS-R, the sum of WMS-R Logical Memory I and Logical Memory II, and TMT-A and TMT-B. The resulting from Mplus by performing the RLCA with the sensitivity index ( $d'$ ) of the CPT performance or the number of categories completed of the WCST after adjusting significant demographic variables, which were age, years of education and occupation, had too low latent class probability in the first class. Therefore, we didn't show the results of the sensitivity index ( $d'$ ) of the CPT performance and the number of categories completed of the WCST using Mplus. On the other hand, our program could not be utilized to perform the RLCA with the sum of WMS-R Logical Memory I and Logical Memory II after adjusting significant demographic variables, i.e. age, years of education, occupation and marital status, because there were too less number of subjects of the sum of WMS-R Logical Memory I and Logical Memory II. However, it was able to perform the RLCA with the sum of WMS-R Logical Memory I and Logical Memory II after adjusting significant demographic variables, i.e. age, years of education and occupation, by utilizing Mplus. Therefore, we could merely show the results about the sum of WMS-R Logical Memory I and Logical Memory II by applying Mplus. In both results based on our program and Mplus, the structures of the PANSS under RLCA with each neuropsychological variable, excluded from the sum of WMS-R Logical Memory I and Logical Memory II, were similar to the structures of the PANSS under RLCA without covariates.

In Table 22, the result based on our program demonstrated that the undegraded  $d'$  of the CPT was significant in the a little mixed class versus the no-symptoms class. Under the comparison of the no-symptom class, patients with lower sustained attention would have higher probability to be allocated to the a little class than patients with higher sustained attention. However, as shown in Table 23, there was no significant parameter estimates of the degraded  $d'$  of the CPT.

In Table 24, the results based on WCST showed the fact that the parameter estimate of the number of categories completed in the a little mixed class versus the no-symptoms class

under the appliance of our program was significant. The result displayed that patients who completed less the number of categories were easier to be assigned to the a little mixed class than patients who completed more the number of categories, as compared with the no-symptoms class. As shown in Table 25 and Table 26, the parameter estimates of the perseverative errors under the utilization of our program and Mplus were non-significant.

Table 27 and Table 28 describe the results of the WAIS-R under the appliance of our program and Mplus. According to the result, the parameter estimate of the full scale IQ in the a little mixed/negative class versus the no-symptoms class was significant. Patients with lower IQ were more likely to belong to the a little mixed/negative class than patients with higher IQ, as compared with the no-symptoms class. However, it is suspected that the result might be unstable because the number of free parameters was more than the number of subjects.

The result of the sum of WMS-R Logical Memory I and Logical Memory II using Mplus was demonstrated in Table 29. The structure of the PANSS was not similar to the structures of the PANSS using RLCA without covariates. The negative and no-symptoms classes were still retained in the first and fourth classes, but the symptoms of the second or third classes had been changed. In the second class, there were only two significant symptoms that had equal or higher conditional probabilities, difficulty in abstract thinking (N5), and unusual thought content (G9). In the third class, there were three significant symptoms, i.e., delusions (P1), difficulty in abstract thinking (N5) and lack of judgment and insight (G12). The parameter estimate in the negative class versus the no-symptoms class was significant. The result indicated that patients with worse memory were more likely to belong to the negative class than the patients with better memory, as compared with the no-symptoms class. However, the result could be unstable due to that the number of free parameters was more than the number of subjects.

After adjusting significant demographic variables, the structures of the PANSS under the appliance of RLCA with covariates of the Trail Making Test (TMT) were similar to

the structures of the PANSS under the appliance of RLCA without covariates. Based on the results relating to the TMT-A, patients who spent long time to complete the TMT-A had higher tendency to be listed on the negative class than patients who spent less time to complete it, as compared with the no-symptoms class, which was mainly due to that the parameter estimate in the negative class versus the symptoms class by using our program was significant (Table 30). However, in the results relating to the TMT-A under the utilization of Mplus, there were no significant parameter estimates as shown in Table 31. On the other hand, according to the results relation to the TMT-B, the parameter estimate in the a little mixed class versus the no-symptoms class under the appliance of our program or Mplus was significant. As demonstrated in the result, patients who spent long time to complete the TMT-B were more likely to be allocated to the a little mixed class than the patients who spent less time to complete it, as compared with the no-symptoms class. What is further, according to the result based on our program, patients who spent long time to complete the TMT-B had higher tendency to be assigned to the negative class than the patients who spent less time to complete the TMT-B, because the parameter estimate in the negative class versus no-symptoms class was also significant. These results were shown in Table 32 and Table 33.

To summarize all statements mentioned above, the results of the chronic phase under the appliance of our program were similar to the resulting based on Mplus. However, in the acute phase, what shows the major difference between the result based on our program and the result based on the Mplus was the fifth class. The result of the significant demographic variables in the acute phase based on our program also differed from that based on Mplus. Besides, due to the different adjusted significant demographic variables, the result of the significant parameter estimates of the environmental factors or neuropsychological variables in the program was also different from that based on the Mplus. On the other hand, the number of component of each structure of the chronic phase was less than of

the acute phase, confirming the fact that the chronic patient was more stable than the acute patient.

### 3.3.3 Comparison of Component of Structure for the PANSS

Till now, a majority of previous studies have performed principal component analysis to explain the structure of the PANSS, and there have been two studies identifying subtypes of the PANSS by cluster analysis (Dollfus et al., 1996) or generalized association plot (GAP, Hwu et al., 2002). The results by carrying out the RLCA without covariates using our program in the present study and these results of previous studies were shown in Table 34. While 12 of the 16 previous studies reported a five-factor solution, the criteria used to select the number of factors differed from study to study, and in fact two of the studies only reported a five-factor model (Marder et al., 1997; Lancon et al., 2000). Other studies, using the conventional method of selecting factors with eigenvalues  $> 1$  actually obtained more than five factors, and then discarded or combined the additional factors for various reasons (Kay and Sevy, 1990; Bell et al., 1994a; Lykouras et al., 2000). Thus, the selecting of the number of factors was arbitrary.

In these studies, we found that all studies had the negative syndrome, whether in the acute/admission phase or in the chronic/discharge phase. The negative syndrome was included blunted affect (N1), emotional withdrawal (N2), poor rapport (N3), passive/apathetic social withdrawal (N4) and lack of spontaneity/flow of conversation (N6) items in these studies. However, in the chronic phase of present study, the negative syndrome was nested within the negative syndrome of other results. A number of the negative syndrome were added the difficulty in abstract thinking item (N5) (present study; Liu, Yeh and Hwu, 1996; Hwu et al., 2002; Dollfus et al., 1996) or the part of the general psychopathology items.

In addition, a majority of previous studies emerged clearly the positive syndrome, except the studies for the subjects of MPGRP (Liu, Yeh and Hwu, 1996; Liu, Hwu,

Chen, 1997; Hwu et al, 2002) and the study in acute patients of Nakaya et al. (1999b). However, in these studies, the other syndromes, which were the psychotic factor of the Liu et al. (1996) study at discharge, the factor of delusion/hallucination of the Liu et al. (1997) and of the Nakaya et al. (1999b), and the factor of delusion of the Hwu et al. (2002), were similar to the positive syndrome of other previous studies (such as Kay and Sevy, 1990; Lindenmayer et al. 1994; Dollfus and Petit, 1995, and so on). Dollfus et al. (1996) suggested the positive syndrome was included all positive items (P1-P7) and a part of the general psychopathology items. However, the positive class of our study didn't include the grandiosity item (P5), and 7 of the previous studies suggested the positive syndrome was only included the delusions (P1), hallucinatory behavior (P3), grandiosity (P5), suspiciousness/persecution (P6) and a part of the general psychopathology items. In addition, 3 of the previous studies suggested the positive syndrome was only included three positive items, which were delusions (P1), hallucinatory behavior (P3), grandiosity (P5)/suspiciousness (P6), and a part of the general psychopathology items (Kay and Sevy, 1990; Dollfus and Petit, 1995; White et al., 1997). In the study of Mass et al. (2000), the positive syndrome was included the delusions (P1), hallucinatory behavior (P3) and unusual thought content (G9) items. Thus, the components of positive syndrome were different, that possible reason was maybe to use different analysis.

In addition, there were only structure of one study not included the disorganized thought factor by the cluster analysis (Dollfus et al., 1996). However, they obtained the disorganized thought specially by subdividing the positive cluster. All previous studies indicated that the components of disorganized thought (or cognitive) were included the conceptual disorganization (P2) item, except the study of White et al. (1997) and the study in the post-acute patients of Nakaya et al. (1999b). A number of previous studies added the difficulty of abstract thinking (N5) and/or stereotyped thinking (N7) items into the components of disorganized thought. In the present study at the acute phase, the components of disorganized thought were included also the conceptual disorganization

(P2) and difficulty in abstract thinking (N5) items, and added the delusions (P1), hallucinatory behavior (P3), unusual thought content (G9) and lack of judgment and insight (G12) items. Thus, the components of disorganized thought of present study seemed to similar to previous studies.

On the other hand, in the present study, we had the delusion class which were included the delusions (P1) and lack of judgment and insight (G12) items. There were only four previous studies to indicate the delusion/hallucination factor in the structure of the PANSS (Liu et al., 1996; 1997; Hwu et al., 2002; Nakaya et al., 1999b). However, the components of the delusion/hallucination factor in these studies were more similar to the components of the positive syndrome in other previous studies. In addition, the previous study of Dollufs et al. (1996) had the mixed and few symptoms clusters in the structure of PANSS. These were similar to the mixed and no-symptoms class of the present study. The previous study of Nakaya et al. (1999b) reported that the mixed factor was emerged in the post-acute phase. However, this study used the 14 items of PANSS, which were the positive and negative symptoms, to analyze.

A number of previous studies suggested that the structure of PANSS included the excitement and anxiety/depression factors. Depression and anxiety symptoms loaded as a single factor in the original PANSS analysis of Kay and Sevy (1990), as well as in the majority of subsequent studies. In 1995, Dollfus and Petit also reported the separate anxiety and depression factors and found an anxiety factor at admission and a depression factor at discharge. Besides, Emsley et al. (2003) also found an anxiety factor without a depressive factor.

To draw a conclusion of all the statements listed above, in the present study, the components of the negative, positive and disorganized thought classes of the acute phase were not different from the previous studies. However, the number of components of each structure in the chronic phase was less than the number of components of each structure

in the acute phase because the symptoms of the chronic patients were not obvious. A majority of previous studies hasn't unveil that the sample was in the acute or chronic phase, and in a number of previous studies, patients in acute and stabilized phases were combined to be analyzed. Thus, it was difficult to discriminate the acute phase from the chronic phase to compare the component of structure for the PANSS. However, it can be discovered that there were much more difference of the results of the chronic phase between the present study and the previous studies than the results of the acute phase.

### 3.4 Discussion

To the best of our knowledge, the present study is the first to use longitudinal data and RLCA to explain the symptomatology schizophrenia in over time. The present findings didn't suppose the two-dimensional construct of positive and negative symptoms in either the acute or the chronic phase of the illness. A five-/four-class model fit the data relatively better than two- to three-/four- class in the acute/chronic phase by the AIC and BIC criteria. A previous study of Nakaya et al. (1999a) reported that the three-, four- and five-dimensional model on the PANSS fits in 100 admitted patients well in the acute phase and only the five-dimensional model adequately fits the data in the chronic stable phase by using confirmatory factor analysis (CFA). The present finding in the acute phase was analogous to their results of the acute phase, but the result in the chronic phase was a little different. It can be conjectured that the different result was mainly due to different analyzing method

Based on the conclusion from our program, there were five classes labeled: mixed, negative, disorganized thought, delusion and positive under the utilization of RLCA in the acute phase. In the result based on Mplus, the positive class did not emerge, but the a little mixed class replaced the positive class. In addition, the significant demographic variables in the conclusion based on our program were different from that based on Mplus. These different results may be due to the reason that the initial value in our program was



different from that in Mplus, and the threshold parameter,  $\tau$ , entered into the mixed model of Mplus. All these factors may lead to different results. However, in the chronic phase, the result based on our program was similar to the result based on Mplus. In the chronic phase, there were four classes labeled: a little mixed, negative, delusion and no-symptoms. The different results between our program and Mplus in the acute and chronic phases could be due to the fact that the latent class model with four-class in the chronic isn't more complex than the latent class model with five-class in the acute chronic.

The most salient finding for demographic characteristics is that older patients had more mixed symptoms. Men were more likely to develop negative symptoms than women in the acute phase. Patients with fewer years of education were more likely to be in the mixed class or the disorganized thought class in the acute phase, and more likely to be assigned to the classes which had more serious symptoms than no-symptoms class at the chronic phase. Besides, patients without occupation had high probability to be allocated to the a little mixed class or the negative class in the chronic phase, and patients with occupation or older age of onset of psychotic symptom had higher possibility to be assigned to the delusion class, which was the slight class in the acute phase. The analogous results have been reported in some previous studies. For instance, Van Den Oord et al. (2006) has unveiled that negative symptoms were somewhat less severe in females and except for positive and excited, more severe symptomatology was associated with fewer years of education. Reichenberg et al. (2005) also found that the correlation between years of education and negative/cognitive (alike disorganized though) factor is negative. However, according to some previous studies, there are no symptom components correlating significantly with any demographic or clinical variables (Liddle, 1987; Malla et al., 1993; Nakaya et al., 1999b). In addition, patients who had unstable mood or abnormal behavior to interfere with adapting to daily life may have higher tendency to be assigned to the negative class than patients without these characteristics in both the acute and chronic phases. However, none of these previous studies have reported about

the relationship between the environmental factors of present study and symptoms.

In another perspective, we found that in the acute phase, patients with low sustained attention would have high probability to be allocated to the negative class. This finding has demonstrated that the relationship between the undegraded  $d'$  of CPT and negative class was negative and confirmed Liu et al. (1997)'s suggestion that the negative dimension was associated with lower sensitivity index ( $d'$ ). Based on their report, the positive dimension was not associated with the  $d'$  on the CPT, and this was similar to the result of present study. Furthermore, some previous studies published by Mass et al. (2000) and Good et al. (2004) also mentioned that there was significant correlation between the neuropsychological variables and cognitive/disorganized though. However, in the present study, the disorganized though class only emerged in the acute phase. In the acute phase, the correlation between the neuropsychological variables and symptoms was not investigated because the participants did not assess the neuropsychological variables, except CPT performance. However, in the present study, the sensitivity index ( $d'$ ) on the CPT was non-significant in the disorganized though class, and this was similar to the result of previous study (Good et al., 2004).

In the field of psychopathology research, both the previous and present studies have examined the symptom structure for two main purposes. First, the recognition of consistent patterns of symptom clusters may help identify homogeneous subgroups of patients and provide validation for diagnostic concepts. Second, distinct clusters may hypothetically reflect distinct pathophysiologies within the schizophrenic disorder. T Based on exploratory factor analysis(EFA), the structure of symptoms in schizophrenia has been discovered in most previous studies. The structure of PANSS based on RLCA was a little different from the structure of PANSS based on EFA. The RLCA is the categorical approach to posit that schizophrenia may be subdivided in separate and mutually exclusive groups of patients. The dimensional model, such as EFA, proffers that the symptoms of schizophrenia tend to cluster together within different symptom complexes which can co-

exist in individual patients. Since the statistical methodology and heterogeneous clinical characteristics of the disease are different, the symptom structure of PANSS is also different. However, the best approach for examining the symptom structure of PANSS still remains unknown. But the best approach to explore it can be considered in the future.



## 4 Transition of Structure on PANSS

### 4.1 Background

Most studies demonstrate high agreement that schizophrenia is a heterogeneous disorder with considerable variation in symptoms, premorbid history, clinical course, prognosis, and pathophysiology. Crow (1980) proposed that the structure of schizophrenic symptoms can be discriminated between the positive symptoms, such as hallucinations and delusions, and negative symptoms, such as blunted affect and passive social withdrawal. The researchers began to produce evidence for a syndromic dichotomy in succession (Bilder et al., 1985; Cornblatt et al., 1985; Andreasen and Grove, 1986; Kay and Sevy, 1990; Mortimer et al., 1990). The dichotomy has been widely accepted and led to the development of reliable scales for measurement of positive and negative symptoms, such as the Assessment of Negative Symptoms (SANS; Andreasen, 1983), the Scale for the Assessment of Positive Symptoms (SAPS; Andreasen, 1984). Later, the Positive and Negative Syndrome Scale (PANSS; Kay et al., 1987) was developed in an attempt to provide a comprehensive assessment of all symptoms of schizophrenia. The PANSS is widely used in clinical and research setting and is regarded as a reliable means of symptom assessment (Bell et al., 1992).

Many of these investigations have developed the symptom structures from Crow's original two-dimension distinction, and others have found that more than two components are needed to describe the symptoms in Schizophrenia (Liddle, 1987; Arndt et al., 1991; Anderson et al., 1995; Lindenmayer et al., 1995; Lenzenweger and Dworkin, 1996; Johnstone and Frith, 1996). For instance, Liddle (1987) has proposed the disorganization symptoms. Later, Cuesta and Peralta (1995) compared seven models by using confirmatory factor analysis, and they found that the three- and four-factor models, which included disorganization and/or disorder of a relating syndrome in addition to positive and negative syndromes, obtained higher goodness of fit than one- or two-factor models. According to

a recent study published by Dollfus and Everitt, it is suggested that a four-factor model fit as well as two- and three- factor models (Dollfus and Everitt, 1998). White et al. (1997) also fitted 20 previously proposed models to data from a sample of 1,233 schizophrenics for attempt to reconcile the different research finds. They concluded that none of these models fitted the data adequately, then they derived a new "pentagonal" model retaining only 25 items of the PANSS, which were labeled: Positive, Negative, Dysphoric mood, Activation, and Autistic preoccupation. Most of the studies that attempt to examine the symptom components in schizophrenia have been limited by the factor that symptoms were measured only cross-sectionally. Therefore, how the composition of the symptom components changes over time remains unknown.

In 1990, Kulhara and Chandiramani (1990) have found 98 schizophrenic inpatients could be divided into three symptom factors (negative symptoms, positive symptoms, thought disorder). However, 18-30 months later, 79 of these patients were reassessed and the composition of these symptom factors had changed, which was that a mixed symptom factor replaced the positive symptom factor. In 1991, Goldman et al. (1991) published the report which indicated that at both time, which were prior to intervention (medication-free baseline) and after 4 weeks of neuroleptic treatment, three symptom factor were evident (negative symptoms, positive symptoms, and unstable behavioral agitation), and the pre- and post-treatment factor loading patterns were similar in 40 schizophrenic inpatients. At the same year, Addington and Addington (1991) also found two symptom factors that possess eigenvalues greater than unity (negative symptoms and thought disorder) in 41 schizophrenic inpatients at the beginning of the study. However, after 6 months, the reality distortion factor appeared in place of the thought disorder. Van der Does et al. (1995) rated 65 schizophrenic patients at the acute phase, 3 months later, and 1 year after the second assessment. They found that there was a different factor structure at each assessment, but a four-dimensional structure (disorganization, negative symptoms, positive symptoms, and depression) was stable over time. According to a

study which observed 86 newly admitted schizophrenic patients and was conducted by Nakaya et al. (1999), four symptom factors were investigated in the acute phase (negative symptoms, excited, delusion/hallucinatory, and thought disorder). However, in the post-acute phase, three symptom factors were evident (negative symptoms, mixed symptoms, and thought disorder). Therefore, they suggested that the negative symptom component is stable while the difference in the phase of illness has some effects on the symptom structure of schizophrenia. In a word, each previous study led to different findings about the composition of symptom components over time, and the sampling and assessment methods differed among the previous studies, making any comparison difficult.

Although a part of previous studies has explored the symptomatology of schizophrenia in different phase, how the patients change between the acute phase and the chronic phase is still unknown. In addition, Nakaya et al. (1999b) reported that the difference in symptomatology between the acute and post-acute phase of schizophrenia. Therefore, the present study mainly focuses on the changes in latent class of the PANSS over time, and the study reported in this article aims to examine the changes in the structure of the PANSS items in both the acute phase and the chronic phase under latent transition analysis (LTA). Furthermore, LTA with demographic variables, environmental factors or neuropsychological variables are all applied to explore the changes of the structure of the PANSS after the adjustment of demographic variables, environmental factors or neuropsychological variables.

## **4.2 Method**

### **4.2.1 Subjects**

The subjects were composed of three projects, the Multidimensional Psychopathology Group Research Projects (MPGRP), the Multidimensional Psychopathological Study on Schizophrenia (MPSS) and the Study on Etiological Factors of Schizophrenia (SEFOS). The initial project started as the MPGRP from July 1993 till June 1998. The subsequent

project following the initial MPGRP, was the MPSS started in July 1998 till June 2001. Both MPGRP and MPSS were successfully carried out from July 1993 to March 2001, and up to the time of sending this SEFOS proposal as the subsequent study on the pathogenesis of schizophrenia, a further step of psychopathological study on schizophrenia.

The focus of the MPGRP was to study the clinical manifestations of schizophrenia and the family situation in a cohort of schizophrenia patients. The MPGRP also concentrated on the phenotype definition of schizophrenia using CPT manifestation in the schizophrenia family. In the MPSS project, the focus was on the follow-up neuropsychological evaluation of the schizophrenia cohort collected in the MPGRP, other than the descriptive follow-up clinical data collection. The Program Project Grant (PPG) entitled SEFOS from January 2002 till December 2005, which aimed to search for the separate etiological factors under the understanding that schizophrenia is a complex disorder. The PPG of SEFOS formulated a dynamic etiological hypothesis of schizophrenia and was a retrospective/prospective study. The PPG of SEFOS designs 3 projects of: (1) A Study on Neurobiology of Schizophrenia; (2) A Study on Environmental insults/stress of schizophrenia; and (3) Molecular Genetics Study of Schizophrenia. The main purpose of these projects is to find different levels of neurobiological and anatomical abnormalities, to discover different levels of environmental insults/stress, and to locate vulnerability genes in different chromosome regions respectively.

The recruitment procedures have been described in detail in earlier reports of MPGRP project (Liu et al., 1997; Chen et al., 1998b; Chang et al., 2001). Briefly, from August 1, 1993 to June 30, 1998, all patients consecutively admitted to the acute inpatient wards of three hospitals, National Taiwan University Hospital, Taipei City Psychiatric Center, and Taoyuan Psychiatric Center, were included in MPGRP if they met DSM-IV (American Psychiatric Association, 1994) criteria for schizophrenia and consented to participate. The diagnoses were re-evaluated at discharge by consensus among three senior psychiatrists using all information available from clinical observations, medical records, and key

informants. Up to 1998, the final year of MPGRP and the starting point for MPSS study, the MPGRP cohort would have been in their 2-5 years' of follow-up period. On this ground, further follow-up of the MPGRP cohort into the long term course, supplemented by neuropsychological evaluations, would provide unusual opportunities for an integrated clinical and neuropsychological approach. The MPSS project thus recruit MPGRP patients who agree to receive further follow-ups. Averagely, patients in the MPSS project were also included in the MPGRP for three follow-up years. In addition, the family which had two schizophrenia sib-paired children - one schizophrenia parent and the other one should be normal - was the inclusion criteria for SEFOS.

This study included the 219 acute patients who had complete information from the PANSS at admission in the MPGRP project. The 122 chronic patients were assessed the PANSS in the first year of MPSS project and the 103 chronic patients had complete assessment of PANSS in the SEFOS project. Thus this study included the 225 chronic patients who participated in the MPSS or SEFOS project. On the other hand, the 115 subjects among these patients included were both assessed the PANSS in the MPGRP and MPSS projects. Thus, the patients in the MPGRP project was divided two groups, which one was follow-up into the MPSS project and the other was loss to follow-up into the MPSS project. Table 1 shows that the characteristics of two groups of patients. In the Table 1, it seems that the characteristics of the dropout patients were non-different from the non-dropout patients.

#### **4.2.2 Instruments**

The main applied instrument in this study is the PANSS, which is an assessment of the clinical symptoms of the patients. It has 33 items rated from 1 to 7 based on a semi-structured interview with detailed descriptions for symptom ratings, and it consists of four subscales: positive (seven symptoms: P1-P7), negative (seven symptoms: N1-N7), general psychopathology (sixteen symptoms: G1-G16), and supplementary excitability



(three symptoms: S1-S3). Each item on the PANSS is accompanied by a complete definition as well as detailed anchoring criteria for all seven rating points, which represent increasing levels of psychopathology: 1 = absent, 2 = minimal, 3 = mild, 4 = moderate, 5 = moderate-severe, 6 = severe, 7 = extreme. The subscales of positive and negative syndromes are assumed to cover the core symptoms in these two dimensions (Kay et al., 1991). The subscales of general psychopathology and supplement items for the aggression risk profiles are considered to be the separated index of severity of illness (Kay et al., 1986). The Chinese version of the PANSS, the PANSS-CH, was translated from the English version specifically for the MPGRP. The details of development of the PANSS-CH and the reliability test were published in earlier literature (Cheng et al., 1996). Psychopathology was further evaluated by a semi-structured interview using the PANSS-CH within 1 week after admission by attending psychiatrists who had completed the PANSS-CH reliability training. In an inter-rater reliability study, the coefficients of agreement (Kay, 1991) were satisfactory: 12 items were above 0.80, 17 items between 0.70 and 0.79, and the remaining four items between 0.66 and 0.69 (Cheng et al., 1996).

All subjects on admission of the MPGRP project have received psychiatrists' clinical assessments with the PANSS. After their condition stabilized during the index hospitalization, subjects were tested with the Continuous Performance Test (CPT; Rosvold et al., 1956). All subjects in each follow-up projects (MPSS and SEFOS) were assessed the PANSS ratings and the CPT performance. However, a part subjects didn't complete the CPT at each projects.

### **4.2.3 Study Variables**

#### **Demographic Variables**

Demographic variables include variables of age, gender, years of education, marital status (single versus married), occupation (with versus without occupation), and age of onset of psychotic symptom. Note that the married marital status consists of people living

together and people getting married; housewives, students, people who never worked, who are unemployed or who already retired are included in people without occupation.

### **Environmental Factors**

In this study, the environmental factors are related to obstetric complications, prenatal growth retardation, special personal behavior, the psychological problem, and so on. There are three environmental factors, described as follows separately.

- (1) The patient has brain injury in the growth, such as prenatal growth retardation, brain damage, retarded intelligence and so on.
- (2) Before getting disease, the patient had the unstable mood or abnormal behavior to interfere with adapting to the daily life, including angry, timid, depressed, inactive, having behavior problems, and so on.
- (3) Before getting disease, the patient had the psychological problems to interfere with adapting to life in their infancy, including bad relation between parents, getting along badly with sibling or parents, getting disease about body, unforeseen happenings of family, and so on.

The first environmental factor was rated by a 3-point scale with 0 as no circumstance, 1 as slight (have not obviously heart body obstacle) and 2 as obvious (have obviously heart body obstacle). Due to the ratio of obvious subjects with the first environmental factor was too low, we combined the slight subjects with the obvious subjects in the first environmental factor. The others were rated by a 3-point scale with 0 as no circumstance, 1 as slight (have not obviously influenced routine life) and 2 as obvious (have obviously influenced routine life). There were one dummy variable for the first environmental factor, two dummy variables for the others.

## Continuous Performance Task (CPT; Rosvold et al., 1956)

We used a CPT machine from Sunrise Systems, version 2.20 (Pembroke, MA, USA). The procedure has been described in detail elsewhere (Liu et al., 1997; Chen et al., 1998a). Briefly, numbers from zero to nine were randomly presented for 50ms each, at a rate of one per second. Each subject undertook two CPT sessions: the undegraded 1-9 task and the degraded 1-9 task. During the undegraded session, subjects responded to the target stimulus (the number 9 preceded by the number 1) by pressing a button. A total of 331 trials, 31 of them targets, were presented over 5 min for each session. During the degraded session a pattern of snow was used to toggle background and foreground dots so that the image was not distinct. The sensitivity index ( $d'$ ) of the CPT performance reflects the subject's sustained attention. Hence the CPT  $d'$  was employed in this study as an external validation indicator of the subjects.

### 4.2.4 Latent Transition Analysis

Latent transition analysis (LTA; Collins and Wugalter, 1992) has been suggested as an approach for testing stage theories when stages are measured at discrete points in time. LTA is basically an analysis that fits a latent class model with latent variables which are allowed to take different values at different occasions. Theoretical stages of development are represented by categorical dynamic latent variables, involving movement through a series of latent class over time. Movement among latent class is summed up in the transition probability matrix. The probability of making a transition to a particular state/class at a subsequent interview period is modeled by applying a logistic regression model for nominal responses. This approach easily incorporates multiple covariates either discrete or continuous and possibly time-dependent.

We suppose a sample of  $N_t$  patients is assessed the PANSS with 30 (M) questions at two occasions, which are the acute and chronic phase. We assume for members of the  $j$ th latent class ( $j = 1, \dots, J_t$ ) that each manifest item,  $m$  ( $= 1, \dots, M$ ), will at occasion

$t$  ( $= 1, \dots, T$ ) take value  $k$  ( $= 1, \dots, K$ ) with probability  $p_{mkjt}$ . The manifest variables, which we represent by  $Y_{imt}$ , are assumed to be independent of future/past latent class given current latent class membership. We assume that at occasion  $t$  the  $i$ th patient will belong to a latent class  $l$  with probability  $\eta_{lt}$  and that, at successive occasion  $t + 1$ , conditional on belonging to class  $l$  at occasion  $t$ , a patient will belong to a class  $j$  with probability  $\tau_{ijl}$ . We make the assumption of occasion invariant transition processes between latent class, hence the absence of a  $t$  subscript on  $\tau_{ijl}$ . The probabilities  $\tau_{ijl}$  are assumed to be associated with a  $P \times 1$  vector of covariates  $\mathbf{x}_{it}$  for the  $i$ th patient at occasion  $t$ , with dependence postulated through multinomial logistic functions;

$$\tau_{ijl}(\mathbf{x}_i) = \frac{\exp(\gamma_j + \delta_{jl} + \zeta_j \mathbf{x}_{it})}{1 + \sum_{k=1}^{J_t-1} \exp(\gamma_k + \delta_{kl} + \zeta_k \mathbf{x}_{it})}, \quad (17)$$

$$i = 1, \dots, N; j = 1, \dots, J_t; l = 1, \dots, J_{t-1}; t = 2, \dots, T$$

From transition probabilities, we can perceive the changes between the latent classes for over time. Parameter estimation reported in this study was carried out by means of the EM algorithm (Dempster, Laird and Rubin, 1977). Further technical details about parameter estimation and other aspects of LTA can be found in Collines and Wugalter (1992).

#### 4.2.5 Analytic Strategy

Demographic, environmental factor and neuropsychological characteristics description was done with frequencies and percentages for categorical variables and with means and standard deviations for continuous variables, these show in Table 2. In the Table 2, it seems that the characteristics of demographic variables of the acute patients were non-different from the chronic patients. And Table 35 shows the demographic, environmental factor and neuropsychological characteristics description of 115 subjects who assessed the PANSS in the MPGRP and MPSS projects.

A latent transition analysis (LTA) was performed on the 30 PANSS-CH, Positive, Negative and General psychosocial scale items to explore the underlying latent structures

and the changes between the latent classes for over time. The supplement items were not included in this study because the subject ratio would have been too low to result in stable, and the majority of researches about explaining the factor structures of the PANSS were using the 30 items to analyze. In addition, because the latent class analysis with 7-point scale is too complex and has large number of parameters, we reduced the 7-point scale on PANSS-CH to the binary scale (no symptom and having symptom) to analyze. Note no symptom was composed 1(absent) and 2 (minimal) scales, because the patient diagnosed with the minimal scale by psychiatrists was almost no symptom. The frequencies and percentages of the PANSS items and the characteristics of positive, negative and general psychosocial items were shown in Table 3. In the Table 3, the frequencies and percentages of the PANSS items of the acute patients were more than of the chronic patients, except the guilt feelings (G3) item. The means of positive, negative and general symptoms in the acute phase were also more than in the chronic phase. In Table 36, the characteristics of PANSS for 115 subjects who assessed the PANSS in the MPGRP and MPSS projects can be found.

To explore the latent structures of PANSS, the regression extension of latent class analysis (RLCA) without incorporate covariate was performed for selecting number of class by the AIC and BIC criteria. As mentioned in the previous chapter, the five- and four-class in the acute and chronic phases has been chosen respectively. In this study, LTA without covariate was conducted to explore the changes between the latent classes at two phases, and the covariate effect was added into LTA later to explore the changes between the latent classes after adjusting covariates such as demographic variables, environmental factors and the sensitivity index ( $d'$ ) of the CPT performance. Mplus version 3 (Muth é n and Muth é n, 2004) was applied to conduct the statistic analysis. In the Mplus program, each individual who had missing value on covariates would be deleted in the analysis. Therefore, we used plus mean of the difference age of the subjects who assessed the PANSS at both two phases, which was 3, to substitute for missing age of the subjects

who didn't assessed the PANSS at the chronic phase but assessed the PANSS at the acute phase. Furthermore, the CPT value of the acute phase was applied to replace missing CPT value of the subjects, i.e., patients who were not assessed under the PANSS at the chronic phase, but assessed at the acute phase. These only retained the subjects, who were not assessed at the chronic phase but assessed at the acute phase, to analyze the structure of the PANSS in the acute phase, and didn't affect the parameter estimates of the CPT variables and of the transition probability.

### 4.3 Results

In Table 37, the summarized result based on the latent transition analysis (LTA) with the latent five-/four- class model at the acute/chronic phase and without covariate has been demonstrated. As being pointed out, in the acute phase, the first class was the mixed class due to its high conditional probabilities on the most positive, negative and general psychopathological items of the PANSS. In the second class, the conditional probabilities of three positive items (P1-P3), five negative items (N1, N2, N4, N5, N7), and three general psychopathological items (G11, G12, G15) were greater than or equal to 0.8, and patients in the second class were diagnosed as having several positive, negative and general psychopathological symptoms. However, the number of symptoms diagnosed in the second class was less than that in the mixed class, so it was labeled as the a little mixed class. In the third class, there were blunted affect (N1), emotional withdrawal (N2), passive/apathetic social withdrawal (N4), difficulty in abstract thinking (N5) and lack of judgment and insight (G12) with high conditional probabilities. The third class was labeled as the negative class because patients in the third class were diagnosed as possessing most negative symptoms. The fourth class consisted of patients with high conditional probabilities on four positive items, i.e., delusions (P1), hallucinatory behavior (P3), excitement (P4) and suspiciousness/persecution (P6), and on two general psychopathological items, unusual thought content (G9) and lack of judgment and in-

sight (G12), but low conditional probabilities on three negative (N1, N3, N6) and other general psychopathological items. Therefore the fourth class could be labeled as the positive class. In the fifth class, there were the delusions (P1) and lack of judgment and insight (G12) with high conditional probabilities. Thus, the fifth class was labeled as the delusion class. According to the research, about thirty percent of patients belonged to the positive class, which had the highest latent prevalence. The negative class had the lowest latent prevalence, which was 0.13.

In the chronic phase, the first class was labeled as the a little mixed class because of high conditional probabilities on four positive (P1-P3, P6), two negative (N4, N5), and three general psychopathological (G1, G9, G12) symptoms. In the second class, there were only three significant symptoms: delusions (P1), unusual thought content (G9) and lack of judgment and insight (G12). The delusions (P1) symptom had the highest conditional probability. Thus, the second class was labeled as the delusion class. The third class could be labeled as a pure negative one, because patients in this class had high conditional probabilities on most negative symptoms (N1-N2, N4-N6) and one general psychopathological symptom (G12), but low conditional probabilities on positive and other general psychopathological symptoms. The fourth class was labeled as the no-symptoms class because patients in this phase were diagnosed as having no symptoms. What has also been found is that four latent class probabilities were equal to or greater than twenty percent.

On the other side, the parameter estimates of the index of each class in the a little mixed class versus the no-symptoms class were significant. Based on the analysis of the result, patients belonging to the mixed/a little mixed/negative/positive class in the acute phase would show higher probability to be allocated to the a little mixed class in the chronic phase than patients in the delusion class, i.e, the slightest class in the acute phase. Furthermore, the parameter estimate of the index of negative class in the negative class versus the no-symptoms class was significant. Patients assigned to the negative class in

the acute phase would not be cured completely. However, these results might be affected by the fixed parameter estimate of the index of negative class in the delusion class versus the no-symptoms class.

From the average latent transition probabilities table, we found that thirty-six percent of the patients assigned to the mixed class in the acute phase also belong to the a little mixed and negative classes in the chronic phase. In addition, approximately thirty percent of the patients listed on the a little mixed class in the acute phase belong to the delusion class in the chronic phase. Symptoms of most patients belonging to the mixed or a little mixed class in the acute phase would be mitigated. However, half of patients allocated to the negative class in the acute phase would retain the negative class in the chronic phase, and the rest patients would belong to the a little mixed or delusion class in the chronic phase. About forty percent of patients belonging to the positive class in the acute phase would be cured completely in the chronic phase, and most of other patients would be assigned to the a little mixed or delusion class in the chronic phase. Besides, patients in the delusion class would be cured completely in the chronic phase, because they have the highest transition probability on the no-symptoms class.

#### • **Demographic Variables**

In our research, the latent transition analysis with demographic variables was conducted to explore the transition probabilities after the effect of demographic variables have been adjusted. The results were summarized and shown in Table 38. The symptoms of each latent class in the acute/chronic phase were similar to the latent class model without covariates. In the acute phase, there were five classes labeled: mixed, a little mixed, negative, positive, and delusion, where as there were four classes labeled in the chronic phase: a little mixed, negative, delusion, and no-symptoms. According to the result, it has been found that the latent class probabilities were also similar to the latent class probabilities of latent class model without covariates. In the acute phase, the most patients belonged to the positive class, which had thirty-one percent of the latent class



probabilities. In the chronic phase, four latent class probabilities were equal to or greater than twenty percent.

After adjusting demographic variables, the parameter estimates of the index of negative class in each class versus the no-symptoms class were significant. The results were in common with the result without covariates and indicated that the patients assigned to the negative class in the acute phase would not be cured completely. In addition, patients belonging to the mixed class in the acute phase would have higher probability to be listed on the a little mixed class in the chronic than patients belonging to the delusion class in the acute phase, because the parameter estimate of the index of mixed class in the a little mixed class versus the no-symptoms class was significant. However, this result might be affected by the fixed parameter estimate of the index of negative class in the negative class versus the no-symptoms class.

The age variables in the a little mixed class versus the no-symptoms class were significant. According to the result, older patients tend to have serious symptoms, while patients with higher years of education would have no symptoms because the log odds ratios of years of education in the a little mixed, negative and delusion class versus the no-symptoms class were significant negative. The log odds ratio of occupation in the a little mixed class versus the no-symptoms class was significantly different from 0, indicating that patients without occupation would have higher probability to be assigned to the a little mixed class. In addition, single patients were more likely to be assigned to the a little mixed class, because the odds ratio of marital status in the a little mixed class versus the no-symptoms class was  $e^{2.10} = 8.17$ .

From the average latent transition probabilities table, we found that sixty percent of patients assigned to the mixed class in the acute phase would belong to the a little mixed in the chronic phase. Based on the result, it may be concluded that after adjusting the demographic variables, few symptoms of the majority of patients with serious symptoms in the acute phase would be mitigated in the chronic phase. The patients belonging

to the a little mixed class in the acute phase would have equal transition probabilities. In additions, the half of patients who belonged to the negative class in the acute phase would retain the negative class in the chronic phase, and other patients would belong to the a little mixed or delusion class. About forty percent of patients who belonged to the positive class in the acute phase would cure completely in the chronic phase, and the most of other patients would belong to a little mixed or delusion class in the chronic phase. In addition, the half of patients who belonged to the delusion class in the acute phase would cure completely in the chronic phase. These results adding demographic variables were in common with the results without covariates.

- **Environmental Factors**

We performed the latent transition analysis with significant demographic variables, which were age, years of education, occupation and marital status, and environmental factors, to explore the transition probabilities after the adjustment of the effect of significant demographic variables and environmental factors. The results were summarized and presented in Table 39. The symptoms of each latent class in the acute/chronic phase were similar to that in the latent class model without covariates. Most patients belonged to the delusion or positive class in the acute phase. In the chronic phase, four latent class probabilities were equal to or greater than twenty percent.

After the demographic variables and environmental factors were adjusted, the parameter estimates of the index of mixed class in the each class versus the no-symptoms class were significant. Based on the result, it can be concluded that patients who belonged to the mixed class in the acute phase would have higher probability to be allocated to the a little mixed class or negative class in the chronic phase than patients belonging to the delusion class in the acute phase. However, patients who belonged to the delusion class in the acute phase would have higher probability to be assigned to the delusion class in the chronic phase than the patients who belonged to the mixed class in the acute phase, because the parameter estimate of the index of mixed class in the delusion class versus

the no-symptoms class was negative. In addition, patients listed on the a little mixed class in the acute phase would be more likely to retain the a little mixed class in the chronic phase than the patients belonging to the delusion class in the acute phase since the parameter estimate of the index of a little mixed class in the a little mixed class versus the no-symptoms class was significant. Patients belonging to the negative class in the acute phase had higher tendency to be assigned to the a little mixed/negative class in the chronic phase than the patients belonging to the delusion class in the acute phase.

After adjusting the significant demographic variables, the parameter estimate of dummy variables of the obvious environmental factor 2 in the a little mixed/delusion class versus the no-symptoms class were significantly different from 0. What the results represented is that patients who obviously have unstable mood or abnormal behavior to interfere with adapting to daily life were more likely to be assigned to the a little mixed/delusion class than the patient without these characteristics, as compared with the no-symptoms class.

On the other hand, the transition probability table displayed that about eight-five percent of the patients belonging to the mixed class in the acute phase would be allocated to the a little mixed in the chronic phase. The result expressed that, after adjusting significant demographic variables and environmental factors, the majority of patients with serious symptoms in the acute phase would mitigate a little symptom in the chronic phase. Approximately thirty percent of patients in the a little mixed class in the acute phase would be assigned to the a little mixed/delusion class in the chronic phase. What is more, most patients who belonged to the negative class in the acute phase would transform into the delusion class or retain the negative class in the chronic phase, and there were six percent of patients who would be cured completely. Around forty percent of patients belonging to the positive class in the acute phase would be assigned to the negative class in the chronic phase, while most of the rest patients would be assigned to the a little mixed or delusion class in the chronic phase. In addition, about forty-five percent of patients who belonged to the delusion class in the acute phase would be cured completely

in the chronic phase, while thirty percent of patients would retain the delusion class in the chronic phase.

- **Continuous Performance Task (CPT)**

We added the sensitivity index ( $d'$ ) of the CPT performance in the transition model for adjusting the effect of the subject's sustained attention. The summarized results of undegraded  $d'$  and of degraded  $d'$  were shown in Table 40 and Table 41, respectively. The symptoms of each latent class in the acute/chronic phase in the results of both variables were similar to the latent class model without covariates. Most patients belonged to the delusion or positive class in the acute phase when the transition model's significant demographic variables, which were age, years of education, occupation and marital status, and undegraded/degraded  $d'$ , were adjusted. In the chronic phase, after adjusting the significant demographic variables and undegraded  $d'$ , the numbers of patients who belonged to the each class were about equal. However, after adjusting the significant demographic variables and degraded  $d'$ , most patients would be assigned to the negative class, while few of them would be listed on the a little mixed class.

After adjusting demographic variables and undegraded  $d'$ , the parameter estimates of the index of a little mixed class in the a little mixed/negative class versus the no-symptoms class were significant, indicating that patients who belonged to the a little mixed class in the acute phase would have higher probability to be allocated to the a little mixed/negative class in the chronic phase than patients belonging to the delusion class in the acute phase. However, after adjusting the demographic variables and degraded  $d'$ , the parameter estimates of the index of a little mixed class in the mixed/negative class versus the no-symptoms class were non-significant, but the parameter estimates of the index of the mixed class in the negative class versus no-symptoms class were significant. Furthermore, in both results of undegraded  $d'$  and of degraded  $d'$ , patients listed on the negative class in the acute phase tended to have higher probability to retain the negative class in the chronic than patients in the delusion class in the acute phase, because the

parameter estimate of the index of negative class in the negative class versus the no-symptoms class was significant.

After the significant demographic variables were adjusted, the parameter estimates of undegraded  $d'$  and of degraded  $d'$ , in the a little mixed class versus the no-symptoms class were significant. According to the result, it can be summarized that patients with low sustained attention possessed higher tendency to be allocated to the a little class than patients with high sustained attention, as compared with the no-symptoms class.

From the other side, according to the transition probability table, most patients in the mixed class in the acute phase would be assigned to the a little mixed class in the chronic phase in the results of undegraded  $d'$ . However, in the results of degraded  $d'$ , eight-three of patients belonging to the mixed class in the acute phase would be assigned to the negative class in the chronic phase, whereas no patients would be allocated to the a little mixed or delusion class. In both results, most patients who belonged to the a little mixed class in the acute phase would also be in the negative class in the chronic. Around thirty percent of the patients belonging to the a little mixed class in the acute phase would be assigned to the a little mixed/delusion class in the chronic phase. Additionally, in both results, most of these patients who belonged to the negative class in the acute phase would transform into the delusion class or retain the negative class in the chronic phase. Furthermore, based on the result of undegraded  $d'$ , the majority of patients in the positive class in the acute phase would retain the positive class or transform into the no-symptoms class in the chronic phase. However, according to the result of degraded  $d'$ , most patients in the positive class would transform into the no-symptoms or negative class in the chronic phase. In both results, about forty-five percent of patients who belonged to the delusion class in the acute phase would be cured completely in the chronic phase.

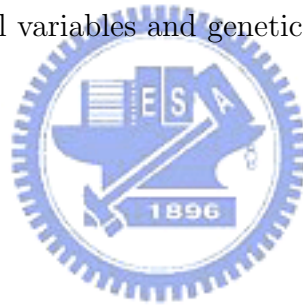
## 4.4 Discussion

In the present study, the structures of the PANSS in the acute or chronic phase were similar in the transition model with or without covariates. In the acute phase, there were five classes which were labeled as mixed, a little mixed, negative, positive and delusion. In the chronic phase, there were four classes which were labeled as a little mixed, delusion, negative and no-symptoms. The components of the a little mixed/negative /delusion class in the acute phase were similar to that of the a little mixed/negative/delusion class in the chronic phase, regardless of the transition model with or without covariates. However, the latent class probabilities and transition probabilities would depend on the transition model with or without covariates. The component of the negative class remained stable over time to confirm that Nakaya et al. (1999)'s report of that the negative component in the post-acute phase had the same composition as that in the acute phase. Arndt et al. (1995) and Amador et al. (1999) also mentioned the high stability of enduring negative symptoms, while Fenton and McGlashan (1991) have reported the stability of positive symptoms, which are less frequently (see Harvey et al., 1996, for an exception). This stability was observed for factor configuration and factor loadings.

To the best of our knowledge, this is the first study to assess the structure of the PANSS under the appliance of latent transition analysis. In the present study, we found that the great majority of patients who belonged to the mixed class in the acute phase would be assigned to the a little mixed class in the chronic phase after adjusting the demographic variables or the significant demographic variable, i.e. age, years of education, occupation and marital status, and environmental factors. In these results, a majority of the rest patients belonging to the mixed class in the acute phase would transform into the negative class in the chronic phase. However, in the transition model without covariates, most patients who belonged to the mixed class in the acute phase would be allocated to the a little mixed class or the negative class in the chronic phase. Based on

the observation of the difference between the transition model with covariate and without covariates, it can be suggested that demographic variables and environmental factors of the individual may influence each individual's symptoms of schizophrenia. Besides, most patients in the negative class in the acute phase would retain the negative class in the chronic phase. It shows the possibility that the negative symptoms are difficult to cure. In addition, majority of patients in the delusion class in the acute would be cured entirely in the chronic phase.

However, due to the fact that there were few patients who had assessed the CPT performance, the model might be unstable. The transition model is complex, and to achieve stabilization, a large sample size is required for the analysis. In the future, a large sample could be utilized to analyze the transition probabilities of schizophrenia with its focus on the neuropsychological variables and genetic factors.



## References

- Addington, J. & Addington, D. (1991). Positive and negative symptoms of schizophrenia -Their course and relationship over time. *Schizophr. Res.*, 5, 51-59.
- Agresti A. (1984). *Analysis of Categorical Data*. New York: J. Wiley and Sons.
- Akaike, H. (1987). Factor analysis and AIC. *Psychometrika*, 52, 317-332.
- Amador, X.F., Kirkpatrick, B., Buchanan, R.W., Carpenter, W.T., Marcinko, L, & Yale, S.A. (1990). Stability of the diagnosis of deficit syndrome in schizophrenia. *American Journal of Psychiatry*, 156, 637-639.
- American Psychiatric Association (1994). Diagnostic and Statistical Manual of Mental Disorders (DSM-IV). 4th ed. American Psychiatric Press, Washington, DC.
- Andreasen, N.C. (1983). *Scale for the Assessment of Negative Symptoms (SANS)*. Iowa City, IA: University of Iowa.
- Andreasen, N.C. (1984). *Scale for the Assessment of Positive Symptoms (SAPS)*. Iowa City, IA: University of Iowa.
- Andreasen, N.C., Arndt, S., Alliger, R., Miller, D. & Faum, M. (1995). Symptoms of schizophrenia. Methods, meanings, and mechanisms. *Arch. Gen. Psychiatry*, 52, 341-341.
- Andreasen, N.C., Grove, W.N. (1986). Evaluation of positive and negative symptoms in schizophrenia. *Psychiatry Psychobiol*, 1, 108-121.
- Army Individual Test Battery. (1994). Manual of Directions and Scoring. Washington, DC: War Department, Adjutant General's Office.



- Arndt, S., Alliger, R.J. & Andreasen, N.C. (1991). The distinction of positive and negative symptoms: The failure of a two-dimensional model. *British Journal of Psychiatry*, 158, 317-322.
- Arndt, S., Andreasen, N.C., Flaum, M., Miller, D., & Nopoulos, P. (1995). A longitudinal study of symptom dimensions in schizophrenia: Prediction and patterns of change. *Archives of General Psychiatry*, 52, 352-360.
- Bell, M., Mistein, R., Beam-Goulet, J., Lysaker, P., & Cicchetti, D. (1992). The Positive and Negative Syndrome Scale and the Brief Psychiatric Rating Scale: Reliability, comparability, and predictive validity. *Journal of Nervous and Mental Disorders*, 180, 723-728.
- Bell, M.D., Lysaker, P.H., Beam-Goulet, J.L., Milstein, R.M. & Lindenmayer, J.P. (1994a). Five-component model of schizophrenia: Assessing the factorial invariance of the Positive and Negative Syndrome Scale. *Psychiatry Res.*, 52, 295-303.
- Bell, M.D., Lysaker, P.H., Mistein, R.M., Beam-Goulet, J.L. (1994b). Concurrent validity of the cognitive component of schizophrenia: relationship of PANSS scores to neuropsychological assessments. *Psychiatry Res.*, 54, 51-58.
- Bilder, R.M., Mukherjee, S., Rieder, R.O., Pandurangi, A.K. (1985). Symptomatic and neuropsychological components of defect states. *Schizophr Bull*, 11, 409-419.
- Chang, C.J., Chen, W.J., Liu, S.K., Cheng, J.J., Ou Yang, W.C., Chang, H.J., Lane, H.Y., Lin, S.K., Yang, T.W., Hwu, H.G. (2001). Morbidity risk of psychiatric disorders among the first degree relatives of schizophrenic patients in Taiwan. *Schizophr. Bull.*, 28, 379-392.
- Chen, W.J., Hsiao, C.K., Hsiao, L.L., Hwu, H.G. (1998a). Performance of the continuous performance test among community samples. *Schizophr. Bull.*, 24, 163-174.

- Chen, W.J., Liu, S.K., Chang, C.J., Lien, Y.J., Chang, Y.H., Hwu, H.G. (1998b). Sustained attention deficit and schizotypal personality features in nonpsychotic relatives of schizophrenic patients. *AM. J. Psychiatry*, *155*, 1214-1220.
- Cheng, J.J., Ho, H., Chang, C.J., Lane, S.Y., Hwu, H.G. (1996). Positive and Negative Syndrome Scale (PANSS): establishment and reliability study of a mandarin Chinese language version. *Chin. Psychiatry*, *10*, 251-258.
- Collins, L.M. & Wugalter, S.E. (1992). Latent class models for stage-sequential dynamic latent variables. *Multivariate Behavioral Research*, *27*, 131-157.
- Collins, L.M., Wugalter, S.E., & Chung, N.K. (1990). Latent class models for stage-sequential dynamic latent variables. Manuscript submitted for publication.
- Cornblatt, B.A., Lenzenweger, M.F., Dworkin, R.H., Erlenmeyer-kimling, L (1985). Positive and negative schizophrenic symptoms, attention, and information processing. *Schizophrenia Bulletin*, *11*, 397-406
- Crow, T.J. (1980a). Molecular pathology of schizophrenia: more than one disease process? *British Medical Journal*, *280*, 66-68
- Crow, T.J. (1980b). Positive and negative schizophrenic symptoms and the role of dopamine. *British Journal of Psychiatry*, *137*, 383-386.
- Cuesta, M.J. & Peralta, V. (1995). Psychological dimensions in schizophrenia. *Schizophrenia Bulletin*, *21*, 473-482.
- Dempster A.P., Laird N.M., & Rubin D.B. (1977). Maximum likelihood from incomplete data via the EM algorithm. *Journal of the Royal Statistical Society, Series B*, *39*, 1-38.
- Dollfus, S. & Everitt, B. (1998). Symptom Structure in Schizophrenia: Two-, Three- or Four-Factor Models? *Psychopathology*, *31*, 120-130.

- Dollfus, S. & Petit, M. (1995). Principal-component analyses of PANSS and SANS-SNPS in schizophrenia: their stability in an acute phase. *Eur. Psychiatry*, *10*, 97-106.
- Dollfus, S., Everitt, B., Ribeyre, j.M., Assouly-Besse, F., Sharp, C & Petit, M. (1996). Identifying subtypes of schizophrenia by cluster analyses. *Schizophrenia Bulletin*, *22*, 545-555.
- Dollfus, S., Petit, M., Lesieur, P. & Menard, J.F. (1991). Principal component analyses of PANSS and SAPS-SANS in schizophrenia. *European Psychiatry*, *6*, 251-529.
- Emsley, R., Rabinowitz, J. & Torreman, M. (2003). The factor structure for the Positive and Negative Syndrome Scale (PANSS) in recent-onset psychosis. *Schizophr. Res.*, *61*, 47-57.
- Fenton, W.S. & McGlashan, T.H. (1991). Natural history of schizophrenia subtypes: II. Positive and negative symptoms and long-term course. *Archives of General Psychiatry*, *48*, 978-986.
- Fitzgerald, P.B., de Castella, A.R. Brewer, K., Filia, K., Collins, J., Davey, P., Rolfe, T. & Kulkarni, J. (2003). A confirmatory factor analytic evaluation of pentagonal PANSS model. *Schizophr. Res.*, *61*, 97-1004.
- Goldman, R.S., Tandon, R., Liberzon, I., Goodson, J & Greden, J.F. (1991). Stability of positive and negative symptom constructs during neuroleptic treatment in schizophrenia. *Psychopathology*. *24*, 247-252
- Good. K.P., Rabinowitz, J., Whitehorn, D., Harvey, P.D., DeSmedt, G., Kopala, L.C. (2004). The relationship of neuropsychological test performance with the PANSS in antipsychotic naïve, First-episode psychosis patients. *Schizophr. Res.*, *68*, 11-19.
- Heaton, R., Chelune, G., Talley, J., Kay, G., Curtis, G. (1993). Wisconsin Card Sorting Test Manual. Psychological Resources, Odessa, Florida.

- Huang, G.H., & Bandeen-Roche, K. (2004). Building an identifiable latent variable model with covariate effects on underlying and measured variables. *Psychometrika*, *69*, 5-32.
- Hwu, H.G., Chen, C.H., Hwang, T.J., Liu, C.M., Cheng, J.J., Lin, S.K., Liu, S.K., Chen, C.H., Chi, Y.Y., Ou-Young, C.W., Lin, H.N. & Chen, W.J. (2002). Symptom patterns and subgrouping of schizophrenic patients: significance of negative symptoms assessed on admission. *Schizophrenia Research*, *56*, 105-119.
- Johnstone, E.C. & Frith, C.D. (1996). Validation of three dimensions of schizophrenic symptoms in a large unselected sample of patients. *Psychol. Med.*, *26*, 669-679.
- Kay, S.R. (1991). *Positive and Negative Syndromes in Schizophrenia. Assessment and Research*. Brunner/Mazel, New York, pp.25-91.
- Kay, S.R. & Sevy, S. (1990). Pyramidal model of schizophrenia. *Schizophr. Bull.*, *16*, 537-545.
- Kay, S.R., Fiszbein, A., & Opler, L.A. (1987). The Positive and Negative Syndrome Scale (PANSS) for schizophrenia. *Schizophrenia Bulletin*, *13*, 261-276.
- Kay, S.R., Fiszbein, A., Lindenmayer, J-P, and Opler, L.A. (1986). Positive and negative syndromes in schizophrenia as a function of chronicity. *Acta Psychiatr. Scand.*, *74*, 507-518.
- Kay, S.R., Opler, L.A. & Fiszbein, A. (2000). The positive and Negative Syndrome Scale (PANSS). Multi-Health Systems, Toronto.
- Kulhara P. & Chandiramani K. (1990). Positive and negative subtypes of schizophrenia - A follow-up study from India. *Schizophr. Res.*, *3*, 107-116
- Lancon, C., Auquier, P., Nayt, G. & Reine, G. (2000). Stability of the five-factor

structure of the Positive and Negative Syndrome Scale (PANSS). *Schizophr. Res.* 42, 231-239.

Lenzenweger, M.F. & Dworkin, R.H. (1996). The dimensions of schizophrenia phenomenology: not one or two, at least three, perhaps four. *Br. J. Psychiatry*, 168, 432-440.

Liddle, P.F. (1987). The symptoms of chronic schizophrenia: Are-examination of the positive-negative dichotomy. *Br. J. Psychiatry*, 151, 145-151.

Lindenmayer, J.P., Bernstein-Hyman, R. & Grochowski, S. (1994). A new five factor model of schizophrenia. *Psychiatr. Q.*, 65, 299-322.

Lindenmayer, J.P., grochowski, S., Hyman, R.B. (1995). Five factor model of schizophrenia: replication across samples. *Schizophr. Res.*, 14, 229-234.

Little, R.J. & Rubin, D.B. (1987). *Statistical Analysis with Missing Data*. New York: Wiley.

Liu, S.K., Hwu, H.G., Chen, W.J. (1997). Clinical symptom dimensions and deficits on the Continuous Performance Test in schizophrenia. *Schizophrenia Research*, 25, 211-219.

Liu, S.K., Yeh, L.L. & Hwu, H.G. (1996). Factor Analysis on Clinical Symptoms in Acute Schizophrenic Inpatients. *Chinese Psychiatry*, 10, 346-355.

Loas, G., Noisette, C., Legrand, A., Delahousse, J. (1997). Modèle quadridimensionnel des schizophrénies chroniques issu de la structure factorielle de l'échelle des syndromes positifs et négatifs (PANSS), Etude chez un groupe de 153 schizophrènes chroniques en comparaison avec la structure factorielle de la BPRS. *L'Encéphale* XXIII, 10-18.

- Lykouras, L., Oulis, P., Psarros, K., Daskalopoulou, E., Botsis, A., Christodoulou, G.N. & Stefanis, C. (2000). Five-factor model of schizophrenic psychopathology: how valid is it? *Eur. Arch. Psychiatry Clin. Neurosci.*, *250*, 93-100.
- Malla, A.K., Norman, R.M.G., Williamson, P., Cortese, L. & Diaz, F. (1993). Three syndrome concept of schizophrenia - A factor analytic study. *Schizophr. Res.*, *10*, 143-150.
- Marder, R.S., Davis, J.M. & Chouinard, G. (1997). The effects of risperidone on the five dimensions of schizophrenia derived by factor analysis: Combined results of the north American trials. *J. Clin. Psychiatry*, *58*, 538-546.
- Mass, R., Schoemig, T., Hitschfeld, K. Wall, E. & Haasen, C. (2000). Psychopathological syndromes of schizophrenia: Evaluation of the the dimensional structure of the Positive and Negative Syndrome Scale. *Schizophrenia Bulletin*, *26*, 167-177.
- McCullagh P., & Nelder J.A. (1989). *Generalized Linear Models, 2nd edition*. London: Chapman and Hall.
- McCutcheon, A.L. (1987). *Latent Class Analysis. Sage University Papers, Series on Quantitative Applications in the social Sciences, No. 07-064*. Beverly Hills, CA: Sage Publications.
- Mortimer, A.M., Lund, C.E. & McKenna, P.J. (1990). The positive-negative dichotomy in schizophrenia. *British Journal of Psychiatry*, *157*, 41-49.
- Muller, M.J., Rossbach, W., Dannigkeit, P., Muller-Siecheneder, F., Szegedit, A. & Wetzel, H. (1998). Evaluation of standard rater training for the Positive and Negative Syndrome Scale (PANSS). *Schizophr. Res.*, *32*, 151-160.
- Muthén, B. & Shedden, K. (1999). Finite mixture modeling with mixture outcomes using the EM algorithm. *Biometrics*, *55*, 463-469.

- Muthén, L. & Muthén, B. (1998-2001). *Mplus user's guide*. Log angeles, CA: Muthén & Muthén.
- Muthén, L.K. & Muthén, B.O. (2004). *Mplus: Statistical Analysis With Latent Variables. User's Guide*.
- Nagin, D.S. (1999). Analyzing developmental trajectories: a semi-parametric, group-based approach. *Psychological Methods*, 4, 139-157.
- Nakaya, M., Suwa, H., & Ohmori, K. (1999a). Latent structures underlying schizophrenic symptoms: a five-dimensional model. *Schizophr. Res.*, 39, 39-50.
- Nakaya, M., Suwa, H., Komahashi, T. & Ohmori, K. (1999b). Is schizophrenic symptomatology independent of the phase of the illness? *Psychopathology*, 32, 23-29.
- Overall, J.E. & Gorham, D.R. (1962). The Brief Psychiatric Rating Scale. *Psychological Report*, 10, 799-812.
- Peralta, V., de Leon, J. & Cuesta, M.J. (1992). Are there more than two syndromes in schizophrenia? A critique of the positive-negative dichotomy. *British Journal of Psychiatry*, 161, 335-343.
- Ramaswamy, V., Desarbo, W., Rebstein, D. & Robinson, W. (1993). An empirical pooling approach for estimating marketing mix elasticities with PIMS data. *Marketing Science*, 12, 103-124.
- Reicherberg, A., Riechmann, N. & Philip D. Harvey Mount Sinai School of Medicine (2005). Stability in schizophrenia symptoms over time: finding from the mount sinai pilgrim psychiatric center longitudinal study. *Journal of Abnormal Psychology*, 114, 363-372.
- Reitan, R.M., and Wolfson, D. (1985). The Halstead-Reitan Neuropsychological Test Battery: Therapy and clinical interpretation. Tucson, AZ:Neuropsychological Press.

- Rosvold, H.E., Mirsk, A.F., Sarason, I., Bransome Jr, E.D., Bech, L.H. (1956). A continuous performance test of brain damage. *J. Consult. Psychol.*, *20*, 343-350.
- Schwarz, G. (1978). Estimating the dimension of a model. *Annals of Statistics*, *6*, 461-464.
- Sclove, L.S. (1987). Application of model-selection criteria to some problems in multivariate analysis. *Psychometrika*, *52*, 333-343.
- Singh, M.M. & Kay, S.R. (1975). A comparative study of haloperidol and chlorpromazine in terms of clinical effects and therapeutic reversal with benztropine in schizophrenia: theoretical implications for potency differences among neuroleptics. *Psychopharmacologia*, *43*, 103-113.
- Van Den Oord, E.J.C.G., Rujescu, D., Robles, J.R., Giegling, I., Birrell, C., Bukszár, J., Murrelle, L., Moller, H.J., Middleton, L. & Muglia, P. (2006). Factor structure and external validity of the PANSS revisited. *Schizophr. Res.*, *82*, 213-223.
- Van Der Does, A.J.W., Dingemans P.M.A.J., Liszen, D.H., Nugter, M.A. & Scholte, W.F. (1995) Dimensions and subtypes of recent-onset schizophrenia - Alongitudinal analysis. *J. Nerv. Ment. Dis.*, *183*, 681-687.
- Wechsler, D. (1982). WAIS-R Manual: Wechsler Adult Intelligence Scale-Revised. Psychological Corporation, New York.
- Wechsler, D. (1987). The Wechsler Memory Scale-Revised. Psychological Corporation, New York.
- White, L., Harvey, P.D., Opler, L. & Lindenmayer, J.P. (1997). Empirical assessment of the factorial structure of clinical symptoms in schizophrenia. A multisite, multi-model evaluation of the factorial structure of the Positive and Negative Syndrome Scale. The PANSS Study Group. *Psychopathology*, *30*, 263-274.



- White, L., Harvey, P.D., Parrella, M., Sevy, S., Knobler, H., Powchik, P. & Davison, M. (1994). Empirical assessment of the factorial structure of clinical symptoms in schizophrenic patients: Symptom structure in geriatric and nongeriatric samples. *New Trends in Experimental and Clinical Psychiatry, 10*, 75-83.
- Yazaji, M.E., Battas, O., Agoub, M., Moussaoui, D., Gutknecht, C., Dalery, J., d'Amato, T. & Saoud, M. (2002). Validity of the depressive dimension extracted from principal component analysis of the PANSS in drug-free patients with schizophrenia. *Schizophr. Res., 56*, 121-127.



Table 1: Characteristics of two groups of patients in the MPGRP project.

**Number and proportion of study subjects having symptom for the PANSS items.**

PANSS Symptom	Dropout		Non-dropout		Z test
	Case number	%	Case number	%	P-value
P1 Delusions	98	94.2	107	93.0	0.7164
P2 Conceptual disorganization	71	68.3	78	67.8	0.9368
P3 Hallucinatory behavior	91	87.5	92	80.0	0.1292
P4 Excitement	60	57.7	56	48.7	0.1806
P5 Grandiosity	25	24.0	33	28.7	0.4291
P6 Suspiciousness/persecution	86	82.7	87	75.7	0.1994
P7 Hostility	66	63.5	47	40.9	0.0006 **
N1 Blunted affect	69	66.3	78	67.8	0.8136
N2 Emotional withdrawal	76	73.1	76	66.1	0.2586
N3 Poor rapport	64	61.5	48	41.7	0.0028
N4 Passive/apathetic social withdrawal	72	69.2	73	63.5	0.3713
N5 Difficulty in abstract thinking	78	75.0	88	76.5	0.7960
N6 Lack of spontaneity/flow of conversation	55	52.9	54	47.0	0.3824
N7 Stereotyped thinking	62	59.6	56	48.7	0.1037
G1 Somatic concern	45	43.3	48	41.7	0.8110
G2 Anxiety	56	53.8	65	56.5	0.6882
G3 Guilt feelings	11	10.6	19	16.5	0.1989
G4 Tension	48	46.2	42	36.5	0.1439
G5 Mannerisms and posturing	27	26.0	25	21.7	0.4560
G6 Depression	44	42.3	44	38.3	0.5466
G7 Motor retardation	40	38.5	40	34.8	0.5703
G8 Uncooperativeness	60	57.7	43	37.4	0.0022 **
G9 Unusual thought content	85	81.7	84	73.0	0.1212
G10 Disorientation	34	32.7	30	26.1	0.2839
G11 Poor attention	58	55.8	65	56.5	0.9170
G12 Lack of judgment and insight	102	98.1	110	95.7	0.3004
G13 Disturbance of volition	55	52.9	55	47.8	0.4504
G14 Poor impulse control	55	52.9	54	47.0	0.3824
G15 Preoccupation	73	70.2	65	56.5	0.0334 *
G16 Active social avoidance	63	60.6	52	45.2	0.0210 *

**The descriptive statistics of the PANSS items.**

	Dropout				Non-dropout			
	Min.	Max.	Mean	Std.	Min.	Max.	Mean	Std.
<b>PANSS (averaged)</b>								
Positive	1.43	5.86	3.5838	0.9914	1.00	5.86	3.3826	1.0037
Negative	1.00	6.86	3.3063	1.4144	1.00	6.00	2.9366	1.1145
General	1.25	5.63	2.7434	0.8635	1.19	4.56	2.4750	0.7217

Note: The number of patient who is loss to follow-up is 104.

The number of patient who is follow-up in the chronic phase is 115.

\*: P-value<0.05; \*\*: P-value<0.01 (two-tailed).

**Characteristics of study subjects in MPGRP project.**

Binary variables	Dropout			Non-dropout		
	N	Case number	%	N	Case number	%
Male	104	49	47.12	115	61	53.04
Unmarried	104	85	81.73	115	96	83.48
Having occupation	103	30	29.13	115	25	21.74

Numerical variables	Dropout					Non-dropout				
	N	Min.	Max.	Mean	Std.	N	Min.	Max.	Mean	Std.
Age (years)	104	19.00	46.00	32.5300	7.4180	115	19.00	46.00	31.5304	7.0888
Education (years)	104	2.00	18.00	10.9700	3.0510	115	3.00	18.00	11.1826	2.8611
Age of onset of psychotic symptom	103	12.00	44.00	23.9700	7.1010	114	14.00	42.00	22.0702	5.6407

Table 2: Characteristics of the participants in the acute or chronic phase.

Binary variables	Acute			Chronic		
	N	Case number	%	N	Case number	%
Male	219	110	50.23	225	119	52.90
Unmarried	219	181	82.60	225	197	87.60
Having occupation	218	55	25.23	225	57	25.30
Having the slight environmental factor 1	212	14	6.60	213	24	11.27
Having the obvious environmental factor 1	212	0	0.00	213	5	2.35
Having the slight environmental factor 2	214	49	22.90	220	70	31.67
Having the obvious environmental factor 2	214	30	14.02	220	43	19.46
Having the slight environmental factor 3	215	45	20.93	220	56	25.34
Having the obvious environmental factor 3	215	40	18.60	220	50	22.62

Numerical variables	Acute				Chronic					
	N	Min.	Max.	Mean	Std.	N	Min.	Max.	Mean	Std.
Age (years)	219	19.00	46.00	32.0046	7.2476	225	15.00	60.00	34.0089	8.0523
Education (years)	219	2.00	18.00	11.0822	2.9480	225	3.00	20.00	11.7956	2.9373
Age of onset of psychotic symptom	217	12.00	44.00	22.9724	6.4312	222	5.00	46.00	21.3649	5.8979
Continuous Performance Test (CPT)										
Undegraded d'	174	-1.61	4.86	1.9619	1.7498	164	-1.37	4.86	3.0792	1.5553
Degraded d'	165	-1.48	4.86	0.9577	1.6293	164	-1.60	4.86	2.0240	1.7012
Wisconsin Card Sorting Test (WCST)										
Perseverative error						171	8.00	94.00	31.0610	19.9916
Categories completed						157	0.00	9.00	3.1159	2.8659
Wechsler Adult Intelligence Scale-Revised (WAIS-R)										
Full Scale IQ						99	56.00	122.00	86.2323	15.8770
Wechsler Memory Scale-Revised (WMS-R)										
Total score						94	4.00	20.00	13.3191	3.3092
Trail Making Test (TMT)										
TMT-A						189	18.00	215.00	57.1429	30.8543
TMT-B						158	0.00	503.00	129.6646	79.3572

Table 3: Characteristics of the PANSS for the acute or chronic phase.

**Number and proportion of study subjects having symptom for the PANSS items.**

Symptom	Acute		Chronic		Z test
	no. of subject having symptom	%	no. of subject having symptom	%	P-value
P1 Delusions	205	93.6	119	52.9	0.0000 **
P2 Conceptual disorganization	149	68.0	92	40.9	0.0000 **
P3 Hallucinatory behavior	183	83.6	103	45.8	0.0000 **
P4 Excitement	116	53.0	40	17.8	0.0000 **
P5 Grandiosity	58	26.5	41	18.2	0.0351 *
P6 Suspiciousness/persecution	173	79.0	78	34.7	0.0000 **
P7 Hostility	113	51.6	32	14.2	0.0000 **
N1 Blunted affect	147	67.1	108	48.0	0.0000 **
N2 Emotional withdrawal	152	69.4	99	44.0	0.0000 **
N3 Poor rapport	112	51.1	71	31.6	0.0000 **
N4 Passive/apathetic social withdrawal	145	66.2	124	55.1	0.0160 **
N5 Difficulty in abstract thinking	166	75.8	150	66.7	0.0331 **
N6 Lack of spontaneity/flow of conversatio	109	49.8	92	40.9	0.0587
N7 Stereotyped thinking	118	53.9	94	41.8	0.0102 *
G1 Somatic concern	93	42.5	71	31.6	0.0168 *
G2 Anxiety	121	55.3	85	37.8	0.0002 **
G3 Guilt feelings	30	13.7	40	17.8	0.2347
G4 Tension	90	41.1	50	22.2	0.0000 **
G5 Mannerisms and posturing	52	23.7	24	10.7	0.0002 **
G6 Depression	88	40.2	53	23.6	0.0001 **
G7 Motor retardation	80	36.5	51	22.7	0.0013 **
G8 Uncooperativeness	103	47.0	35	15.6	0.0000 **
G9 Unusual thought content	169	77.2	101	44.9	0.0000 **
G10 Disorientation	64	29.2	36	16.0	0.0008 **
G11 Poor attention	123	56.2	66	29.3	0.0000 **
G12 Lack of judgment and insight	212	96.8	160	71.1	0.0000 **
G13 Disturbance of volition	110	50.2	76	33.8	0.0004 **
G14 Poor impulse control	109	49.8	46	20.4	0.0000 **
G15 Preoccupation	138	63.0	59	26.2	0.0000 **
G16 Active social avoidance	115	52.5	68	30.2	0.0000 **

**The descriptive statistics of the PANSS items**

	Acute				Chronic			
	Min.	Max.	Mean	Std.	Min.	Max.	Mean	Std.
Positive	1.00	5.86	3.4781	1.0006	1.00	5.14	2.056	0.9337
Negative	1.00	6.86	3.1122	1.2763	1.00	5.29	2.434	1.0549
General	1.19	5.63	2.6025	0.8017	1.00	3.75	1.847	0.6050

Note: The number of patient in the acute phase is 219.

The number of patient in the chronic phase is 225.

\*: P-value<0.05; \*\*: P-value<0.01 (two-tailed).

Table 4: AIC, BIC criteria and the number of fixed parameters in the acute and chronic phases under the latent class model without incorporated covariates.

<b>Our program</b>						
Phase	Acute			Chronic		
	no. of fixed	Method		no. of fixed	Method	
Class	parameters	AIC	BIC	parameters	AIC	BIC
2	0	7183.67	7204.43	0	7058.58	7080.18
3	0	6970.36	7001.68	0	6899.47	6932.05
4	0	6949.43	6991.31	4	6823.07	6865.21
5	8	6913.80	6963.50	17	6855.58	6904.09
6	26	6944.42	6998.56	22	6749.01	6786.90
7	30	6850.13	6917.13	40	6778.29	6840.61
8	27	6920.85	6995.75	42	6723.21	6795.81
9	23	6814.42	6901.23	47	6809.86	6891.66
10	40	6837.49	6929.07	a		
11	69	6914.17	7006.43	a		

<b>Mplus</b>						
Phase	Acute			Chronic		
	no. of fixed	Method		no. of fixed	Method	
Class	parameters	AIC	BIC	parameters	AIC	BIC
2	0	7249.94	7270.71	0	7037.82	7059.30
3	4	7025.76	7055.72	4	6795.00	6857.91
4	9	6900.80	6939.61	6	6680.23	6721.44
5	15	6813.14	6860.46	13	6610.76	6660.42
6	33	6728.58	6780.33	18	6585.13	6643.94
7	39	6712.47	6772.73	43	6550.61	6611.54
8	52	6710.70	6777.09	53	6617.42	6685.75
9	69	6653.23	6724.38	62	6539.22	6615.30
10	78	6639.39	6718.03	87	6547.91	6626.09
11	82	6661.38	6749.21	100	6483.14	6567.66

<sup>a</sup> In the chronic phase, the numbers of fixed parameters in the ten- and eleven-class models are too large to make the EM algorithm converge, and it would spend much time. So we cannot show the results of the ten- and eleven-class models in the chronic phase.

Table 5: Final class proportions for the latent classes based on the estimated model.

<b>Our program</b>					
		Acute		Chronic	
Model		5-class	6-class	4-class	5-class
class	1	0.1756	0.1802	0.2787	0.1504
	2	0.1776	0.2814	0.3285	0.1729
	3	0.2029	0.1532	0.2610	0.3040
	4	0.2037	0.1508	0.1318	0.2759
	5	0.2403	0.1388		0.0966
	6		0.0955		

<b>Mplus</b>					
		Acute		Chronic	
Model		5-class	6-class	4-class	5-class
class	1	0.2073	0.1348	0.2564	0.1889
	2	0.1990	0.2555	0.2313	0.2349
	3	0.3097	0.1549	0.2839	0.0984
	4	0.1651	0.1835	0.2285	0.2605
	5	0.1190	0.1814		0.2174
	6		0.0899		

Table 6: The summary results of the acute phase with the latent five-class model without covariates using our program.

**Conditional probabilities**

Symptom	Class	Disorganized									
		Mixed		Negative		thought		Delusion		Positive	
		+	-	+	-	+	-	+	-	+	-
P1	Delusions	<b>1.00</b>		<b>0.82</b>		<b>1.00</b>		<b>0.90</b>		<b>1.00</b>	
P2	Conceptual disorganization	<b>1.00</b>		0.67		0.79		0.78		<b>0.83</b>	
P3	Hallucinatory behavior	<b>0.96</b>		0.67		<b>0.82</b>		0.76		<b>1.00</b>	
P4	Excitement	0.73			0.75					<b>0.85</b>	
P5	Grandiosity		0.74	<b>0.93</b>					<b>0.82</b>		0.65
P6	Suspiciousness/persecution	<b>1.00</b>				0.71		0.73		<b>0.95</b>	
P7	Hostility	<b>0.83</b>			0.66		<b>0.90</b>			<b>0.80</b>	
N1	Blunted affect	<b>0.95</b>		<b>1.00</b>					0.74		
N2	Emotional withdrawal	<b>0.98</b>		<b>1.00</b>					0.67	0.70	
N3	Poor rapport	<b>0.95</b>		<b>0.83</b>			<b>0.97</b>		<b>0.86</b>		
N4	Passive/apathetic social withdrawal	<b>0.91</b>		<b>1.00</b>					0.72	0.66	
N5	Difficulty in abstract thinking	<b>1.00</b>		<b>0.82</b>		<b>0.93</b>				0.72	
N6	Lack of spontaneity/flow of conversation	<b>0.85</b>		<b>0.96</b>			0.76		<b>0.90</b>		0.73
N7	Stereotyped thinking	<b>0.96</b>							<b>0.87</b>	0.71	
G1	Somatic concern				0.69						
G2	Anxiety	0.73								0.78	
G3	Guilt feelings		<b>0.80</b>	<b>0.91</b>		0.67		<b>1.00</b>			<b>0.86</b>
G4	Tension	<b>0.83</b>		0.64		<b>0.97</b>		0.78			
G5	Mannerisms and posturing			<b>0.83</b>		<b>1.00</b>		<b>0.87</b>			0.79
G6	Depression							0.66			
G7	Motor retardation	0.69					<b>0.88</b>	<b>0.90</b>			0.77
G8	Uncooperativeness	<b>0.84</b>			0.68		<b>0.94</b>		0.66	0.73	
G9	Unusual thought content	<b>1.00</b>				<b>0.92</b>		0.64		<b>0.82</b>	
G10	Disorientation	<b>0.85</b>					<b>0.88</b>		<b>0.97</b>		<b>1.00</b>
G11	Poor attention	<b>0.96</b>							<b>0.81</b>		
G12	Lack of judgment and insight	<b>1.00</b>		<b>0.98</b>		<b>1.00</b>		<b>0.88</b>		<b>1.00</b>	
G13	Disturbance of volition	0.79					0.74		<b>0.84</b>		
G14	Poor impulse control	<b>0.82</b>			0.78		<b>0.84</b>				<b>0.85</b>
G15	Preoccupation	<b>0.98</b>							0.75	<b>0.85</b>	
G16	Active social avoidance	<b>0.86</b>					<b>0.81</b>		0.70	0.69	

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.

2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.

3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.

4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.

5. The conditional probabilities in bold are equal to or higher than 0.8.

**Latent prevalence regression parameter estimates from RLCA (4) without covariates.**

Covariate	Disorganized thought							
	Mixed vs Positive		Negative vs Positive		vs Positive		Delusion vs Positive	
	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.
int	0.02	0.21	0.13	0.20	-0.29	0.22	0.16	0.20

**Average latent prevalence**

Mixed	Negative	Disorganized	
		thought	Positive
0.2007	0.2248	0.1472	0.1971

**Summary table**

No. of Fixed Parameters	17 <sup>a</sup>
No. of Free Parameters	137
N	219
-2logL	6663.639
AIC	6937.639
BIC	7401.942

a: The number of fixed parameters is different from the one shown in Table 3, we here fix some extra parameters to ensure more interpretable results.

Table 7: The summary results of the acute phase with the latent five-class model without covariates using Mplus.

Symptom		Conditional probabilities											
		Class		Mixed		Negative		Disorganized thought		Delusion		A little mixed	
		+	-	+	-	+	-	+	-	+	-	+	-
P1	Delusions	<b>1.00</b>		0.77		<b>1.00</b>		<b>0.89</b>		<b>0.94</b>			
P2	Conceptual disorganization	<b>0.94</b>								<b>0.89</b>			
P3	Hallucinatory behavior	<b>0.98</b>				<b>0.90</b>				<b>0.88</b>			
P4	Excitement	<b>0.82</b>		<b>0.86</b>		0.78		<b>1.00</b>					
P5	Grandiosity			<b>0.83</b>				0.75				<b>0.89</b>	
P6	Suspiciousness/persecution	<b>1.00</b>				<b>0.86</b>					0.74		
P7	Hostility	<b>1.00</b>						<b>1.00</b>		<b>1.00</b>			
N1	Blunted affect	<b>0.93</b>		<b>0.96</b>			0.75					<b>0.97</b>	
N2	Emotional withdrawal	<b>0.98</b>		<b>1.00</b>				<b>1.00</b>					
N3	Poor rapport	<b>0.95</b>					0.77			<b>1.00</b>		<b>0.93</b>	
N4	Passive/apathetic social withdrawal	<b>0.92</b>		<b>0.97</b>						<b>0.94</b>		<b>0.91</b>	
N5	Difficulty in abstract thinking	<b>0.95</b>		<b>0.83</b>								<b>0.81</b>	
N6	Lack of spontaneity/flow of conversation	<b>0.82</b>		0.74			<b>0.89</b>			<b>0.92</b>		<b>0.85</b>	
N7	Stereotyped thinking	<b>0.94</b>				<b>0.83</b>				<b>0.82</b>			
G1	Somatic concern					<b>0.80</b>						<b>0.80</b>	
G2	Anxiety	0.70		<b>0.82</b>									0.77
G3	Guilt feelings		<b>0.84</b>	<b>1.00</b>		<b>0.85</b>		<b>0.89</b>					
G4	Tension	<b>0.81</b>		<b>0.90</b>		0.68		<b>0.90</b>					
G5	Mannerisms and posturing			<b>0.97</b>		<b>0.82</b>		<b>1.00</b>					0.71
G6	Depression			0.70				<b>0.83</b>					
G7	Motor retardation						<b>0.90</b>	<b>0.94</b>		<b>0.85</b>			
G8	Uncooperativeness	<b>0.93</b>						<b>1.00</b>		<b>0.80</b>			
G9	Unusual thought content	<b>0.96</b>				<b>0.82</b>					0.77		
G10	Disorientation	0.69					<b>0.99</b>	<b>0.92</b>					
G11	Poor attention	<b>0.84</b>						<b>0.83</b>		<b>0.82</b>			
G12	Lack of judgment and insight	<b>1.00</b>		<b>0.97</b>		<b>0.94</b>		<b>0.96</b>		<b>0.98</b>			
G13	Disturbance of volition	0.74						<b>0.94</b>					
G14	Poor impulse control	<b>0.94</b>				<b>0.81</b>		<b>0.96</b>					
G15	Preoccupation	<b>1.00</b>						<b>0.80</b>		<b>0.88</b>			
G16	Active social avoidance	<b>0.93</b>				<b>0.81</b>		<b>0.89</b>		<b>0.75</b>			

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.  
 2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.  
 3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.  
 4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.  
 5. The conditional probabilities in bold are equal to or higher than 0.8.

**Latent prevalence regression parameter estimates from RLCA (4) without covariates.**

Covariate	Mixed vs A little mixed		Negative vs A little mixed		Disorganized thought vs A little mixed		Delusion vs A little mixed	
	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.
int	0.04	0.37	-0.19	0.35	0.44	0.28	-0.51	0.32

\*\* : significantly different from 0 at the 0.01 level

**Average latent prevalence**

	Mixed	Negative	Disorganized thought	Delusion	A little mixed
	0.2073	0.1651	0.3097	0.1190	0.1990

**Summary table**

No. of Fixed Parameters	15
No. of Free Parameters	139
N	219
-2logL	6535.136
AIC	6813.136
BIC	7284.217
Entropy	0.94

**Classification table**

Most Likely Class	Mean Posterior Probabilities				
	Mixed	Negative	Disorganized thought	Delusion	A little mixed
Mixed	0.973	0.020	0.003	0.003	0.000
Negative	0.020	0.957	0.009	0.014	0.000
Disorganized thought	0.011	0.010	0.969	0.009	0.001
Delusion	0.000	0.022	0.012	0.966	0.000
A little mixed	0.000	0.000	0.037	0.000	0.963



Table 8: The summary results of the acute phase with the latent five-class model with demographic variables using our program.

Symptom		Conditional probabilities									
		Class		Mixed		Negative		Disorganized thought		Delusion	
		+	-	+	-	+	-	+	-	+	-
P1	Delusions	<b>1.00</b>		<b>0.83</b>		<b>1.00</b>		<b>0.90</b>		<b>1.00</b>	
P2	Conceptual disorganization	<b>1.00</b>		0.67		<b>0.81</b>		0.78		<b>0.83</b>	
P3	Hallucinatory behavior	<b>0.95</b>		0.69		<b>0.81</b>		0.77		<b>0.98</b>	
P4	Excitement	0.79			0.77					<b>0.86</b>	
P5	Grandiosity		<b>0.82</b>		<b>0.90</b>				<b>0.88</b>		
P6	Suspiciousness/persecution	<b>1.00</b>			0.71	0.76		0.72		<b>0.93</b>	
P7	Hostility	<b>0.92</b>					<b>0.91</b>			<b>0.87</b>	
N1	Blunted affect	<b>1.00</b>		<b>0.98</b>					0.72		
N2	Emotional withdrawal	<b>1.00</b>		<b>1.00</b>					0.65	0.70	
N3	Poor rapport	<b>0.94</b>		<b>0.81</b>			0.93		<b>0.90</b>		
N4	Passive/apathetic social withdrawal	<b>1.00</b>		<b>0.98</b>					0.72		
N5	Difficulty in abstract thinking	<b>1.00</b>		<b>0.83</b>		<b>1.00</b>				0.73	
N6	Lack of spontaneity/flow of conversation	<b>0.91</b>		<b>0.96</b>			<b>0.81</b>		<b>0.95</b>		0.65
N7	Stereotyped thinking	<b>1.00</b>							<b>0.83</b>	0.71	
G1	Somatic concern				0.66				0.69		
G2	Anxiety	0.73								0.73	
G3	Guilt feelings		<b>0.82</b>	<b>0.88</b>			0.75		<b>0.93</b>		<b>0.87</b>
G4	Tension	<b>0.96</b>			0.63		<b>0.93</b>		<b>0.80</b>		
G5	Mannerisms and posturing	0.69			<b>0.80</b>		<b>0.93</b>		<b>0.91</b>		0.76
G6	Depression										0.66
G7	Motor retardation	0.78		0.68			<b>0.84</b>		<b>0.97</b>		0.78
G8	Uncooperativeness	<b>0.85</b>			0.69		<b>0.96</b>		0.69	<b>0.80</b>	
G9	Unusual thought content	<b>1.00</b>				<b>0.87</b>		0.68		<b>0.84</b>	
G10	Disorientation	<b>0.88</b>					<b>0.86</b>		<b>1.00</b>		<b>0.86</b>
G11	Poor attention	<b>0.94</b>		0.65					<b>0.90</b>		0.66
G12	Lack of judgment and insight	<b>1.00</b>		<b>0.98</b>			<b>0.97</b>		<b>0.92</b>		<b>0.98</b>
G13	Disturbance of volition	<b>0.84</b>		0.64				0.71	<b>0.84</b>		
G14	Poor impulse control	<b>0.86</b>			0.78		<b>0.81</b>		0.67	<b>0.92</b>	
G15	Preoccupation	<b>1.00</b>							0.76	<b>0.84</b>	
G16	Active social avoidance	<b>0.97</b>					<b>0.80</b>		0.74	0.69	

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.  
 2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.  
 3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.  
 4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.  
 5. The conditional probabilities in bold are equal to or higher than 0.8.

**Latent prevalence regression parameter estimates from RLCA (4).**

Covariate	Mixed vs Positive		Negative vs Positive		Disorganized thought vs Positive		Delusion vs Positive	
	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.
intercept	-1.25	1.75	-2.09	1.48	0.81	1.79	-4.13	1.57
gender	0.52	0.47	0.90 *	0.40	0.38	0.47	-0.26	0.42
age	0.09 *	0.04	0.04	0.04	0.06	0.04	-0.07	0.04
education, yrs	-0.18 *	0.09	0.04	0.08	-0.26 **	0.09	0.17 *	0.08
occupation	-0.52	0.57	-0.21	0.47	-0.84	0.63	1.09 *	0.44
age of onset	-0.02	0.05	0.01	0.04	-0.03	0.05	0.15 **	0.05
marital status	0.28	0.67	-0.17	0.60	0.37	0.70	0.38	0.66

Note: 1. gender: 1: male, 0: female; occupation: 1: having occupation, 0: no occupation; marital status: 1: single, 0: married.  
 2. \*: significantly different from 0 at the 0.05 level.  
 \*\*: significantly different from 0 at the 0.01 level.

**Average latent prevalence**

Mixed	Negative	Disorganized thought	Delusion	Positive
0.1516	0.2452	0.1410	0.2206	0.2416

**Summary table**

No. of Fixed Parameters	16
No. of Free Parameters	162
N	216
-2logL	6479.445
AIC	6803.445
BIC	7350.240

Table 9: The summary results of the acute phase with the latent five-class model with demographic variables using Mplus.

Symptom		Conditional probabilities										
		Class		Mixed		Negative		Disorganized thought		Delusion		A little mixed
		+	-	+	-	+	-	+	-	+	-	
P1	Delusions	<b>1.00</b>			0.70			<b>1.00</b>		<b>0.85</b>		<b>1.00</b>
P2	Conceptual disorganization	<b>1.00</b>										<b>0.89</b>
P3	Hallucinatory behavior	<b>0.95</b>						<b>0.88</b>				<b>0.97</b>
P4	Excitement	<b>0.89</b>				<b>0.87</b>	0.70			<b>1.00</b>		
P5	Grandiosity		0.75			<b>0.86</b>				0.75		
P6	Suspiciousness/persecution	<b>1.00</b>						<b>0.87</b>				<b>0.83</b>
P7	Hostility	<b>1.00</b>								<b>1.00</b>		
N1	Blunted affect	<b>0.94</b>				<b>1.00</b>				<b>0.81</b>		<b>0.96</b>
N2	Emotional withdrawal	<b>1.00</b>				<b>1.00</b>				<b>1.00</b>		<b>0.94</b>
N3	Poor rapport	<b>1.00</b>				<b>1.00</b>			<b>0.80</b>	<b>1.00</b>		0.71
N4	Passive/apathetic social withdrawal	<b>0.97</b>				<b>0.83</b>		0.67		<b>1.00</b>		<b>0.90</b>
N5	Difficulty in abstract thinking	<b>1.00</b>			0.78							<b>0.87</b>
N6	Lack of spontaneity/flow of conversation	<b>1.00</b>							<b>0.91</b>	<b>0.90</b>		
N7	Stereotyped thinking	<b>1.00</b>					0.73	0.63		<b>0.80</b>		0.78
G1	Somatic concern						0.70					
G2	Anxiety	0.77					0.76					0.73
G3	Guilt feelings		0.81			<b>1.00</b>		<b>0.87</b>		<b>0.90</b>		0.78
G4	Tension	<b>0.92</b>				<b>0.81</b>		0.68		<b>1.00</b>		
G5	Mannerisms and posturing	0.70				<b>0.97</b>		<b>0.85</b>		<b>1.00</b>		0.69
G6	Depression									<b>0.95</b>		
G7	Motor retardation	0.68						<b>0.90</b>		<b>0.95</b>		
G8	Uncooperativeness	<b>0.87</b>								<b>1.00</b>		
G9	Unusual thought content	<b>1.00</b>						<b>0.80</b>				<b>0.86</b>
G10	Disorientation	0.80							<b>0.96</b>	<b>1.00</b>		
G11	Poor attention	<b>0.91</b>								<b>0.90</b>		0.79
G12	Lack of judgment and insight	<b>1.00</b>				<b>1.00</b>		<b>0.91</b>		<b>1.00</b>		<b>0.98</b>
G13	Disturbance of volition	<b>0.86</b>								<b>1.00</b>		
G14	Poor impulse control	<b>0.92</b>					0.78			<b>0.95</b>		
G15	Preoccupation	<b>1.00</b>					0.73			<b>0.85</b>		<b>0.91</b>
G16	Active social avoidance	<b>1.00</b>					0.73			<b>1.00</b>		0.73

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.  
 2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.  
 3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.  
 4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.  
 5. The conditional probabilities in bold are equal to or higher than 0.8.

**Latent prevalence regression parameter estimates from RLCA (4).**

Covariate	Mixed vs A little mixed		Negative vs A little mixed		Disorganized thought vs A little mixed		Delusion vs A little mixed	
	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.
intercept	0.80	5.13	0.60	2.68	0.85	2.50	-4.28	2.88
gender	-0.71	1.00	-0.26	0.58	-0.75	0.51	-1.31 *	0.65
age	0.09	0.14	0.05	0.04	0.02	0.05	-0.06	0.08
education, yrs	-0.24	0.23	-0.12	0.11	-0.07	0.11	-0.04	0.11
occupation	-0.83	1.11	-1.50	0.81	-0.69	0.51	1.14	0.60
age at onset	-0.06	0.04	-0.03	0.05	-0.01	0.03	0.13	0.10
marital status	0.34	1.77	-0.09	0.80	0.44	0.66	2.74	1.72

Note: 1. gender: 1: male, 0: female; occupation: 1: having occupation, 0: no occupation; marital status: 1: single, 0: married.  
 2. \*: significantly different from 0 at the 0.05 level.

**Average latent prevalence**

Disorganized				
Mixed	Negative	thought	Delusion	A little mixed
0.1449	0.1680	0.3196	0.0919	0.2758

**Summary table**

No. of Fixed Parameters	32
No. of Free Parameters	146
N	216
-2logL	6427.390
AIC	6719.390
BIC	388.009
Entropy	0.947

**Classification table**

Most Likely Class	Mean Posterior Probabilities				
	Mixed	Negative	Disorganized thought	Delusion	A little mixed
Mixed	0.948	0.052	0.000	0.000	0.000
Negative	0.000	0.965	0.009	0.026	0.000
Disorganized thought	0.000	0.031	0.965	0.003	0.000
Delusion	0.000	0.011	0.000	0.989	0.000
A little mixed	0.000	0.000	0.000	0.008	0.992

Table 10: The summary results of the acute phase with the latent five-class model with environmental factors adjusted significant demographic variables using our program.

**Conditional probabilities**

Symptom	Class	Disorganized									
		Mixed		Negative		thought		Delusion		Positive	
		+	-	+	-	+	-	+	-	+	-
P1 Delusions		<b>1.00</b>		<b>0.83</b>		<b>0.97</b>		<b>0.91</b>		<b>1.00</b>	
P2 Conceptual disorganization		<b>1.00</b>		0.65		0.76		0.77		0.79	
P3 Hallucinatory behavior		<b>0.96</b>		0.67		0.78		0.77		<b>0.98</b>	
P4 Excitement		0.74			0.76					<b>0.86</b>	
P5 Grandiosity			0.79		<b>0.91</b>			<b>0.88</b>			
P6 Suspiciousness/persecution		<b>1.00</b>				0.74		0.73		<b>0.91</b>	
P7 Hostility		0.75			0.66		<b>0.90</b>			<b>0.92</b>	
N1 Blunted affect		<b>1.00</b>		<b>0.97</b>				0.73			
N2 Emotional withdrawal		<b>1.00</b>		<b>1.00</b>				0.65			
N3 Poor rapport		<b>0.84</b>		<b>0.86</b>			<b>0.93</b>	<b>0.90</b>			
N4 Passive/apathetic social withdrawal		<b>0.93</b>		<b>1.00</b>				0.70			
N5 Difficulty in abstract thinking		<b>1.00</b>		<b>0.81</b>		<b>1.00</b>		0.65	0.70		
N6 Lack of spontaneity/flow of conversation		<b>0.88</b>		<b>0.93</b>			0.76	<b>0.98</b>			0.70
N7 Stereotyped thinking		<b>0.98</b>						<b>0.85</b>	0.67		
G1 Somatic concern					0.70			0.69			0.69
G2 Anxiety		0.76								0.69	
G3 Guilt feelings			0.72		<b>0.93</b>		0.74	<b>0.91</b>		<b>0.95</b>	
G4 Tension		<b>0.94</b>			0.68		<b>0.94</b>	0.77			
G5 Mannerisms and posturing					<b>0.84</b>		<b>0.94</b>	<b>0.91</b>			0.75
G6 Depression											0.74
G7 Motor retardation		0.76					<b>0.84</b>	<b>0.98</b>			<b>0.82</b>
G8 Uncooperativeness		0.72			0.65		<b>0.97</b>	0.72	<b>0.85</b>		
G9 Unusual thought content		<b>0.95</b>				<b>0.82</b>		0.69	<b>0.83</b>		
G10 Disorientation		0.75					<b>0.88</b>	<b>1.00</b>		<b>0.89</b>	
G11 Poor attention		<b>0.93</b>						<b>0.90</b>		0.67	
G12 Lack of judgment and insight		<b>1.00</b>		<b>0.98</b>		<b>0.97</b>		<b>0.91</b>		<b>0.98</b>	
G13 Disturbance of volition		<b>0.82</b>					0.72	<b>0.82</b>			
G14 Poor impulse control		0.79			0.77		0.77	0.73	<b>0.95</b>		
G15 Preoccupation		<b>0.98</b>						0.74	<b>0.82</b>		
G16 Active social avoidance		<b>0.88</b>					<b>0.84</b>	0.75	0.71		

- Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.  
 2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.  
 3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.  
 4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.  
 5. The conditional probabilities in bold are equal to or higher than 0.8.

**Latent prevalence regression parameter estimates from RLCA (4).**

Covariate	Disorganized thought							
	Mixed vs Positive		Negative vs Positive		vs Positive		Delusion vs Positive	
	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.
envir1	-32.77	3.85E+06	-1.08	0.85	-0.98	0.88	0.55	0.85
envir21	-0.02	0.65	1.44 *	0.57	-0.52	0.76	0.57	0.62
envir22	-1.75 *	0.74	-0.63	0.76	-1.34	0.74	-1.01	0.84
envir31	1.14	0.60	-1.19	0.69	0.65	0.66	0.33	0.60
envir32	1.40	0.73	0.62	0.70	1.41	0.75	1.62 *	0.74

- Note: 1. dummy variable : envir1(having environmental factor 1); envir21 (slight environmental factor 2); envir22 (obvious environmental factor 2);  
 envir31 (slight environmental factor 3); envir32 (obvious environmental factor 3).  
 2. The effect of environmental factors are adjusted the significant demographic variables (gender, age, years of education, occupation, age of onset).  
 3. \*: significantly different from 0 at the 0.05 level.

**Average latent prevalence**

Disorganized				
Mixed	Negative	thought	Delusion	Positive
0.2001	0.2254	0.1504	0.2095	0.2145

**Summary table**

No. of Fixed Parameters	12
No. of Free Parameters	182
N	208
-2logL	6330.969
AIC	6694.969
BIC	7302.400

Table 11: The summary results of the acute phase with the latent five-class model with environmental factors adjusted significant demographic variables using Mplus.

Symptom		Conditional probabilities										
		Class	Mixed		Negative		Disorganized thought		Delusion		A little mixed	
			+	-	+	-	+	-	+	-	+	-
P1	Delusions	<b>1.00</b>		0.78		<b>1.00</b>		<b>0.88</b>		<b>1.00</b>		
P2	Conceptual disorganization	<b>0.96</b>								<b>0.89</b>		
P3	Hallucinatory behavior	<b>0.98</b>		0.68		<b>0.87</b>				<b>0.85</b>		
P4	Excitement	<b>0.83</b>			0.77	0.79			<b>1.00</b>			
P5	Grandiosity		0.67		<b>0.81</b>				0.73		<b>1.00</b>	
P6	Suspiciousness/persecution	<b>1.00</b>				<b>0.87</b>					0.74	
P7	Hostility	<b>0.91</b>							<b>1.00</b>			
N1	Blunted affect	<b>0.92</b>		<b>0.96</b>			0.77				<b>1.00</b>	
N2	Emotional withdrawal	<b>0.96</b>		<b>1.00</b>					<b>0.80</b>		<b>1.00</b>	
N3	Poor rapport	<b>0.88</b>					0.79		<b>1.00</b>			
N4	Passive/apathetic social withdrawal	<b>0.92</b>		<b>0.98</b>			0.66		0.75		<b>0.88</b>	
N5	Difficulty in abstract thinking	<b>1.00</b>		<b>0.83</b>							<b>0.88</b>	
N6	Lack of spontaneity/flow of conversation	0.74		0.75			<b>0.87</b>		<b>0.90</b>		<b>0.95</b>	
N7	Stereotyped thinking	<b>0.93</b>							<b>0.81</b>		<b>0.88</b>	
G1	Somatic concern				<b>0.81</b>							
G2	Anxiety	0.72			0.71						<b>0.84</b>	
G3	Guilt feelings		<b>0.84</b>		<b>0.95</b>		<b>0.85</b>		<b>0.91</b>		0.74	
G4	Tension	0.75			<b>0.81</b>				<b>0.96</b>		0.77	
G5	Mannerisms and posturing				<b>0.91</b>		<b>0.85</b>		<b>1.00</b>			
G6	Depression								<b>0.86</b>			
G7	Motor retardation						<b>0.89</b>		<b>0.90</b>		<b>0.88</b>	
G8	Uncooperativeness	<b>0.85</b>							<b>1.00</b>			
G9	Unusual thought content	<b>0.95</b>				<b>0.81</b>					<b>0.80</b>	
G10	Disorientation				0.68		<b>0.98</b>		<b>0.94</b>			
G11	Poor attention	<b>0.86</b>							<b>0.84</b>		0.78	
G12	Lack of judgment and insight	<b>1.00</b>		<b>0.95</b>		<b>0.92</b>		<b>1.00</b>			<b>1.00</b>	
G13	Disturbance of volition	0.79							<b>0.92</b>		<b>0.84</b>	
G14	Poor impulse control	<b>1.00</b>			0.68				<b>0.97</b>		<b>0.86</b>	
G15	Preoccupation	<b>1.00</b>							0.75		<b>0.89</b>	
G16	Active social avoidance	<b>0.92</b>			<b>0.70</b>				<b>0.88</b>		<b>0.77</b>	

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.  
 2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.  
 3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.  
 4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.  
 5. The conditional probabilities in bold are equal to or higher than 0.8.

**Latent prevalence regression parameter estimates from RLCA (4).**

Covariate	Mixed		Negative		Disorganized thought		Delusion	
	vs A little mixed		vs A little mixed		vs A little mixed		vs A little mixed	
	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.
envir1	0.08	1.37	-0.66	1.47	1.15	1.25	1.58	1.38
envir21	-0.54	0.82	1.31	1.31	0.91	0.76	-1.14	1.11
envir22	0.58	1.00	1.11	0.99	0.98	1.02	0.40	1.70
envir31	0.39	0.76	-2.29	1.03	0.18	0.72	-0.57	1.02
envir32	-0.46	0.88	-0.58	0.73	-0.17	0.56	0.26	1.05

Note: 1. dummy variable : envir1(having environmental factor 1); envir21 (slight environmental factor 2); envir22 (obvious environmental factor 2);  
 envir31 (slight environmental factor 3); envir32 (obvious environmental factor 3).  
 2. The effect of environmental factors are adjusted the significant demographic variables (gender).

**Average latent prevalence**

	Mixed	Negative	Disorganized thought	Delusion	A little mixed
	0.2255	0.2002	0.2997	0.1486	0.1260

**Summary table**

No. of Fixed Parameters	19
No. of Free Parameters	159
N	210
-2logL	6272.242
AIC	6590.242
BIC	7122.432
Entropy	0.948

**Classification table**

Most Likely Class	Mean Posterior Probabilities				
	Mixed	Negative	Disorganized thought	Delusion	A little mixed
Mixed	0.959	0.000	0.026	0.015	0.000
Negative	0.000	0.949	0.001	0.029	0.022
Disorganized thought	0.008	0.003	0.981	0.008	0.000
Delusion	0.000	0.006	0.014	0.979	0.000
A little mixed	0.000	0.009	0.014	0.003	0.974

Table 12: The summary results of the acute phase with the latent five-class model with the undegraded  $d'$  of the CPT performance adjusted significant demographic variables using our program.

**Conditional probabilities**

Symptom	Class	Disorganized									
		Mixed		Negative		thought		Delusion		Positive	
		+	-	+	-	+	-	+	-	+	-
P1 Delusions		<b>1.00</b>		<b>0.85</b>		<b>0.95</b>		<b>0.97</b>		<b>1.00</b>	
P2 Conceptual disorganization		<b>1.00</b>		0.67		0.77		0.78		<b>0.83</b>	
P3 Hallucinatory behavior		<b>1.00</b>		0.71		0.71		0.78		<b>0.97</b>	
P4 Excitement		0.75			0.68					<b>0.84</b>	
P5 Grandiosity			<b>0.83</b>		<b>0.94</b>				<b>0.81</b>	<b>0.87</b>	
P6 Suspiciousness/persecution		<b>1.00</b>		0.67		0.76		<b>0.81</b>		<b>0.96</b>	
P7 Hostility		<b>0.90</b>			0.64		<b>0.88</b>				
N1 Blunted affect		<b>1.00</b>		<b>0.98</b>					<b>0.86</b>		
N2 Emotional withdrawal		<b>1.00</b>		<b>1.00</b>					0.68		
N3 Poor rapport		<b>0.89</b>		0.78			<b>0.92</b>		<b>0.89</b>		
N4 Passive/apathetic social withdrawal		<b>0.97</b>		<b>0.94</b>					0.74		
N5 Difficulty in abstract thinking		<b>1.00</b>		<b>0.81</b>		<b>1.00</b>					
N6 Lack of spontaneity/flow of conversation		<b>0.88</b>		<b>0.96</b>			0.72		<b>0.97</b>		0.74
N7 Stereotyped thinking		<b>1.00</b>							<b>0.89</b>		
G1 Somatic concern						0.71					0.70
G2 Anxiety		<b>0.82</b>									
G3 Guilt feelings			<b>0.83</b>		<b>0.83</b>		<b>0.84</b>		<b>0.89</b>		<b>0.90</b>
G4 Tension		<b>0.94</b>					<b>1.00</b>		0.70		
G5 Mannerisms and posturing					<b>0.81</b>		<b>1.00</b>		<b>0.86</b>		0.70
G6 Depression							0.74				0.76
G7 Motor retardation		0.76		0.67			<b>0.91</b>		<b>0.97</b>		<b>0.90</b>
G8 Uncooperativeness		<b>0.86</b>			0.72		<b>1.00</b>		0.67		<b>0.93</b>
G9 Unusual thought content		<b>1.00</b>				<b>0.84</b>		0.73		<b>0.96</b>	
G10 Disorientation		<b>0.82</b>					<b>0.85</b>		<b>1.00</b>		<b>0.81</b>
G11 Poor attention		<b>0.93</b>		0.64					<b>0.89</b>		0.76
G12 Lack of judgment and insight		<b>1.00</b>		<b>0.98</b>		<b>0.96</b>		<b>0.89</b>		<b>0.97</b>	
G13 Disturbance of volition		0.78		0.68			<b>0.81</b>		0.78		
G14 Poor impulse control		<b>0.85</b>			0.76		0.76		0.72		<b>0.97</b>
G15 Preoccupation		<b>1.00</b>							0.75		<b>0.92</b>
G16 Active social avoidance		<b>1.00</b>					0.79		0.73		0.72

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.

- The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.
- The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.
- The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.
- The conditional probabilities in bold are equal to or higher than 0.8.

**Latent prevalence regression parameter estimates from RLCA (4).**

Covariate	Disorganized thought							
	Mixed vs Positive		Negative vs Positive		vs Positive		Delusion vs Positive	
	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.
undegraded $d'$	-0.14	0.17	-0.28 *	0.14	0.04	0.18	0.27	0.17

Note: 1. The effect of undegraded  $d'$  is adjusted the significant demographic variables (gender, age, years of education, occupation, age of onset).

- significantly different from 0 at the 0.05 level.

**Average latent prevalence**

	Mixed	Negative	Disorganized	
			thought	Positive
	0.1614	0.3051	0.1402	0.1801

**Summary table**

No. of Fixed Parameters	19
No. of Free Parameters	159
N	171
-2logL	5038.390
AIC	5356.390
BIC	5855.914

Table 13: The summary results of the acute phase with the latent five-class model with the undegraded  $d'$  of the CPT performance adjusted significant demographic variables using Mplus.

**Conditional probabilities**

Symptom	Class	Disorganized									
		Mixed		Negative		thought		Delusion		A little mixed	
		+	-	+	-	+	-	+	-	+	-
P1 Delusions		<b>1.00</b>		<b>0.85</b>		<b>1.00</b>		<b>0.88</b>		<b>0.94</b>	
P2 Conceptual disorganization		<b>1.00</b>								<b>0.86</b>	
P3 Hallucinatory behavior		<b>1.00</b>				<b>0.86</b>				<b>0.86</b>	
P4 Excitement		<b>0.87</b>			0.75	0.74		<b>1.00</b>			
P5 Grandiosity			0.70		<b>0.82</b>						<b>0.91</b>
P6 Suspiciousness/persecution		<b>1.00</b>		0.72		<b>0.85</b>				0.69	
P7 Hostility		<b>1.00</b>						<b>1.00</b>			0.79
N1 Blunted affect		<b>0.93</b>		<b>0.94</b>			0.77			<b>1.00</b>	
N2 Emotional withdrawal		<b>1.00</b>		<b>0.97</b>				<b>1.00</b>		<b>1.00</b>	
N3 Poor rapport		<b>1.00</b>		0.73		<b>0.82</b>		<b>1.00</b>			
N4 Passive/apathetic social withdrawal		<b>0.90</b>		<b>0.98</b>				<b>1.00</b>		<b>0.91</b>	
N5 Difficulty in abstract thinking		<b>1.00</b>		<b>0.85</b>						<b>0.86</b>	
N6 Lack of spontaneity/flow of conversation		<b>0.87</b>				<b>0.89</b>		<b>0.88</b>		<b>0.91</b>	
N7 Stereotyped thinking		<b>1.00</b>			0.72			<b>0.83</b>		<b>0.86</b>	
G1 Somatic concern					0.78						
G2 Anxiety		<b>0.83</b>			0.71					0.72	
G3 Guilt feelings			<b>0.80</b>	<b>1.00</b>		<b>0.83</b>		<b>0.94</b>			0.74
G4 Tension		<b>0.80</b>			0.75	0.66		<b>0.89</b>			
G5 Mannerisms and posturing				<b>0.97</b>		<b>0.81</b>		<b>1.00</b>			
G6 Depression					0.78			<b>0.89</b>		0.70	
G7 Motor retardation					0.71	<b>0.92</b>		<b>1.00</b>		<b>0.88</b>	
G8 Uncooperativeness		<b>0.91</b>						<b>1.00</b>			0.79
G9 Unusual thought content		<b>1.00</b>				<b>0.88</b>				0.73	
G10 Disorientation		0.76			0.71	<b>0.94</b>		<b>1.00</b>			
G11 Poor attention		<b>0.93</b>						<b>0.95</b>		0.79	
G12 Lack of judgment and insight		<b>1.00</b>		<b>0.98</b>		<b>0.92</b>		<b>0.95</b>		<b>0.97</b>	
G13 Disturbance of volition		0.73						<b>1.00</b>		<b>0.81</b>	
G14 Poor impulse control		<b>0.94</b>						<b>0.94</b>			0.74
G15 Preoccupation		<b>1.00</b>						<b>0.89</b>		<b>0.88</b>	
G16 Active social avoidance		<b>0.97</b>			0.74			<b>0.89</b>		<b>0.78</b>	

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.

- The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.
- The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.
- The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.
- The conditional probabilities in bold are equal to or higher than 0.8.

**Latent prevalence regression parameter estimates from RLCA (4).**

Covariate	Mixed vs A little mixed		Negative vs A little mixed		Disorganized thought vs A little mixed		Delusion vs A little mixed	
	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.
undegraded $d'$	0.05	0.15	-0.04	0.15	0.41	0.15	0.13	0.23

Note: The effect of undegraded  $d'$  is adjusted the significant demographic variables (gender).

**Average latent prevalence**

	Mixed	Negative	Disorganized thought	Delusion	A little mixed
	0.1702	0.2266	0.3071	0.0957	0.2005

**Summary table**

No. of Fixed Parameters	26
No. of Free Parameters	136
N	174
-2logL	5169.406
AIC	5441.406
BIC	5871.038
Entropy	0.951

**Classification table**

Most Likely Class	Mean Posterior Probabilities				
	Mixed	Negative	Disorganized thought	Delusion	A little mixed
Mixed	0.984	0.015	0.000	0.000	0.000
Negative	0.002	0.969	0.026	0.002	0.000
Disorganized thought	0.000	0.010	0.963	0.027	0.000
Delusion	0.000	0.002	0.018	0.979	0.000
A little mixed	0.000	0.000	0.000	0.021	0.979

Table 14: The summary results of the acute phase with the latent five-class model with the degraded  $d'$  of the CPT performance adjusted significant demographic variables using our program.

**Conditional probabilities**

Symptom	Class	Disorganized									
		Mixed		Negative		thought		Delusion		Positive	
		+	-	+	-	+	-	+	-	+	-
P1 Delusions		<b>1.00</b>		<b>0.84</b>		<b>0.95</b>		<b>0.97</b>		<b>1.00</b>	
P2 Conceptual disorganization		<b>1.00</b>		0.66		0.76		0.75		0.76	
P3 Hallucinatory behavior		<b>1.00</b>		0.72				0.76		<b>0.96</b>	
P4 Excitement		0.74			0.69					<b>0.86</b>	
P5 Grandiosity			<b>0.82</b>		<b>0.93</b>				<b>0.80</b>		
P6 Suspiciousness/persecution		<b>1.00</b>		0.68		0.79		0.79		<b>0.86</b>	
P7 Hostility		<b>0.89</b>			0.65		<b>0.87</b>			<b>0.96</b>	
N1 Blunted affect		<b>1.00</b>		<b>0.98</b>					<b>0.89</b>		
N2 Emotional withdrawal		<b>1.00</b>		<b>1.00</b>							
N3 Poor rapport		<b>0.89</b>		<b>0.81</b>			<b>0.91</b>		<b>0.88</b>		
N4 Passive/apathetic social withdrawal		<b>0.97</b>		<b>0.94</b>					0.71		
N5 Difficulty in abstract thinking		<b>1.00</b>		<b>0.80</b>		<b>1.00</b>			0.70		
N6 Lack of spontaneity/flow of conversation		<b>0.87</b>		<b>0.96</b>			0.71		<b>0.97</b>		0.76
N7 Stereotyped thinking		<b>1.00</b>							<b>0.88</b>		
G1 Somatic concern						0.73					
G2 Anxiety		<b>0.85</b>									
G3 Guilt feelings			<b>0.82</b>		<b>0.84</b>		<b>0.82</b>		<b>0.88</b>		<b>0.89</b>
G4 Tension		<b>0.97</b>					<b>1.00</b>				
G5 Mannerisms and posturing					<b>0.80</b>		<b>1.00</b>		<b>0.88</b>		0.72
G6 Depression							0.71				0.70
G7 Motor retardation		0.73		0.69			<b>0.91</b>		<b>1.00</b>		<b>0.85</b>
G8 Uncooperativeness		<b>0.86</b>			0.73		<b>1.00</b>		0.71	<b>0.92</b>	
G9 Unusual thought content		<b>1.00</b>				<b>0.83</b>		0.76		<b>0.93</b>	
G10 Disorientation		0.79					<b>0.89</b>		<b>1.00</b>		<b>0.83</b>
G11 Poor attention		<b>0.93</b>							<b>0.93</b>	0.74	
G12 Lack of judgment and insight		<b>1.00</b>		<b>0.98</b>		<b>0.96</b>		<b>0.88</b>		<b>0.96</b>	
G13 Disturbance of volition		0.76					<b>0.80</b>		0.75		
G14 Poor impulse control		<b>0.85</b>			0.77		0.74		0.77	<b>0.96</b>	
G15 Preoccupation		<b>1.00</b>							0.76	<b>0.85</b>	
G16 Active social avoidance		<b>1.00</b>					0.78		0.73	0.71	

- Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.  
 2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.  
 3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.  
 4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.  
 5. The conditional probabilities in bold are equal to or higher than 0.8.

**Latent prevalence regression parameter estimates from RLCA (4).**

Covariate	Disorganized thought							
	Mixed vs Positive		Negative vs Positive		vs Positive		Delusion vs Positive	
	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.
degraded $d'$	-0.12	0.18	-0.17	0.15	-0.06	0.19	-0.03	0.17

Note: The effect of degraded  $d'$  is adjusted the significant demographic variables (gender, age, years of education, occupation, age of onset).

**Average latent prevalence**

	Disorganized				
	Mixed	Negative	thought	Delusion	Positive
	0.1682	0.3089	0.1436	0.2006	0.1787

**Summary table**

No. of Fixed Parameters	20
No. of Free Parameters	158
N	162
-2logL	4785.618
AIC	5101.618
BIC	5589.458

Table 15: The summary results of the acute phase with the latent five-class model with the degraded  $d'$  of the CPT performance adjusted significant demographic variables using Mplus.

**Conditional probabilities**

Symptom	Class	Disorganized									
		Mixed		Negative		thought		Delusion		A little mixed	
		+	-	+	-	+	-	+	-	+	-
P1 Delusions		<b>1.00</b>				<b>1.00</b>		<b>0.89</b>		<b>1.00</b>	
P2 Conceptual disorganization		<b>0.94</b>								<b>0.88</b>	
P3 Hallucinatory behavior		<b>1.00</b>				<b>0.86</b>				<b>0.89</b>	
P4 Excitement		0.77			<b>0.80</b>	0.74			<b>1.00</b>		
P5 Grandiosity					<b>0.87</b>						<b>0.87</b>
P6 Suspiciousness/persecution		<b>0.98</b>				<b>0.84</b>					
P7 Hostility		<b>1.00</b>							<b>1.00</b>		<b>0.80</b>
N1 Blunted affect		<b>0.97</b>		<b>1.00</b>			0.74	0.78		<b>0.94</b>	
N2 Emotional withdrawal		<b>1.00</b>		<b>1.00</b>			0.77	<b>1.00</b>		<b>1.00</b>	
N3 Poor rapport		<b>0.93</b>			0.79			<b>1.00</b>			
N4 Passive/apathetic social withdrawal		<b>0.91</b>		<b>1.00</b>					<b>0.94</b>		<b>0.88</b>
N5 Difficulty in abstract thinking		<b>1.00</b>		<b>0.81</b>							<b>0.83</b>
N6 Lack of spontaneity/flow of conversation		0.79		<b>0.80</b>			<b>0.90</b>		<b>0.89</b>	<b>0.93</b>	
N7 Stereotyped thinking		<b>0.96</b>							<b>0.84</b>	0.79	
G1 Somatic concern											
G2 Anxiety											
G3 Guilt feelings			<b>0.81</b>	<b>1.00</b>		<b>0.83</b>		<b>0.95</b>			0.77
G4 Tension		0.79					0.65	<b>0.89</b>			
G5 Mannerisms and posturing				<b>0.97</b>		<b>0.85</b>		<b>1.00</b>			
G6 Depression								0.78			
G7 Motor retardation							<b>0.94</b>	<b>1.00</b>	<b>0.89</b>		
G8 Uncooperativeness		<b>0.93</b>						<b>1.00</b>			0.78
G9 Unusual thought content		<b>1.00</b>				<b>0.84</b>				0.76	
G10 Disorientation					0.77		<b>1.00</b>	<b>0.89</b>			
G11 Poor attention		<b>0.88</b>						<b>0.89</b>		0.77	
G12 Lack of judgment and insight		<b>1.00</b>		<b>1.00</b>		<b>0.92</b>		<b>0.95</b>		<b>0.94</b>	
G13 Disturbance of volition								<b>1.00</b>		0.79	
G14 Poor impulse control		<b>0.96</b>						<b>0.94</b>		<b>0.82</b>	
G15 Preoccupation		<b>1.00</b>						<b>0.89</b>	<b>0.91</b>		
G16 Active social avoidance		<b>0.97</b>						<b>0.83</b>	0.75		

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.

- The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.
- The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.
- The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.
- The conditional probabilities in bold are equal to or higher than 0.8.

**Latent prevalence regression parameter estimates from RLCA (4).**

Covariate	Mixed vs A little mixed		Negative vs A little mixed		Disorganized thought vs A little mixed		Delusion vs A little mixed	
	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.
degraded $d'$	-0.19	0.16	-0.29	0.22	0.14	0.16	-0.29	0.17

Note: The effect of degraded  $d'$  is adjusted the significant demographic variables (gendert).

**Average latent prevalence**

	Mixed	Negative	Disorganized thought	Delusion	A little mixed
	0.1999	0.1739	0.3105	0.1083	0.2074

**Summary table**

No. of Fixed Parameters	25
No. of Free Parameters	137
N	165
-2logL	4897.124
AIC	5171.124
BIC	5596.639
Entropy	0.957

**Classification table**

Most Likely Class	Mean Posterior Probabilities				
	Mixed	Negative	Disorganized thought	Delusion	A little mixed
Mixed	0.978	0.013	0.006	0.004	0.000
Negative	0.000	0.969	0.022	0.009	0.000
Disorganized thought	0.011	0.012	0.976	0.002	0.000
Delusion	0.007	0.014	0.004	0.974	0.000
A little mixed	0.000	0.000	0.000	0.008	0.992



Table 16: The summary results of the chronic phase with the latent four-class model without covariates using our program.

Symptom		Conditional probabilities								
		Class	A little mixed		Negative		Delusion		No-symptoms	
			+	-	+	-	+	-	+	-
P1	Delusions		<b>0.92</b>			0.72	0.75			<b>1.00</b>
P2	Conceptual disorganization		<b>0.87</b>					0.68		<b>1.00</b>
P3	Hallucinatory behavior		<b>0.84</b>			0.68				<b>0.94</b>
P4	Excitement		0.75			<b>0.88</b>		<b>0.84</b>		<b>1.00</b>
P5	Grandiosity			0.67		<b>0.98</b>		0.69		<b>1.00</b>
P6	Suspiciousness/persecution					<b>0.85</b>		0.63		<b>0.96</b>
P7	Hostility			0.66		<b>0.92</b>		<b>0.88</b>		<b>1.00</b>
N1	Blunted affect		0.76		<b>0.92</b>			<b>0.85</b>		<b>0.89</b>
N2	Emotional withdrawal		0.77		0.78			<b>0.82</b>		<b>0.97</b>
N3	Poor rapport				0.67			<b>0.95</b>		<b>1.00</b>
N4	Passive/apathetic social withdrawal		<b>0.83</b>		<b>0.93</b>			0.75		<b>0.80</b>
N5	Difficulty in abstract thinking		<b>0.97</b>		<b>0.90</b>					0.74
N6	Lack of spontaneity/flow of conversation		0.66		0.78			<b>0.91</b>		<b>0.87</b>
N7	Stereotyped thinking		0.75					0.70		<b>0.98</b>
G1	Somatic concern					0.79		0.67		<b>0.95</b>
G2	Anxiety		0.73			<b>0.85</b>		0.65		0.77
G3	Guilt feelings			0.73		<b>0.91</b>		<b>0.86</b>		0.78
G4	Tension					<b>0.82</b>		<b>0.83</b>		<b>0.89</b>
G5	Mannerisms and posturing			0.76		<b>0.92</b>		<b>0.92</b>		<b>0.98</b>
G6	Depression					<b>0.87</b>		<b>0.80</b>		<b>0.83</b>
G7	Motor retardation							<b>0.97</b>		<b>0.94</b>
G8	Uncooperativeness					<b>0.82</b>		<b>0.97</b>		<b>1.00</b>
G9	Unusual thought content		<b>0.89</b>			<b>0.82</b>				<b>1.00</b>
G10	Disorientation			0.72		0.74		<b>0.93</b>		<b>0.98</b>
G11	Poor attention		0.64			0.65		<b>0.84</b>		<b>1.00</b>
G12	Lack of judgment and insight		<b>0.98</b>		<b>0.85</b>		0.69			0.74
G13	Disturbance of volition							<b>0.83</b>		<b>0.89</b>
G14	Poor impulse control					<b>0.85</b>		<b>0.86</b>		<b>1.00</b>
G15	Preoccupation		0.70			<b>0.83</b>		<b>0.86</b>		<b>1.00</b>
G16	Active social avoidance					0.71		0.76		<b>0.97</b>

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.

2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.
3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.
4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.
5. The conditional probabilities in bold are equal to or higher than 0.8.

#### Latent prevalence regression parameter estimates from RLCA (4) without covariates.

Covariate	A little mixed vs No-symptoms		Negative vs No-symptoms		Delusion vs No-symptoms	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
intercept	0.21	0.19	0.11	0.20	0.35	0.19

#### Average latent prevalence

A little mixed	Negative	Delusion	No-symptoms
0.2593	0.2343	0.2971	0.2093

#### Summary table

No. of Fixed Parameters	11 <sup>a</sup>
No. of Free Parameters	112
N	225
-2logL	6460.924
AIC	6684.924
BIC	7067.528

a: The number of fixed parameters is different from the one shown in Table 3, we here fix some extra parameters to ensure more interpretable results.

Table 17: The summary results of the chronic phase with the latent four-class model without covariates using Mplus.

Symptom		<b>Conditional probabilities</b>									
		Class		A little mixed		Negative		Delusion		No-symptoms	
		+	-	+	-	+	-	+	-	+	-
P1	Delusions	<b>0.92</b>				<b>0.83</b>				<b>1.00</b>	
P2	Conceptual disorganization	<b>0.88</b>					0.66			<b>0.99</b>	
P3	Hallucinatory behavior	<b>0.83</b>								<b>0.91</b>	
P4	Excitement				<b>0.92</b>		0.79			<b>1.00</b>	
P5	Grandiosity		0.66		<b>0.96</b>		0.67			<b>0.99</b>	
P6	Suspiciousness/persecution	0.75			0.77					<b>0.97</b>	
P7	Hostility				<b>0.92</b>		<b>0.91</b>			<b>0.95</b>	
N1	Blunted affect	0.74			<b>1.00</b>		<b>0.83</b>			<b>0.88</b>	
N2	Emotional withdrawal	0.74			<b>0.84</b>		0.78			<b>0.95</b>	
N3	Poor rapport				0.72		<b>0.94</b>			<b>0.98</b>	
N4	Passive/apathetic social withdrawal	<b>0.82</b>			<b>0.95</b>		0.71			0.76	
N5	Difficulty in abstract thinking	<b>1.00</b>			<b>0.87</b>					0.70	
N6	Lack of spontaneity/flow of conversation				<b>0.85</b>		<b>0.89</b>			<b>0.86</b>	
N7	Stereotyped thinking	0.74					0.68			<b>0.92</b>	
G1	Somatic concern	0.68				0.78	0.69			<b>0.91</b>	
G2	Anxiety	<b>0.81</b>			<b>0.85</b>		0.65			0.77	
G3	Guilt feelings		0.70		<b>0.92</b>		<b>0.86</b>			<b>0.80</b>	
G4	Tension		0.74		<b>0.81</b>		<b>0.84</b>			<b>0.90</b>	
G5	Mannerisms and posturing		0.70		<b>0.91</b>		<b>0.92</b>			<b>0.99</b>	
G6	Depression				<b>0.85</b>		<b>0.81</b>			<b>0.84</b>	
G7	Motor retardation						<b>0.97</b>			<b>0.94</b>	
G8	Uncooperativeness				<b>0.80</b>		<b>0.95</b>			<b>1.00</b>	
G9	Unusual thought content	<b>0.88</b>								<b>1.00</b>	
G10	Disorientation	0.66				0.72	<b>0.92</b>			<b>0.98</b>	
G11	Poor attention	<b>0.98</b>					<b>0.82</b>			<b>0.99</b>	
G12	Lack of judgment and insight	0.72		<b>0.87</b>		0.70					
G13	Disturbance of volition						0.78			<b>0.89</b>	
G14	Poor impulse control				<b>0.89</b>		<b>0.85</b>			<b>0.96</b>	
G15	Preoccupation				0.78		<b>0.83</b>			<b>1.00</b>	
G16	Active social avoidance						0.76			<b>0.96</b>	

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.

- The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.
- The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.
- The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.
- The conditional probabilities in bold are equal to or higher than 0.8.

**Latent prevalence regression parameter estimates from RLCA (4) without covariates.**

Covariate	A little mixed vs No-symptoms		Negative vs No-symptoms		Delusion vs No-symptoms	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
intercept	-0.12	0.23	-0.10	0.22	0.22	0.21

**Average latent prevalence**

A little mixed	Negative	Delusion	No-symptoms
0.2285	0.2313	0.2971	0.2564

**Summary table**

No. of Fixed Parameters	6
No. of Free Parameters	117
N	225
-2logL	6446.232
AIC	6680.232
BIC	7079.916
Entropy	0.935

**Classification table**

Most Likely Class	Mean Posterior Probabilities			
	Mixed	Negative	Delusion	No-symptoms
A little mixed	0.966	0.012	0.022	0.000
Negative	0.010	0.931	0.030	0.028
Delusion	0.014	0.006	0.971	0.010
No-symptoms	0.000	0.021	0.002	0.977

Table 18: The summary results of the chronic phase with the latent four-class model with demographic variables using our program.

Symptom		Conditional probabilities									
		Class		A little mixed		Negative		Delusion		No-symptoms	
		+	-	+	-	+	-	+	-	+	-
P1	Delusions	<b>0.91</b>			0.71	<b>0.84</b>					<b>1.00</b>
P2	Conceptual disorganization	<b>0.87</b>					0.66				<b>0.98</b>
P3	Hallucinatory behavior	<b>0.86</b>			0.70						<b>0.92</b>
P4	Excitement				<b>0.87</b>		<b>0.82</b>				<b>1.00</b>
P5	Grandiosity		0.69		<b>0.98</b>		0.66				<b>0.99</b>
P6	Suspiciousness/persecution	0.75			<b>0.85</b>						<b>0.97</b>
P7	Hostility		0.65		<b>0.92</b>			<b>0.92</b>			<b>0.94</b>
N1	Blunted affect	0.78			<b>0.92</b>		<b>0.83</b>				<b>0.90</b>
N2	Emotional withdrawal	0.76			0.78		<b>0.81</b>				<b>0.96</b>
N3	Poor rapport				0.64		<b>0.95</b>				<b>0.98</b>
N4	Passive/apathetic social withdrawal	<b>0.82</b>			<b>0.93</b>		0.74				0.78
N5	Difficulty in abstract thinking	<b>0.97</b>			<b>0.90</b>						0.72
N6	Lack of spontaneity/flow of conversation	0.69			0.76		<b>0.90</b>				<b>0.87</b>
N7	Stereotyped thinking	0.75					0.68				<b>0.95</b>
G1	Somatic concern				0.79		0.67				<b>0.91</b>
G2	Anxiety	0.74			<b>0.85</b>		0.64				0.76
G3	Guilt feelings		0.73		<b>0.91</b>		<b>0.86</b>				<b>0.80</b>
G4	Tension				<b>0.82</b>		<b>0.83</b>				<b>0.89</b>
G5	Mannerisms and posturing		0.76		<b>0.92</b>		<b>0.92</b>				<b>0.98</b>
G6	Depression				<b>0.86</b>		<b>0.80</b>				<b>0.83</b>
G7	Motor retardation						<b>0.97</b>				<b>0.94</b>
G8	Uncooperativeness				<b>0.84</b>		<b>0.97</b>				<b>1.00</b>
G9	Unusual thought content	<b>0.89</b>			<b>0.82</b>	0.65					<b>1.00</b>
G10	Disorientation		0.70		0.75		<b>0.93</b>				<b>0.98</b>
G11	Poor attention	0.65			0.66		<b>0.84</b>				<b>0.99</b>
G12	Lack of judgment and insight	<b>0.98</b>		<b>0.86</b>		0.69					0.69
G13	Disturbance of volition	0.68					<b>0.81</b>				<b>0.90</b>
G14	Poor impulse control				<b>0.85</b>		<b>0.89</b>				<b>0.96</b>
G15	Preoccupation				<b>0.82</b>		<b>0.84</b>				<b>1.00</b>
G16	Active social avoidance				0.70		0.76				<b>0.95</b>

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.  
 2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.  
 3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.  
 4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.  
 5. The conditional probabilities in bold are equal to or higher than 0.8.

**Latent prevalence regression parameter estimates from RLCA (4).**

Covariate	A little mixed vs No-symptoms		Negative vs No-symptoms		Delusion vs No-symptoms	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
intercept	1.29	1.59	3.86 *	1.63	1.91	1.47
gender	0.03	0.41	0.49	0.43	-0.54	0.39
age	0.08 *	0.03	-0.03	0.04	0.03	0.03
education, yrs	-0.28 **	0.08	-0.41 **	0.08	-0.22 **	0.07
occupation	-1.37 **	0.48	-1.06 *	0.49	-0.52	0.41
age of onset	-0.07	0.04	0.04	0.05	-0.02	0.04
marital status	1.39 *	0.69	1.20	0.78	1.13	0.65

Note: 1. gender: 1: male, 0: female; occupation: 1: having occupation, 0: no occupation; marital status: 1: single, 0: married.  
 2. \*: significantly different from 0 at the 0.05 level.  
 \*\*: significantly different from 0 at the 0.01 level.

**Average latent prevalence**

A little mixed	Negative	Delusion	No-symptoms
0.2600	0.2264	0.2725	0.2411

**Summary table**

No. of Fixed Parameters	5
No. of Free Parameters	136
N	222
-2logL	6313.417
AIC	6585.417
BIC	7048.182

Table 19: The summary results of the chronic phase with the latent four-class model with demographic variables using Mplus.

Symptom		Conditional probabilities									
		Class		A little mixed		Negative		Delusion		No-symptoms	
		+	-	+	-	+	-	+	-	+	-
P1	Delusions			<b>0.91</b>			0.72	<b>0.90</b>			<b>0.91</b>
P2	Conceptual disorganization			<b>0.87</b>							<b>0.98</b>
P3	Hallucinatory behavior			<b>0.86</b>			0.70				<b>0.91</b>
P4	Excitement					<b>0.88</b>			0.78		<b>1.00</b>
P5	Grandiosity		0.70			<b>0.98</b>			0.65		<b>0.94</b>
P6	Suspiciousness/persecution		0.76			<b>0.85</b>					<b>0.96</b>
P7	Hostility					<b>0.92</b>			<b>0.92</b>		<b>0.95</b>
N1	Blunted affect		0.78			<b>0.92</b>			<b>0.80</b>		<b>0.90</b>
N2	Emotional withdrawal		0.77			0.79			<b>0.80</b>		<b>0.94</b>
N3	Poor rapport								<b>0.94</b>		<b>0.98</b>
N4	Passive/apathetic social withdrawal			<b>0.83</b>		<b>0.93</b>			0.69		<b>0.80</b>
N5	Difficulty in abstract thinking			<b>0.97</b>		<b>0.90</b>					0.73
N6	Lack of spontaneity/flow of conversation		0.70		0.76				<b>0.88</b>		<b>0.89</b>
N7	Stereotyped thinking		0.75								<b>0.94</b>
G1	Somatic concern		0.75				0.79				<b>0.90</b>
G2	Anxiety						<b>0.84</b>				0.74
G3	Guilt feelings				0.72		<b>0.91</b>		<b>0.85</b>		<b>0.81</b>
G4	Tension						<b>0.82</b>		<b>0.84</b>		<b>0.87</b>
G5	Mannerisms and posturing				0.75		<b>0.92</b>		<b>0.90</b>		<b>0.98</b>
G6	Depression						<b>0.86</b>		0.76		<b>0.86</b>
G7	Motor retardation								<b>0.96</b>		<b>0.95</b>
G8	Uncooperativeness						<b>0.84</b>		<b>0.96</b>		<b>1.00</b>
G9	Unusual thought content			<b>0.89</b>			<b>0.82</b>		<b>0.91</b>		<b>0.93</b>
G10	Disorientation				0.70		0.75		<b>0.81</b>		<b>0.98</b>
G11	Poor attention										<b>0.98</b>
G12	Lack of judgment and insight			<b>0.98</b>		<b>0.86</b>		0.68	0.78		<b>0.92</b>
G13	Disturbance of volition								<b>0.87</b>		<b>0.96</b>
G14	Poor impulse control						<b>0.84</b>		<b>0.80</b>		<b>1.00</b>
G15	Preoccupation			0.69			<b>0.82</b>		0.74		<b>0.94</b>
G16	Active social avoidance						0.70				

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.  
 2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.  
 3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.  
 4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.  
 5. The conditional probabilities in bold are equal to or higher than 0.8.

**Latent prevalence regression parameter estimates from RLCA (4).**

Covariate	A little mixed vs No-symptoms		Negative vs No-symptoms		Delusion vs No-symptoms	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
intercept	1.94	1.74	4.62 **	1.67	4.15	2.28
gender	0.31	0.46	0.73	0.58	-0.02	0.52
age	0.07 *	0.03	-0.04	0.04	0.01	0.04
education, yrs	-0.25 *	0.09	-0.38 **	0.10	-0.23	0.12
occupation	-1.42 *	0.55	-1.19 *	0.55	-0.85	0.69
age at onset	-0.09	0.05	0.01	0.06	-0.09	0.06
marital	0.97	0.73	0.77	0.76	0.39	0.78

Note: 1. gender: 1: male, 0: female; occupation: 1: having occupation, 0: no occupation; marital status: 1: single, 0: married.  
 2. \*: significantly different from 0 at the 0.05 level.  
 \*\*: significantly different from 0 at the 0.01 level.

**Average latent prevalence**

A little mixed	Negative	Delusion	No-symptoms
0.2536	0.2276	0.2327	0.2860

**Summary table**

No. of Fixed Parameters	3
No. of Free Parameters	138
N	222
-2logL	6313.042
AIC	6589.042
BIC	7058.611
Entropy	0.924

**Classification table**

Most Likely Class	Mean Posterior Probabilities			
	A little mixed	Negative	Delusion	No-symptoms
A little mixed	0.966	0.012	0.022	0.000
Negative	0.010	0.931	0.030	0.028
Delusion	0.014	0.006	0.971	0.010
No-symptoms	0.000	0.021	0.002	0.977

Table 20: The summary results of the chronic phase with the latent four-class model with environmental factors adjusted significant demographic variables using our program.

Symptom		Conditional probabilities									
		Class		A little mixed		Negative		Delusion		No-symptoms	
		+	-	+	-	+	-	+	-	+	-
P1	Delusions	<b>0.91</b>			0.74	<b>0.88</b>					<b>1.00</b>
P2	Conceptual disorganization	<b>0.86</b>					0.73				<b>0.98</b>
P3	Hallucinatory behavior	<b>0.82</b>			0.66						<b>0.94</b>
P4	Excitement				<b>0.86</b>		<b>0.83</b>				<b>1.00</b>
P5	Grandiosity		0.69		<b>0.98</b>		0.67				<b>0.99</b>
P6	Suspiciousness/persecution	0.73			<b>0.86</b>						<b>0.97</b>
P7	Hostility				<b>0.92</b>		<b>0.93</b>				<b>0.94</b>
N1	Blunted affect	0.75			<b>0.89</b>		<b>0.82</b>				<b>0.90</b>
N2	Emotional withdrawal	0.76			0.74		<b>0.84</b>				<b>0.98</b>
N3	Poor rapport						<b>0.94</b>				<b>0.98</b>
N4	Passive/apathetic social withdrawal	<b>0.81</b>			<b>0.89</b>		0.73				<b>0.80</b>
N5	Difficulty in abstract thinking	<b>0.96</b>			<b>0.90</b>						0.70
N6	Lack of spontaneity/flow of conversation	0.66			0.76		<b>0.94</b>				<b>0.86</b>
N7	Stereotyped thinking	0.76					0.73				<b>0.95</b>
G1	Somatic concern				0.78						<b>0.92</b>
G2	Anxiety	0.71			<b>0.86</b>		0.64				0.75
G3	Guilt feelings		0.73		<b>0.90</b>		<b>0.85</b>				<b>0.80</b>
G4	Tension				<b>0.84</b>		<b>0.84</b>				<b>0.88</b>
G5	Mannerisms and posturing		0.76		<b>0.92</b>		<b>0.92</b>				<b>0.99</b>
G6	Depression				<b>0.88</b>		0.78				<b>0.82</b>
G7	Motor retardation						<b>0.98</b>				<b>0.94</b>
G8	Uncooperativeness				<b>0.82</b>		<b>0.96</b>				<b>1.00</b>
G9	Unusual thought content	<b>0.87</b>			<b>0.81</b>	0.66					<b>1.00</b>
G10	Disorientation		0.72		0.73		<b>0.96</b>				<b>0.98</b>
G11	Poor attention	0.65			0.65		<b>0.87</b>				<b>0.98</b>
G12	Lack of judgment and insight	<b>0.98</b>			<b>0.84</b>		0.68				0.73
G13	Disturbance of volition						<b>0.84</b>				<b>0.90</b>
G14	Poor impulse control				<b>0.82</b>		<b>0.91</b>				<b>0.96</b>
G15	Preoccupation	0.71			<b>0.83</b>		<b>0.84</b>				<b>1.00</b>
G16	Active social avoidance				0.77		0.75				<b>0.96</b>

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.  
 2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.  
 3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.  
 4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.  
 5. The conditional probabilities in bold are equal to or higher than 0.8.

#### Latent prevalence regression parameter estimates from RLCA (4).

Covariate	A little mixed vs No-symptoms		Negative vs No-symptoms		Delusion vs No-symptoms	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
envir11	1.61	0.88	1.03	0.90	1.57	0.85
envir21	1.09 *	0.54	1.11 *	0.52	0.67	0.50
envir22	1.17	0.75	1.58 *	0.70	0.96	0.69
envir31	-1.26 *	0.60	-0.92	0.57	-0.39	0.52
envir32	-0.41	0.61	-0.38	0.59	-0.30	0.58

Note: 1. dummy variable : envir11(having environmental factor 1); envir21 (slight environmental factor 2); envir22 (obvious environmental factor 2);  
 envir31 (slight environmental factor 3) ; envir32 (obvious environmental factor 3).  
 2. The effect of environmental factors are adjusted the significant demographic variables (age, years of education, occupation, marital status).  
 3. \*: significantly different from 0 at the 0.05 level.  
 \*\*: significantly different from 0 at the 0.01 level.

#### Average latent prevalence

A little mixed	Negative	Delusion	No-symptoms
0.2583	0.2371	0.2642	0.2404

#### Summary table

No. of Fixed Parameters	5
No. of Free Parameters	145
N	211
-2logL	5986.518
AIC	6276.518
BIC	6762.538

Table 21: The summary results of the chronic phase with the latent four-class model with environmental factors adjusted significant demographic variables using Mplus.

Symptom		Conditional probabilities									
		Class		A little mixed		Negative		Delusion		No-symptoms	
		+	-	+	-	+	-	+	-	+	-
P1	Delusions			<b>0.91</b>						<b>0.92</b>	
P2	Conceptual disorganization			<b>0.86</b>						<b>0.98</b>	
P3	Hallucinatory behavior			<b>0.83</b>						<b>0.92</b>	
P4	Excitement										
P5	Grandiosity		0.69			<b>0.87</b>		0.78		<b>1.00</b>	
P6	Suspiciousness/persecution	0.74				<b>0.98</b>		0.67		<b>0.94</b>	
P7	Hostility					<b>0.87</b>				<b>0.96</b>	
P7	Hostility					<b>0.92</b>				<b>0.90</b>	
N1	Blunted affect	0.77				<b>0.90</b>		0.79		<b>0.90</b>	
N2	Emotional withdrawal	0.77				0.75		<b>0.84</b>		<b>0.95</b>	
N3	Poor rapport									<b>0.94</b>	
N4	Passive/apathetic social withdrawal			<b>0.82</b>		<b>0.89</b>		0.69		<b>0.81</b>	
N5	Difficulty in abstract thinking			<b>0.96</b>		<b>0.90</b>					0.73
N6	Lack of spontaneity/flow of conversation	0.67				0.76				<b>0.93</b>	
N7	Stereotyped thinking	0.77									<b>0.95</b>
G1	Somatic concern							0.78			<b>0.90</b>
G2	Anxiety	0.73				<b>0.85</b>					0.74
G3	Guilt feelings		0.72			<b>0.91</b>			<b>0.83</b>		<b>0.82</b>
G4	Tension					<b>0.84</b>			<b>0.84</b>		<b>0.88</b>
G5	Mannerisms and posturing		0.76			<b>0.92</b>			<b>0.92</b>		<b>0.98</b>
G6	Depression					<b>0.88</b>		0.75			<b>0.85</b>
G7	Motor retardation									<b>0.96</b>	<b>0.95</b>
G8	Uncooperativeness					<b>0.82</b>			<b>0.96</b>		<b>1.00</b>
G9	Unusual thought content	<b>0.88</b>				<b>0.81</b>	0.70				<b>0.94</b>
G10	Disorientation		0.73			0.73			<b>0.94</b>		<b>0.98</b>
G11	Poor attention								<b>0.83</b>		<b>0.98</b>
G12	Lack of judgment and insight	<b>0.98</b>				<b>0.84</b>	0.67				
G13	Disturbance of volition									<b>0.82</b>	<b>0.91</b>
G14	Poor impulse control					<b>0.82</b>			<b>0.88</b>		<b>0.97</b>
G15	Preoccupation	0.71				<b>0.83</b>			<b>0.80</b>		<b>1.00</b>
G16	Active social avoidance					0.77		0.74			<b>0.93</b>

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.  
 2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.  
 3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.  
 4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.  
 5. The conditional probabilities in bold are equal to or higher than 0.8.

**Latent prevalence regression parameter estimates from RLCA (4).**

Covariate	A little mixed vs No-symptoms		Negative vs No-symptoms		Delusion vs No-symptoms	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
envir11	0.21	0.96	0.84	0.84	0.62	1.06
envir21	0.97	0.55	0.95	0.61	0.56	0.53
envir22	1.83 **	0.68	1.49 *	0.72	1.56 *	0.76
envir31	-0.87	0.60	-1.19	0.62	-0.27	0.52
envir32	-0.31	0.56	-0.41	0.65	-0.38	0.57

Note: 1. dummy variable : envir11(having environmental factor 1); envir21 (slight environmental factor 2); envir22 (obvious environmental factor 2);  
 envir31 (slight environmental factor 3); envir32 (obvious environmental factor 3).  
 2. The effect of environmental factors are adjusted the significant demographic variables (age, years of education, occupation).  
 3. \*: significantly different from 0 at the 0.05 level.  
 \*\*: significantly different from 0 at the 0.01 level.

**Average latent prevalence**

Delusion	A little mixed	Negative	No-symptoms
0.2321	0.2500	0.2361	0.2818

**Summary table**

No. of Fixed Parameters	3
No. of Free Parameters	144
N	211
-2logL	5992.406
AIC	6280.406
BIC	6763.074
Entropy	0.936

**Classification table**

Most Likely Class	Mean Posterior Probabilities			
	A little mixed	Negative	Delusion	No-symptoms
A little mixed	0.957	0.009	0.013	0.020
Negative	0.014	0.956	0.023	0.007
Delusion	0.011	0.009	0.980	0.000
No-symptoms	0.013	0.003	0.000	0.984

Table 22: The summary results of the chronic phase with the latent four-class model with the undegraded  $d'$  of the CPT performance adjusted significant demographic variables using our program.

Symptom		Conditional probabilities								
		Class	A little mixed		Negative		Delusion		No-symptoms	
			+	-	+	-	+	-	+	-
P1	Delusions		<b>0.98</b>			0.73	<b>0.91</b>			<b>1.00</b>
P2	Conceptual disorganization		<b>0.84</b>					0.76		<b>0.98</b>
P3	Hallucinatory behavior		<b>0.92</b>			0.67				<b>0.92</b>
P4	Excitement					<b>0.85</b>		<b>0.81</b>		<b>1.00</b>
P5	Grandiosity					<b>0.98</b>		0.72		<b>0.98</b>
P6	Suspiciousness/persecution		0.79			<b>0.85</b>				<b>0.96</b>
P7	Hostility					<b>0.89</b>		<b>0.90</b>		<b>0.94</b>
N1	Blunted affect		<b>0.80</b>		<b>0.89</b>			<b>0.86</b>		<b>0.92</b>
N2	Emotional withdrawal		<b>0.82</b>			0.76		<b>0.91</b>		<b>0.96</b>
N3	Poor rapport					0.70		<b>0.97</b>		<b>0.98</b>
N4	Passive/apathetic social withdrawal		<b>0.90</b>		<b>0.93</b>			0.77		0.78
N5	Difficulty in abstract thinking		<b>0.95</b>			<b>0.91</b>				0.73
N6	Lack of spontaneity/flow of conversation					0.76		<b>0.93</b>		<b>0.90</b>
N7	Stereotyped thinking		0.74					0.77		<b>0.98</b>
G1	Somatic concern					0.74		0.66		<b>0.90</b>
G2	Anxiety		0.74			<b>0.86</b>		0.69		0.78
G3	Guilt feelings			<b>0.87</b>		<b>0.92</b>		<b>0.81</b>		0.78
G4	Tension					<b>0.84</b>		<b>0.85</b>		<b>0.90</b>
G5	Mannerisms and posturing			<b>0.80</b>		<b>0.91</b>		<b>0.90</b>		<b>0.98</b>
G6	Depression					<b>0.86</b>		0.75		<b>0.84</b>
G7	Motor retardation							<b>0.97</b>		<b>0.96</b>
G8	Uncooperativeness					0.77		<b>0.95</b>		<b>1.00</b>
G9	Unusual thought content		<b>0.97</b>					0.70		<b>1.00</b>
G10	Disorientation			0.71		0.76		<b>0.95</b>		<b>0.98</b>
G11	Poor attention					0.67		<b>0.89</b>		<b>0.98</b>
G12	Lack of judgment and insight		<b>0.97</b>		<b>0.84</b>					0.70
G13	Disturbance of volition							<b>0.84</b>		<b>0.92</b>
G14	Poor impulse control					<b>0.80</b>		<b>0.87</b>		<b>0.96</b>
G15	Preoccupation		0.66			<b>0.86</b>		<b>0.87</b>		<b>1.00</b>
G16	Active social avoidance					0.71		0.71		<b>0.94</b>

- Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.  
 2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.  
 3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.  
 4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.  
 5. The conditional probabilities in bold are equal to or higher than 0.8.

**Latent prevalence regression parameter estimates from RLCA (4).**

Covariate	A little mixed vs No-symptoms		Negative vs No-symptoms		Delusion vs No-symptoms	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
undegraded $d'$	-0.62 **	0.19	-0.30	0.19	-0.02	0.20

- Note: 1. The effect of undegraded  $d'$  is adjusted the significant demographic variables (age, years of education, occupation, marital status).  
 2. \*\*: significantly different from 0 at the 0.01 level.

**Average latent prevalence**

A little mixed	Negative	Delusion	No-symptoms
0.2287	0.2574	0.2298	0.2841

**Summary table**

No. of Fixed Parameters	5
No. of Free Parameters	134
N	171
-2logL	4610.605
AIC	4878.605
BIC	5299.588

Table 23: The summary results of the chronic phase with the latent four-class model with the degraded  $d'$  of the CPT performance adjusted significant demographic variables using our program.

<b>Conditional probabilities</b>										
Symptom		Class	A little mixed		Negative		Delusion		No-symptoms	
			+	-	+	-	+	-	+	-
P1	Delusions		<b>0.97</b>			0.72	<b>0.93</b>			<b>1.00</b>
P2	Conceptual disorganization		<b>0.82</b>					0.71		<b>0.98</b>
P3	Hallucinatory behavior		<b>0.94</b>			0.67				<b>0.92</b>
P4	Excitement					<b>0.82</b>		<b>0.83</b>		<b>1.00</b>
P5	Grandiosity					<b>0.97</b>		0.71		<b>0.98</b>
P6	Suspiciousness/persecution		<b>0.83</b>			<b>0.85</b>				<b>0.96</b>
P7	Hostility					<b>0.87</b>		<b>0.94</b>		<b>0.92</b>
N1	Blunted affect		0.77		<b>0.90</b>			<b>0.88</b>		<b>0.89</b>
N2	Emotional withdrawal		<b>0.83</b>		0.78			<b>0.94</b>		<b>0.96</b>
N3	Poor rapport				0.69			<b>0.97</b>		<b>0.98</b>
N4	Passive/apathetic social withdrawal		<b>0.89</b>		<b>0.92</b>			<b>0.82</b>		0.79
N5	Difficulty in abstract thinking		<b>0.94</b>		<b>0.90</b>					0.71
N6	Lack of spontaneity/flow of conversation				0.72			<b>0.93</b>		<b>0.90</b>
N7	Stereotyped thinking		0.72					0.77		<b>0.98</b>
G1	Somatic concern					0.71				<b>0.90</b>
G2	Anxiety		0.71			<b>0.84</b>		0.69		0.75
G3	Guilt feelings			<b>0.88</b>		<b>0.90</b>		<b>0.82</b>		0.79
G4	Tension					<b>0.82</b>		<b>0.86</b>		<b>0.87</b>
G5	Mannerisms and posturing			0.77		<b>0.90</b>		<b>0.92</b>		<b>0.98</b>
G6	Depression					<b>0.85</b>		0.75		<b>0.81</b>
G7	Motor retardation							<b>0.97</b>		<b>0.96</b>
G8	Uncooperativeness					0.74		<b>0.94</b>		<b>1.00</b>
G9	Unusual thought content		<b>0.97</b>			0.79	0.76			<b>1.00</b>
G10	Disorientation			0.71		0.77		<b>0.97</b>		<b>0.96</b>
G11	Poor attention					0.71		<b>0.91</b>		<b>0.98</b>
G12	Lack of judgment and insight		<b>0.97</b>		<b>0.82</b>					0.69
G13	Disturbance of volition							<b>0.85</b>		<b>0.91</b>
G14	Poor impulse control					0.77		<b>0.88</b>		<b>0.96</b>
G15	Preoccupation					<b>0.84</b>		<b>0.88</b>		<b>0.98</b>
G16	Active social avoidance					0.70		0.77		<b>0.92</b>

- Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.  
 2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.  
 3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.  
 4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.  
 5. The conditional probabilities in bold are equal to or higher than 0.8.

**Latent prevalence regression parameter estimates from RLCA (4).**

Covariate	A little mixed vs No-symptoms		Negative vs No-symptoms		Delusion vs No-symptoms	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
degraded d'	-0.20	0.15	-0.08	0.15	-0.11	0.14

Note: The effect of degraded d' is adjusted the significant demographic variables (age, years of education, occupation, marital status).

**Average latent prevalence**

A little mixed	Negative	Delusion	No-symptoms
0.2214	0.2464	0.2290	0.3033

**Summary table**

No. of Fixed Parameters	4
No. of Free Parameters	135
N	157
-2logL	4244.926
AIC	4514.926
BIC	4927.519



Table 24: The summary results of the chronic phase with the latent four-class model with the number of categories completed of the WCST adjusted significant demographic variables using our program.

<b>Conditional probabilities</b>										
Symptom		Class	A little mixed		Negative		Delusion		No-symptoms	
			+	-	+	-	+	-	+	-
P1	Delusions		<b>0.96</b>			0.77		<b>0.94</b>		<b>1.00</b>
P2	Conceptual disorganization		<b>0.84</b>					0.75		<b>0.98</b>
P3	Hallucinatory behavior		<b>0.89</b>			0.72		0.66		<b>0.92</b>
P4	Excitement			0.67		<b>0.83</b>			<b>0.80</b>	<b>1.00</b>
P5	Grandiosity			0.66		<b>0.97</b>			0.73	<b>0.98</b>
P6	Suspiciousness/persecution		0.78			<b>0.87</b>				<b>0.96</b>
P7	Hostility					<b>0.89</b>			<b>0.92</b>	<b>0.92</b>
N1	Blunted affect		<b>0.80</b>			<b>0.91</b>			<b>0.87</b>	<b>0.90</b>
N2	Emotional withdrawal		<b>0.85</b>			0.75			<b>0.88</b>	<b>0.96</b>
N3	Poor rapport					0.70			<b>0.97</b>	<b>0.98</b>
N4	Passive/apathetic social withdrawal		<b>0.88</b>			<b>0.91</b>			0.73	0.78
N5	Difficulty in abstract thinking		<b>0.95</b>			<b>0.89</b>				0.71
N6	Lack of spontaneity/flow of conversation		0.70			0.72			<b>0.93</b>	<b>0.90</b>
N7	Stereotyped thinking		0.75						0.76	<b>0.98</b>
G1	Somatic concern					0.75			0.67	<b>0.88</b>
G2	Anxiety		0.69			<b>0.86</b>			0.67	0.75
G3	Guilt feelings			<b>0.85</b>		<b>0.91</b>			<b>0.80</b>	<b>0.80</b>
G4	Tension					<b>0.81</b>			<b>0.84</b>	<b>0.88</b>
G5	Mannerisms and posturing			<b>0.80</b>		<b>0.89</b>			<b>0.89</b>	<b>0.98</b>
G6	Depression					<b>0.87</b>			0.76	<b>0.82</b>
G7	Motor retardation								<b>0.97</b>	<b>0.96</b>
G8	Uncooperativeness					0.74			<b>0.97</b>	<b>1.00</b>
G9	Unusual thought content		<b>0.97</b>			<b>0.83</b>		<b>0.74</b>		<b>1.00</b>
G10	Disorientation			0.73		0.79			<b>1.00</b>	<b>0.96</b>
G11	Poor attention					0.66			<b>0.88</b>	<b>0.98</b>
G12	Lack of judgment and insight		<b>0.97</b>		<b>0.84</b>					0.70
G13	Disturbance of volition								<b>0.82</b>	<b>0.92</b>
G14	Poor impulse control					0.78			<b>0.89</b>	<b>0.96</b>
G15	Preoccupation					<b>0.84</b>			<b>0.89</b>	<b>0.98</b>
G16	Active social avoidance					0.73			0.72	<b>0.92</b>

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.

2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.

3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.

4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.

5. The conditional probabilities in bold are equal to or higher than 0.8.

#### Latent prevalence regression parameter estimates from RLCA (4).

Covariate	A little mixed vs No-symptoms		Negative vs No-symptoms		Delusion vs No-symptoms	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
no. of categories completed	-0.2224 *	0.0926	0.0264	0.0877	0.0204	0.0775

Note: 1. The effect of number of categories completed is adjusted the significant demographic variables (age, years of education, occupation, marital status).

2. \*: significantly different from 0 at the 0.05 level.

#### Average latent prevalence

A little mixed	Negative	Delusion	No-symptoms
0.2438	0.2305	0.2283	0.2974

#### Summary table

No. of Fixed Parameters	5
No. of Free Parameters	134
N	164
-2logL	4443.633
AIC	4711.633
BIC	5127.015

Table 25: The summary results of the chronic phase with the latent four-class model with the perseverative errors of the WCST adjusted significant demographic variables using our program.

<b>Conditional probabilities</b>										
Symptom		Class	A little mixed		Negative		Delusion		No-symptoms	
			+	-	+	-	+	-	+	-
P1	Delusions		<b>0.95</b>			0.79		<b>0.94</b>		<b>1.00</b>
P2	Conceptual disorganization		<b>0.84</b>					0.75		<b>0.98</b>
P3	Hallucinatory behavior		<b>0.88</b>			0.72		0.66		<b>0.92</b>
P4	Excitement			0.68		<b>0.83</b>			<b>0.80</b>	<b>1.00</b>
P5	Grandiosity			0.67		<b>0.97</b>		0.72		<b>0.98</b>
P6	Suspiciousness/persecution		0.78			<b>0.88</b>				<b>0.96</b>
P7	Hostility					<b>0.89</b>		<b>0.92</b>		<b>0.92</b>
N1	Blunted affect		<b>0.81</b>			<b>0.91</b>		<b>0.87</b>		<b>0.90</b>
N2	Emotional withdrawal		<b>0.86</b>			0.75		<b>0.86</b>		<b>0.96</b>
N3	Poor rapport					0.72		<b>0.97</b>		<b>0.98</b>
N4	Passive/apathetic social withdrawal		<b>0.88</b>			<b>0.91</b>		0.71		0.78
N5	Difficulty in abstract thinking		<b>0.95</b>			<b>0.89</b>				0.71
N6	Lack of spontaneity/flow of conversation		0.71			0.73		<b>0.93</b>		<b>0.90</b>
N7	Stereotyped thinking		0.76					0.74		<b>0.98</b>
G1	Somatic concern					0.76		0.67		<b>0.88</b>
G2	Anxiety		0.69			<b>0.86</b>		0.68		0.75
G3	Guilt feelings			<b>0.85</b>		<b>0.92</b>		<b>0.80</b>		<b>0.80</b>
G4	Tension					<b>0.81</b>		<b>0.84</b>		<b>0.88</b>
G5	Mannerisms and posturing			<b>0.80</b>		<b>0.89</b>		<b>0.89</b>		<b>0.98</b>
G6	Depression					<b>0.87</b>		0.76		<b>0.82</b>
G7	Motor retardation							<b>0.97</b>		<b>0.96</b>
G8	Uncooperativeness					0.73		0.74	<b>0.97</b>	<b>1.00</b>
G9	Unusual thought content		<b>0.97</b>			<b>0.85</b>				<b>1.00</b>
G10	Disorientation			0.73		0.78		<b>1.00</b>		<b>0.96</b>
G11	Poor attention					0.67		<b>0.87</b>		<b>0.98</b>
G12	Lack of judgment and insight		<b>0.97</b>		<b>0.84</b>			0.66		0.70
G13	Disturbance of volition							<b>0.81</b>		<b>0.92</b>
G14	Poor impulse control					0.78		<b>0.89</b>		<b>0.96</b>
G15	Preoccupation					<b>0.84</b>		<b>0.89</b>		<b>0.98</b>
G16	Active social avoidance					0.74		0.72		<b>0.92</b>

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.

2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.

3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.

4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.

5. The conditional probabilities in bold are equal to or higher than 0.8.

**Latent prevalence regression parameter estimates from RLCA (4).**

Covariate	A little mixed vs No-symptoms		Negative vs No-symptoms		Delusion vs No-symptoms	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
perseverative errors	0.0152	0.0114	-0.0137	0.0149	0.0137	0.0110

Note: The effect of perseverative errors is adjusted the significant demographic variables (age, years of education, occupation, marital status).

**Average latent prevalence**

A little mixed	Negative	Delusion	No-symptoms
0.2447	0.2231	0.2349	0.2973

**Summary table**

No. of Fixed Parameters	5
No. of Free Parameters	134
N	164
-2logL	4447.438
AIC	4715.438
BIC	5130.821

Table 26: The summary results of the chronic phase with the latent four-class model with the perseverative errors of the WCST adjusted significant demographic variables using Mplus.

Symptom		Conditional probabilities							
		A little mixed		Negative		Delusion		No-symptoms	
		+	-	+	-	+	-	+	-
P1	Delusions	<b>0.93</b>			<b>0.81</b>	<b>0.92</b>			<b>0.92</b>
P2	Conceptual disorganization	<b>0.85</b>							<b>0.98</b>
P3	Hallucinatory behavior	<b>0.86</b>			0.72				<b>0.91</b>
P4	Excitement		0.67		<b>0.87</b>		0.74		<b>1.00</b>
P5	Grandiosity		0.69		<b>0.97</b>		0.75		<b>0.95</b>
P6	Suspiciousness/persecution	0.77			<b>0.87</b>				<b>0.95</b>
P7	Hostility				<b>0.94</b>		<b>0.91</b>		<b>0.91</b>
N1	Blunted affect	<b>0.82</b>		<b>1.00</b>			<b>0.87</b>		<b>0.90</b>
N2	Emotional withdrawal	<b>0.87</b>			0.75		0.79		<b>0.96</b>
N3	Poor rapport				0.75		<b>0.95</b>		<b>0.98</b>
N4	Passive/apathetic social withdrawal	<b>0.88</b>		<b>0.94</b>					0.79
N5	Difficulty in abstract thinking	<b>0.95</b>		<b>0.88</b>					0.74
N6	Lack of spontaneity/flow of conversation	0.74		0.76			<b>0.89</b>		<b>0.91</b>
N7	Stereotyped thinking	0.74							<b>0.98</b>
G1	Somatic concern				0.75		0.68		<b>0.87</b>
G2	Anxiety	0.70			<b>0.87</b>		0.71		0.74
G3	Guilt feelings		<b>0.83</b>		<b>0.94</b>		<b>0.80</b>		<b>0.81</b>
G4	Tension				<b>0.81</b>		<b>0.88</b>		<b>0.86</b>
G5	Mannerisms and posturing		<b>0.80</b>		<b>0.88</b>		<b>0.89</b>		<b>0.98</b>
G6	Depression				<b>0.88</b>		0.76		<b>0.83</b>
G7	Motor retardation						<b>0.97</b>		<b>0.96</b>
G8	Uncooperativeness				0.75		<b>0.95</b>		<b>1.00</b>
G9	Unusual thought content					0.75			<b>0.96</b>
G10	Disorientation	<b>0.95</b>	0.73		0.78		<b>0.97</b>		<b>0.96</b>
G11	Poor attention						<b>0.84</b>		<b>0.98</b>
G12	Lack of judgment and insight	<b>0.97</b>		<b>0.85</b>					
G13	Disturbance of volition								<b>0.93</b>
G14	Poor impulse control				<b>0.84</b>		<b>0.84</b>		<b>0.96</b>
G15	Preoccupation				<b>0.85</b>		<b>0.85</b>		<b>0.98</b>
G16	Active social avoidance				0.77				<b>0.91</b>

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.

2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.

3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.

4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.

5. The conditional probabilities in bold are equal to or higher than 0.8.

#### Latent prevalence regression parameter estimates from RLCA (4).

Covariate	A little mixed vs No-symptoms		Negative vs No-symptoms		Delusion vs No-symptoms	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
perseverative errors	0.0140	0.0120	-0.0230	0.0200	0.0140	0.0130

Note: The effect of perseverative errors is adjusted the significant demographic variables (age, years of education, occupation).

#### Average latent prevalence

A little mixed	Negative	Delusion	No-symptoms
0.2446	0.1967	0.2293	0.3295

#### Summary table

No. of Fixed Parameters	3
No. of Free Parameters	132
N	164
-2logL	4463.932
AIC	4727.932
BIC	5137.114
Entropy	0.952

#### Classification table

Most Likely Class	Mean Posterior Probabilities			
	A little mixed	Negative	Delusion	No-symptoms
A little mixed	0.977	0.016	0.007	0.000
Negative	0.010	0.985	0.002	0.002
Delusion	0.018	0.002	0.959	0.021
No-symptoms	0.000	0.000	0.016	0.984

Table 27: The summary results of the chronic phase with the latent four-class model with the full scale IQ of the WAIS-R adjusted significant demographic variables using our program.

Symptom		<b>Conditional probabilities</b>								
		Class	A little mixed		Negative		Delusion		No-symptoms	
			+	-	+	-	+	-	+	-
P1	Delusions		<b>0.83</b>				<b>0.87</b>			<b>0.97</b>
P2	Conceptual disorganization		0.74							<b>1.00</b>
P3	Hallucinatory behavior		0.74							<b>0.90</b>
P4	Excitement					<b>0.95</b>		<b>0.84</b>		<b>1.00</b>
P5	Grandiosity			<b>0.83</b>		<b>0.95</b>				<b>0.97</b>
P6	Suspiciousness/persecution					<b>0.82</b>				<b>1.00</b>
P7	Hostility					<b>0.91</b>		<b>1.00</b>		<b>0.97</b>
N1	Blunted affect		0.79		<b>0.87</b>			0.76		<b>0.83</b>
N2	Emotional withdrawal		0.78		0.78			0.75		<b>0.87</b>
N3	Poor rapport							<b>0.92</b>		<b>0.93</b>
N4	Passive/apathetic social withdrawal		<b>0.82</b>		<b>0.88</b>					0.79
N5	Difficulty in abstract thinking		<b>1.00</b>		<b>1.00</b>					
N6	Lack of spontaneity/flow of conversation		0.74		<b>1.00</b>			<b>0.88</b>		<b>0.86</b>
N7	Stereotyped thinking		0.74							<b>0.93</b>
G1	Somatic concern					0.78		0.75		<b>0.87</b>
G2	Anxiety		0.77			<b>0.87</b>		0.71		<b>0.86</b>
G3	Guilt feelings			0.79		<b>0.91</b>		<b>0.84</b>		<b>0.83</b>
G4	Tension					<b>0.91</b>		<b>0.84</b>		<b>0.93</b>
G5	Mannerisms and posturing			0.74		<b>1.00</b>		<b>0.88</b>		<b>1.00</b>
G6	Depression					<b>0.83</b>		0.79		<b>0.83</b>
G7	Motor retardation							<b>1.00</b>		<b>0.97</b>
G8	Uncooperativeness					<b>1.00</b>		<b>0.92</b>		<b>1.00</b>
G9	Unusual thought content		<b>0.96</b>			0.75				<b>1.00</b>
G10	Disorientation			<b>0.83</b>				<b>0.96</b>		<b>1.00</b>
G11	Poor attention							<b>0.92</b>		<b>0.97</b>
G12	Lack of judgment and insight		<b>0.96</b>		<b>0.82</b>					
G13	Disturbance of volition		0.78					0.75		<b>0.82</b>
G14	Poor impulse control					<b>0.87</b>		<b>0.83</b>		<b>0.93</b>
G15	Preoccupation		0.78			<b>0.88</b>		0.75		<b>0.97</b>
G16	Active social avoidance							<b>0.83</b>		<b>0.94</b>

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.

2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.

3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.

4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.

5. The conditional probabilities in bold are equal to or higher than 0.8.

#### Latent prevalence regression parameter estimates from RLCA (4).

Covariate	A little mixed vs No-symptoms		Negative vs No-symptoms		Delusion vs No-symptoms	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
full scale IQ	-0.1005 **	0.0324	-0.1131 **	0.0364	-0.0494	0.0286

Note: 1. The effect of full scale IQ is adjusted the significant demographic variables (age, years of education, occupation, marital status).

2. \*\*: significantly different from 0 at the 0.01 level.

#### Average latent prevalence

A little mixed	Negative	Delusion	No-symptoms
0.2349	0.2304	0.2454	0.2893

#### Summary table

No. of Fixed Parameters	14
No. of Free Parameters	125
N	99
-2logL	2677.579
AIC	2927.579
BIC	3251.969

Table 28: The summary results of the chronic phase with the latent four-class model with the full scale IQ of the WAIS-R adjusted significant demographic variables using Mplus.

Symptom		Conditional probabilities									
		Class		A little mixed		Negative		Delusion		No-symptoms	
		+	-	+	-	+	-	+	-	+	-
P1	Delusions		<b>0.87</b>					<b>0.87</b>			<b>0.97</b>
P2	Conceptual disorganization		0.73								<b>1.00</b>
P3	Hallucinatory behavior		0.73								<b>0.89</b>
P4	Excitement					<b>0.85</b>		<b>0.91</b>			<b>1.00</b>
P5	Grandiosity			<b>0.86</b>		<b>0.92</b>					<b>1.00</b>
P6	Suspiciousness/persecution					<b>0.81</b>					<b>1.00</b>
P7	Hostility					<b>0.93</b>		<b>1.00</b>			<b>0.96</b>
N1	Blunted affect		0.78		<b>0.86</b>			0.79			<b>0.85</b>
N2	Emotional withdrawal		0.78		0.74			0.78			<b>0.85</b>
N3	Poor rapport							<b>0.91</b>			<b>0.93</b>
N4	Passive/apathetic social withdrawal		<b>0.86</b>		<b>0.82</b>						0.78
N5	Difficulty in abstract thinking		<b>1.00</b>		<b>1.00</b>						
N6	Lack of spontaneity/flow of conversation		<b>0.73</b>		<b>0.92</b>			<b>0.92</b>			<b>0.85</b>
N7	Stereotyped thinking		<b>0.73</b>								<b>0.96</b>
G1	Somatic concern					0.78					<b>0.89</b>
G2	Anxiety		<b>0.76</b>			<b>0.85</b>					<b>0.89</b>
G3	Guilt feelings			<b>0.82</b>		<b>0.85</b>		<b>0.87</b>			<b>0.82</b>
G4	Tension					<b>0.92</b>		<b>0.83</b>			<b>0.93</b>
G5	Mannerisms and posturing			0.73		<b>1.00</b>		<b>0.87</b>			<b>1.00</b>
G6	Depression					<b>0.82</b>		0.78			<b>0.81</b>
G7	Motor retardation							<b>1.00</b>			<b>1.00</b>
G8	Uncooperativeness					<b>1.00</b>		<b>0.91</b>			<b>1.00</b>
G9	Unusual thought content		<b>1.00</b>			0.78					<b>1.00</b>
G10	Disorientation			<b>0.82</b>		0.71		<b>0.96</b>			<b>1.00</b>
G11	Poor attention							<b>0.91</b>			<b>0.96</b>
G12	Lack of judgment and insight		<b>0.96</b>		<b>0.85</b>						
G13	Disturbance of volition		0.77					0.78			<b>0.85</b>
G14	Poor impulse control					0.78		<b>0.87</b>			<b>0.96</b>
G15	Preoccupation		<b>0.81</b>			<b>0.86</b>		0.78			<b>0.96</b>
G16	Active social avoidance					0.70		<b>0.83</b>			<b>0.93</b>

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.  
 2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.  
 3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.  
 4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.  
 5. The conditional probabilities in bold are equal to or higher than 0.8.

#### Latent prevalence regression parameter estimates from RLCA (4).

Covariate	A little mixed vs No-symptoms		Negative vs No-symptoms		Delusion vs No-symptoms	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
full scale IQ	-0.0810 **	0.0290	-0.0950 **	0.0350	-0.0270	0.0280

Note: 1. The effect of full scale IQ is adjusted the significant demographic variables (age, years of education, occupation).  
 2. \*\*: significantly different from 0 at the 0.01 level.

#### Average latent prevalence

A little mixed	Negative	Delusion	No-symptoms
0.2249	0.2705	0.2338	0.2708

#### Summary table

No. of Fixed Parameters	16
No. of Free Parameters	119
N	99
-2logL	2695.446
AIC	2933.446
BIC	3242.265
Entropy	0.973

#### Classification table

Most Likely Class	Mean Posterior Probabilities			
	A little mixed	Negative	Delusion	No-symptoms
A little mixed	0.996	0.001	0.003	0.000
Negative	0.003	0.992	0.005	0.001
Delusion	0.010	0.004	0.983	0.002
No-symptoms	0.000	0.007	0.003	0.990

Table 29: The summary results of the chronic phase with the latent four-class model with the sum of WMS-R Logical Memory I and Logical Memory II adjusted significant demographic variables using Mplus.

Symptom		<b>Conditional probabilities</b>							
		Class		Class2		Class3		No-symptoms	
		+	-	+	-	+	-	+	-
P1	Delusions			0.73		<b>0.88</b>			0.79
P2	Conceptual disorganization				0.76				<b>1.00</b>
P3	Hallucinatory behavior			0.73					<b>0.87</b>
P4	Excitement		<b>0.80</b>		<b>0.88</b>				<b>1.00</b>
P5	Grandiosity		<b>0.87</b>		<b>0.88</b>		0.77		<b>0.92</b>
P6	Suspiciousness/persecution				<b>1.00</b>				<b>0.85</b>
P7	Hostility		<b>0.86</b>		<b>1.00</b>				<b>0.90</b>
N1	Blunted affect	<b>1.00</b>			<b>0.88</b>				<b>0.86</b>
N2	Emotional withdrawal	<b>0.90</b>			<b>1.00</b>				<b>0.95</b>
N3	Poor rapport	<b>0.84</b>			<b>0.88</b>		0.78		<b>0.97</b>
N4	Passive/apathetic social withdrawal	<b>1.00</b>			<b>1.00</b>				0.69
N5	Difficulty in abstract thinking	<b>0.93</b>		<b>0.87</b>		<b>0.82</b>			0.79
N6	Lack of spontaneity/flow of conversation	<b>0.83</b>					<b>1.00</b>		<b>0.85</b>
N7	Stereotyped thinking	0.77							<b>0.95</b>
G1	Somatic concern				<b>0.88</b>				<b>0.93</b>
G2	Anxiety				<b>0.88</b>				
G3	Guilt feelings		<b>0.87</b>		<b>1.00</b>		0.78		0.76
G4	Tension				<b>1.00</b>				<b>0.84</b>
G5	Mannerisms and posturing				<b>1.00</b>		0.76		<b>0.97</b>
G6	Depression		<b>0.80</b>		<b>0.88</b>				<b>0.87</b>
G7	Motor retardation				0.76		<b>1.00</b>		<b>0.92</b>
G8	Uncooperativeness		0.73		<b>0.88</b>		0.77		<b>0.98</b>
G9	Unusual thought content			<b>0.85</b>					<b>0.85</b>
G10	Disorientation		0.73		0.76		<b>0.88</b>		<b>0.98</b>
G11	Poor attention				<b>1.00</b>		0.76		<b>1.00</b>
G12	Lack of judgment and insight		<b>0.87</b>			<b>0.87</b>			
G13	Disturbance of volition						<b>0.87</b>		<b>0.95</b>
G14	Poor impulse control				0.76				<b>0.97</b>
G15	Preoccupation		0.73		<b>1.00</b>				<b>1.00</b>
G16	Active social avoidance						<b>0.81</b>		<b>0.95</b>

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.

- The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.
- The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.
- The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.
- The conditional probabilities in bold are equal to or higher than 0.8.

#### Latent prevalence regression parameter estimates from RLCA (4).

Covariate	Negative vs No-symptoms		class 2 vs No-symptoms		class 3 vs No-symptoms	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
lmrtotal	-0.2310 *	0.1150	0.0000	0.1500	-0.1960	0.1240

Note: 1. lmrtotal = the sum of Logical Memory I and Logical Memory II.

- The effect of the sum of Logical Memory I and Logical Memory II is adjusted the significant demographic variables (age, years of education, occupation).
- \*: significantly different from 0 at the 0.05 level.

#### Average latent prevalence

Negative	Class2	Class3	No-symptoms
0.3210	0.0873	0.1805	0.4112

#### Summary table

No. of Fixed Parameters	17
No. of Free Parameters	118
N	94
-2logL	2535.152
AIC	2771.152
BIC	3071.261
Entropy	0.964

#### Classification table

Most Likely Class	Mean Posterior Probabilities			
	Negative	Class 2	Class3	No-symptoms
Negative	0.993	0.000	0.007	0.000
Class 2	0.000	0.995	0.001	0.004
Class 3	0.020	0.000	0.963	0.017
No-symptoms	0.001	0.006	0.010	0.983

Table 30: The summary results of the chronic phase with the latent four-class model with the TMT-A adjusted significant demographic variables using our program.

Symptom		Conditional probabilities							
		Class		A little mixed		Negative		Delusion	
		+	-	+	-	+	-	+	-
P1	Delusions	<b>0.91</b>			0.69	<b>0.93</b>			
P2	Conceptual disorganization	<b>0.86</b>					0.72		<b>0.98</b>
P3	Hallucinatory behavior	<b>0.86</b>			0.65				<b>0.92</b>
P4	Excitement				<b>0.87</b>	<b>0.81</b>			<b>1.00</b>
P5	Grandiosity		0.72		<b>0.95</b>		0.65		<b>0.98</b>
P6	Suspiciousness/persecution	0.77			<b>0.84</b>				<b>0.96</b>
P7	Hostility				<b>0.92</b>	<b>0.91</b>			<b>0.94</b>
N1	Blunted affect	<b>0.81</b>		<b>0.85</b>			<b>0.82</b>		<b>0.93</b>
N2	Emotional withdrawal	<b>0.86</b>		0.79			<b>0.91</b>		<b>0.95</b>
N3	Poor rapport						<b>0.93</b>		<b>0.98</b>
N4	Passive/apathetic social withdrawal	<b>0.86</b>		<b>0.88</b>			0.75		0.79
N5	Difficulty in abstract thinking	<b>0.98</b>		<b>0.90</b>					0.73
N6	Lack of spontaneity/flow of conversation	0.74		0.76			<b>0.92</b>		<b>0.88</b>
N7	Stereotyped thinking	0.79					0.78		<b>0.96</b>
G1	Somatic concern	0.65			<b>0.81</b>		0.68		<b>0.90</b>
G2	Anxiety	0.77			<b>0.87</b>				<b>0.80</b>
G3	Guilt feelings		<b>0.82</b>		<b>0.92</b>		<b>0.81</b>		0.77
G4	Tension				<b>0.84</b>		<b>0.80</b>		<b>0.92</b>
G5	Mannerisms and posturing		0.73		<b>0.90</b>		<b>0.91</b>		<b>0.98</b>
G6	Depression				<b>0.88</b>		0.76		<b>0.84</b>
G7	Motor retardation						<b>0.98</b>		<b>0.98</b>
G8	Uncooperativeness				<b>0.84</b>		<b>0.95</b>		<b>1.00</b>
G9	Unusual thought content	<b>0.91</b>			0.74	0.70			<b>1.00</b>
G10	Disorientation		0.78		0.77		<b>0.96</b>		<b>0.98</b>
G11	Poor attention				0.64		<b>0.91</b>		<b>0.98</b>
G12	Lack of judgment and insight	<b>0.98</b>		<b>0.86</b>		0.65			0.67
G13	Disturbance of volition						<b>0.86</b>		<b>0.92</b>
G14	Poor impulse control				<b>0.82</b>		<b>0.89</b>		<b>0.96</b>
G15	Preoccupation	0.65			<b>0.81</b>		<b>0.85</b>		<b>1.00</b>
G16	Active social avoidance				0.70		0.76		<b>0.94</b>

- Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.  
 2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.  
 3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.  
 4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.  
 5. The conditional probabilities in bold are equal to or higher than 0.8.

**Latent prevalence regression parameter estimates from RLCA (4).**

Covariate	A little mixed vs No-symptoms		Negative vs No-symptoms		Delusion vs No-symptoms	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
TMT-A	0.0119	0.0089	0.0182 *	0.0087	-0.0032	0.0095

- Note: 1. The effect of TMT-A is adjusted the significant demographic variables (age, years of education, occupation, marital status).  
 2. \*: significantly different from 0 at the 0.05 level.

**Average latent prevalence**

A little mixed	Negative	Delusion	No-symptoms
0.2326	0.2664	0.2419	0.2591

**Summary table**

No. of Fixed Parameters	5
No. of Free Parameters	134
N	189
-2logL	5230.660
AIC	5498.660
BIC	5933.055

Table 31: The summary results of the chronic phase with the latent four-class model with the TMT-A adjusted significant demographic variables using Mplus.

Symptom		Conditional probabilities									
		Class		A little mixed		Negative		Delusion		No-symptoms	
		+	-	+	-	+	-	+	-	+	-
P1	Delusions	<b>0.91</b>						<b>0.98</b>			<b>0.92</b>
P2	Conceptual disorganization	<b>0.86</b>									<b>0.98</b>
P3	Hallucinatory behavior	<b>0.86</b>									<b>0.91</b>
P4	Excitement					<b>0.88</b>		0.78			<b>1.00</b>
P5	Grandiosity		0.73			<b>0.94</b>					<b>0.93</b>
P6	Suspiciousness/persecution	0.77				<b>0.83</b>					<b>0.95</b>
P7	Hostility					<b>0.92</b>		<b>0.93</b>			<b>0.92</b>
N1	Blunted affect	<b>0.81</b>				<b>0.86</b>				<b>0.82</b>	<b>0.92</b>
N2	Emotional withdrawal	<b>0.86</b>				<b>0.80</b>				<b>0.88</b>	<b>0.96</b>
N3	Poor rapport									<b>0.92</b>	<b>0.98</b>
N4	Passive/apathetic social withdrawal	<b>0.86</b>				<b>0.88</b>					<b>0.81</b>
N5	Difficulty in abstract thinking	<b>1.00</b>				<b>0.88</b>					0.75
N6	Lack of spontaneity/flow of conversation	0.73				0.77				<b>0.90</b>	<b>0.89</b>
N7	Stereotyped thinking	0.78									<b>0.96</b>
G1	Somatic concern					<b>0.81</b>					<b>0.88</b>
G2	Anxiety	<b>0.80</b>				<b>0.87</b>					0.76
G3	Guilt feelings		<b>0.81</b>			<b>0.92</b>		0.79			0.79
G4	Tension					<b>0.84</b>		<b>0.83</b>			<b>0.89</b>
G5	Mannerisms and posturing		0.72			<b>0.90</b>		<b>0.90</b>			<b>0.98</b>
G6	Depression					<b>0.86</b>		0.74			<b>0.84</b>
G7	Motor retardation							<b>0.98</b>			<b>0.98</b>
G8	Uncooperativeness					<b>0.84</b>		<b>0.95</b>			<b>1.00</b>
G9	Unusual thought content	<b>0.91</b>				0.72		0.75			<b>0.95</b>
G10	Disorientation		0.78			0.77				<b>0.97</b>	<b>0.97</b>
G11	Poor attention									<b>0.88</b>	<b>0.98</b>
G12	Lack of judgment and insight	<b>0.98</b>				<b>0.86</b>					
G13	Disturbance of volition									<b>0.83</b>	<b>0.93</b>
G14	Poor impulse control					<b>0.82</b>		<b>0.87</b>			<b>0.96</b>
G15	Preoccupation					<b>0.81</b>		<b>0.85</b>			<b>0.98</b>
G16	Active social avoidance					0.69		0.77			<b>0.91</b>

- Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.  
 2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.  
 3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.  
 4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.  
 5. The conditional probabilities in bold are equal to or higher than 0.8.

**Latent prevalence regression parameter estimates from RLCA (4).**

Covariate	A little mixed vs No-symptoms		Negative vs No-symptoms		Delusion vs No-symptoms	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
TMT-A	0.0100	0.0090	0.0160	0.0090	-0.0090	0.0140

Note: The effect of a-time is adjusted the significant demographic variables (age, years of education, occupation).

**Average latent prevalence**

A little mixed	Negative	Delusion	No-symptoms
0.2233	0.2717	0.2083	0.2967

**Summary table**

No. of Fixed Parameters	5
No. of Free Parameters	132
N	189
-2logL	5235.184
AIC	5499.184
BIC	5927.095
Entropy	0.939

**Classification table**

Most Likely Class	Mean Posterior Probabilities			
	A little mixed	Negative	Delusion	No-symptoms
A little mixed	0.976	0.007	0.017	0.000
Negative	0.011	0.937	0.019	0.032
Delusion	0.015	0.004	0.975	0.007
No-symptoms	0.000	0.009	0.002	0.989



Table 32: The summary results of the chronic phase with the latent four-class model with the TMT-B adjusted significant demographic variables using our program.

Symptom		Conditional probabilities									
		Class		A little mixed		Negative		Delusion		No-symptoms	
		+	-	+	-	+	-	+	-	+	-
P1	Delusions	<b>0.89</b>			0.71	<b>0.91</b>					<b>1.00</b>
P2	Conceptual disorganization	<b>0.89</b>					0.73				<b>0.98</b>
P3	Hallucinatory behavior	<b>0.83</b>			0.68						<b>0.93</b>
P4	Excitement				<b>0.86</b>		<b>0.80</b>				<b>1.00</b>
P5	Grandiosity				<b>0.95</b>						<b>0.99</b>
P6	Suspiciousness/persecution	0.73			<b>0.85</b>						<b>0.96</b>
P7	Hostility		0.68		<b>0.91</b>		<b>0.91</b>				<b>0.93</b>
N1	Blunted affect	0.78			<b>0.82</b>		<b>0.81</b>				<b>0.93</b>
N2	Emotional withdrawal	<b>0.83</b>			0.73		<b>0.90</b>				<b>0.96</b>
N3	Poor rapport						<b>0.93</b>				<b>0.98</b>
N4	Passive/apathetic social withdrawal	<b>0.84</b>			<b>0.84</b>		0.73				0.78
N5	Difficulty in abstract thinking	<b>0.97</b>			<b>0.87</b>						0.74
N6	Lack of spontaneity/flow of conversation	0.73					<b>0.92</b>				<b>0.87</b>
N7	Stereotyped thinking	0.78					<b>0.80</b>				<b>0.96</b>
G1	Somatic concern					<b>0.84</b>		0.67			<b>0.90</b>
G2	Anxiety	0.74				<b>0.87</b>					0.79
G3	Guilt feelings		<b>0.81</b>			<b>0.90</b>		<b>0.80</b>			0.76
G4	Tension					<b>0.84</b>		<b>0.79</b>			<b>0.91</b>
G5	Mannerisms and posturing			0.78		<b>0.92</b>		<b>0.90</b>			<b>0.98</b>
G6	Depression					<b>0.90</b>		0.77			<b>0.82</b>
G7	Motor retardation							<b>0.98</b>			<b>0.98</b>
G8	Uncooperativeness					0.78		<b>0.98</b>			<b>1.00</b>
G9	Unusual thought content	<b>0.92</b>				0.79	0.69				<b>1.00</b>
G10	Disorientation		<b>0.84</b>			<b>0.87</b>		<b>0.98</b>			<b>0.98</b>
G11	Poor attention					0.68		<b>0.90</b>			<b>0.98</b>
G12	Lack of judgment and insight	<b>1.00</b>		<b>0.84</b>		<b>0.84</b>		0.65			<b>0.68</b>
G13	Disturbance of volition							<b>0.85</b>			<b>0.91</b>
G14	Poor impulse control					0.78		<b>0.90</b>			<b>0.96</b>
G15	Preoccupation					<b>0.80</b>		<b>0.87</b>			<b>1.00</b>
G16	Active social avoidance							0.77			<b>0.94</b>

- Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.  
 2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.  
 3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.  
 4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.  
 5. The conditional probabilities in bold are equal to or higher than 0.8.

#### Latent prevalence regression parameter estimates from RLCA (4).

Covariate	A little mixed vs No-symptoms		Negative vs No-symptoms		Delusion vs No-symptoms	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
TMT-B	0.0073 *	0.0036	0.0089 *	0.0037	0.0048	0.0034

- Note: 1. The effect of TMT-B is adjusted the significant demographic variables (age, years of education, occupation, marital status).  
 2. \*: significantly different from 0 at the 0.05 level.

#### Average latent prevalence

A little mixed	Negative	Delusion	No-symptoms
0.2326	0.2664	0.2419	0.2591

#### Summary table

No. of Fixed Parameters	6
No. of Free Parameters	133
N	158
-2logL	4317.165
AIC	4583.165
BIC	4990.490

Table 33: The summary results of the chronic phase with the latent four-class model with the TMT-B adjusted significant demographic variables using Mplus.

Symptom		Conditional probabilities								
		Class		A little mixed		Negative		Delusion		No-symptoms
		+	-	+	-	+	-	+	-	
P1	Delusions	<b>0.89</b>						<b>0.86</b>		<b>0.83</b>
P2	Conceptual disorganization	<b>0.90</b>								<b>1.00</b>
P3	Hallucinatory behavior	<b>0.81</b>								<b>0.90</b>
P4	Excitement				<b>0.87</b>		0.75			<b>1.00</b>
P5	Grandiosity				<b>0.94</b>					<b>0.93</b>
P6	Suspiciousness/persecution	0.74			<b>0.82</b>					<b>0.92</b>
P7	Hostility				<b>0.90</b>			<b>0.91</b>		<b>0.93</b>
N1	Blunted affect	<b>0.85</b>			<b>0.87</b>			<b>0.81</b>		<b>0.93</b>
N2	Emotional withdrawal	<b>0.86</b>			0.76			<b>0.84</b>		<b>0.96</b>
N3	Poor rapport							<b>0.97</b>		<b>0.99</b>
N4	Passive/apathetic social withdrawal	<b>0.87</b>			<b>0.89</b>					0.79
N5	Difficulty in abstract thinking	<b>0.97</b>			<b>0.81</b>					<b>0.80</b>
N6	Lack of spontaneity/flow of conversation	0.77						<b>0.82</b>		<b>0.90</b>
N7	Stereotyped thinking	0.78								<b>0.96</b>
G1	Somatic concern					<b>0.84</b>				<b>0.87</b>
G2	Anxiety	0.77			<b>0.90</b>					0.75
G3	Guilt feelings		<b>0.81</b>		<b>0.90</b>		0.74			<b>0.80</b>
G4	Tension				<b>0.83</b>		0.77			<b>0.89</b>
G5	Mannerisms and posturing		0.77		<b>0.94</b>		<b>0.88</b>			<b>0.97</b>
G6	Depression				<b>0.87</b>		0.75			<b>0.84</b>
G7	Motor retardation							<b>1.00</b>		<b>0.98</b>
G8	Uncooperativeness				0.77			<b>0.94</b>		<b>1.00</b>
G9	Unusual thought content	<b>0.94</b>			0.78					<b>0.87</b>
G10	Disorientation			<b>0.82</b>	<b>0.93</b>			<b>0.92</b>		<b>0.98</b>
G11	Poor attention				0.71			<b>0.80</b>		<b>0.98</b>
G12	Lack of judgment and insight	<b>1.00</b>		<b>0.83</b>						
G13	Disturbance of volition									<b>0.93</b>
G14	Poor impulse control				<b>0.81</b>			<b>0.82</b>		<b>0.97</b>
G15	Preoccupation				<b>0.80</b>			<b>0.80</b>		<b>1.00</b>
G16	Active social avoidance							0.75		<b>0.91</b>

- Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.  
 2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.  
 3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.  
 4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.  
 5. The conditional probabilities in bold are equal to or higher than 0.8.

**Latent prevalence regression parameter estimates from RLCA (4).**

Covariate	A little mixed vs No-symptoms		Negative vs No-symptoms		Delusion vs No-symptoms	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
TMT-B	0.0090 *	0.0050	0.0090	0.0050	0.0120	0.0070

- Note: 1. The effect of b-time is adjusted the significant demographic variables (age, years of education, occupation).  
 2. \*: significantly different from 0 at the 0.05 level.

**Average latent prevalence**

A little mixed	Negative	Delusion	No-symptoms
0.2150	0.1961	0.2349	0.3540

**Summary table**

No. of Fixed Parameters	6
No. of Free Parameters	129
N	158
-2logL	4322.388
AIC	4580.388
BIC	4975.463
Entropy	0.936

**Classification table**

Most Likely Class	Mean Posterior Probabilities			
	A little mixed	Negative	Delusion	No-symptoms
A little mixed	0.968	0.014	0.018	0.000
Negative	0.015	0.965	0.016	0.003
Delusion	0.016	0.009	0.968	0.006
No-symptoms	0.000	0.005	0.020	0.976

Table 34: Comparison of structure for the PANSS items for the present study with other studies.

Literature	Source/sample	Analytic method (Criteria)	Phase	Structure	P1	P2	P3	P4	P5	P6	P7	N1	N2	N3	N4	N5	N6	N7	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	G11	G12	G13	G14	G15	G16			
In present study <sup>a</sup>	MPGRP (n=219)	LCA (AIC & BIC criteria)	Acute (Admission)	Mixed Negative Disorganized thought Delusion Positive	M	M	M	M	M	M	M	N	N	N	N	N	N	N	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M			
	MPSS & SEFOS (n=225)	LCA (AIC & BIC criteria)	Chronic	Mixed Negative Delusion D <sup>c</sup>	M	M	M	M	M	M	M	N	N	N	N	N	N	N	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M		
Liu, Yeh, & Hwu (1996)	MPGRP (n=93)	PCA, varimax rotation (eigenvalues>1)	Admission <sup>e</sup>	Negative Excitement Anxiety /Depression Delusion Disorganized thought Grandiosity	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	MPGRP (n=60)	PCA of 14 PANSS, quarrimax rotation (eigenvalues >1)	Admission	Negative thought Psychotic Associated negative Anxiety /Depression Excitement Delusion /hallucination Disorganized thought Excitement	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Hwu et al. (2002)	MPGRP (n=163)	GAP	Admission	Negative Disorganized thought Excitement Delusion	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

P1:Delusions, P2:Conceptual disorganization, P3:Hallucinatory behavior, P4:Excitement, P5:Grandiosity, P6:Excitement/persecution, P7:Hostility, N1:Blunted affect, N2:Emotional withdrawal, N3:Poor rapport, N4:Passive/apathetic social withdrawal, N5:Difficulty in abstract thinking, N6:Lack of spontaneity/flow of conversation, N7:Stereotyped thinking, G1:Somatic concern, G2:Anxiety, G3:Guilt feelings, G4:Tension, G5:Mannerisms and posturing, G6:Depression, G7:Motor retardation, G8:Uncooperativeness, G9:Unusual thought content, G10:Disorientation, G11:Poor attention, G12:Lack of judgment and insight, G13:Disturbance of volition, G14:Poor impulse control, G15:Preoccupation, G16:Active social avoidance, LCA: Latent class analysis, PCA:Principal component analysis, GAP:Generalized association plot, MPGRP:Multidimensional Psychopathology Group Research Projects, MPSS:Multidimensional Psychopathological Study on Schizophrenia, M: Mixed, N:Negative, DT:Disorganized thought, D:Delusion, Dh:Delusion/hallucination, P:Positive, Ps: Psychotic, E:Excitement, AD:Anxiety/Depression, G:Grandiosity, AN:Associated negative.  
<sup>a</sup>In present study, the results using our program were shown and the conditional probabilities  $\geq 0.8$  were shown. <sup>b</sup>The conditional probability of P2 item is 0.79. <sup>c</sup>The conditional probability of P1/G12 item is 0.75/0.69.  
<sup>d</sup>:There are not high conditional probabilities of having symptoms in the no-symptoms class. <sup>e</sup>: The label of structures were not reported in the literature, thus we labeled the structures by our knowledge.







Table 35: Characteristics of the participants who assessed the PANSS in the both two phases.

Binary variables	Chronic	
	N	Case number %
Male	115	61 53.00
Unmarried	115	96 83.50
Having occupation	115	26 22.60
Having the slight or obvious environmental factor 1	111	7 6.10
Having the slight environmental factor 2	114	32 27.80
Having the obvious environmental factor 2	114	15 13.00
Having the slight environmental factor 3	114	28 24.30
Having the obvious environmental factor 3	114	24 20.90

Numerical variables	Chronic			
	N	Min.	Max.	Mean Std.
Age (years)	115	21.00	51.00	34.6500 7.2120
Education (years)	115	3.00	18.00	11.1700 2.8570
Age of onset of psychotic symptom	114	14.00	42.00	22.1000 5.6190
Continuous Performance Test (CPT)				
Undegraded d'	78	-1.37	4.86	2.4932 1.7212
Degraded d'	67	-1.60	4.86	1.5002 1.7096

Table 36: Characteristics of the PANSS for the participants who assessed the PANSS in the both two phases.

**Number and proportion of study subjects having symptom for the PANSS items.**

Symptom	Acute		Chronic		Z test
	no. of subject having symptom	%	no. of subject having symptom	%	P-value
P1 Delusions	107	93.0	65	56.5	0.0000 **
P2 Conceptual disorganization	78	67.8	54	47.0	0.0011 **
P3 Hallucinatory behavior	92	80.0	58	50.4	0.0000 **
P4 Excitement	56	48.7	21	18.3	0.0000 **
P5 Grandiosity	33	28.7	25	21.7	0.2200
P6 Suspiciousness/persecution	87	75.7	42	36.5	0.0000 **
P7 Hostility	47	40.9	17	14.8	0.0000 **
N1 Blunted affect	78	67.8	59	51.3	0.0097 **
N2 Emotional withdrawal	76	66.1	57	49.6	0.0102 *
N3 Poor rapport	48	41.7	32	27.8	0.0253 *
N4 Passive/apathetic social withdrawal	73	63.5	66	57.4	0.3432
N5 Difficulty in abstract thinking	88	76.5	80	69.6	0.2369
N6 Lack of spontaneity/flow of conversator	54	47.0	53	46.1	0.8912
N7 Stereotyped thinking	56	48.7	50	43.5	0.4283
G1 Somatic concern	48	41.7	41	35.7	0.3493
G2 Anxiety	65	56.5	36	31.3	0.0001 **
G3 Guilt feelings	19	16.5	20	17.4	0.8557
G4 Tension	42	36.5	17	14.8	0.0001 **
G5 Mannerisms and posturing	25	21.7	8	7.0	0.0011 **
G6 Depression	44	38.3	31	27.0	0.0657
G7 Motor retardation	40	34.8	23	20.0	0.0107 *
G8 Uncooperativeness	43	37.4	16	13.9	0.0000 **
G9 Unusual thought content	84	73.0	54	47.0	0.0000 **
G10 Disorientation	30	26.1	19	16.5	0.0734
G11 Poor attention	65	56.5	41	35.7	0.0012 **
G12 Lack of judgment and insight	110	95.7	84	73.0	0.0000 **
G13 Disturbance of volition	55	47.8	44	38.3	0.1438
G14 Poor impulse control	54	47.0	26	22.6	0.0001 **
G15 Preoccupation	65	56.5	39	33.9	0.0004 **
G16 Active social avoidance	52	45.2	40	34.8	0.1055

**The descriptive statistics of the PANSS items**

	Acute				Chronic			
	Min.	Max.	Mean	Std.	Min.	Max.	Mean	Std.
Positive	1.00	5.86	3.3826	1.0037	1.00	5.14	2.1925	1.0109
Negative	1.00	6.00	2.9366	1.1145	1.00	5.14	2.4696	0.9689
General	1.19	4.56	2.4750	0.7217	1.00	3.75	1.9016	0.6294

Note: The number of patient in the acute and chronic phase is 115.

\*: P-value<0.05; \*\*: P-value<0.01 (two-tailed).



Table 37: The summary resulting from LTA without covariates.

Symptom	Acute										Chronic										
	Class		Mixed		A little mixed		Negative		Positive		Delusion		A little mixed		Delusion		Negative		No-symptoms		
	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	
P1 Delusions	1.00		0.95		0.95		0.77		1.00		0.89		1.00		0.87						0.97
P2 Conceptual disorganization	0.95		0.90		0.90				0.89		0.70		0.87								0.98
P3 Hallucinatory behavior	1.00		0.89		0.89				0.85		0.78		0.87								0.91
P4 Excitement	0.91				0.90				0.85		0.75				0.77						1.00
P5 Grandiosity	1.00		0.79		0.90				0.86		0.70		0.80		0.67						0.97
P6 Suspectiousness/persecution	1.00								0.65		1.00				0.90						0.95
P7 Hostility	1.00								0.77				0.72		0.82						0.89
N1 Blunted affect	0.92		1.00		1.00		0.97				1.00		0.74		0.78						0.93
N2 Emotional withdrawal	1.00		0.94		1.00		1.00		0.76						0.93						0.98
N3 Poor rapport	1.00				0.93		1.00				0.93		0.87		0.69						0.77
N4 Passive/apathetic social withdrawal	0.92		0.93		0.93		1.00						1.00		0.88						0.70
N5 Difficulty in abstract thinking	1.00		0.89		0.89		0.81				0.93		0.76		0.89						0.87
N6 Lack of spontaneity/flow of conversation	0.87		0.78		0.78		0.75		0.90				0.81		0.85						0.70
N7 Stereotyped thinking	0.98		0.83		0.83		0.83				0.82		0.68		0.89						0.87
G1 Somatic concern							0.80		0.81				0.81		0.68						0.93
G2 Anxiety	0.74						0.80					0.72			0.75						0.91
G3 Guilt feelings			0.80		0.81		1.00		0.85		0.89		0.81		0.86						0.78
G4 Tension	0.80						0.88		0.68		0.89		0.74		0.84						0.80
G5 Mannerisms and posturing							0.96		0.82		1.00				0.91						0.90
G6 Depression							0.96		0.82		0.82				0.80						0.99
G7 Motor retardation							0.91		0.91		0.93				0.80						0.85
G8 Uncooperativeness	0.97								0.81		1.00		0.92		0.95						0.95
G9 Unusual thought content	1.00		0.77		0.77				0.81		0.98		0.65		0.80						1.00
G10 Disorientation	0.71								0.98		0.93		0.68		0.92						0.97
G11 Poor attention	0.88		0.80		0.80		1.00		0.98		0.82		0.98		0.81						0.98
G12 Lack of judgment and insight	1.00		0.98		0.98		1.00		0.92		0.96		0.71		0.88						0.98
G13 Disturbance of volition	0.77										0.93				0.76						0.90
G14 Poor impulse control	1.00										0.96				0.84						0.96
G15 Preoccupation	1.00		0.90		0.90						0.78		0.76		0.82						1.00
G16 Active social avoidance	0.97						0.80		0.80		0.89				0.76						0.94

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.

2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.

3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.

4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels, respectively.

5. The conditional probabilities in bold are equal to or higher than 0.8.

**Average latent prevalence**

Phase	Acute				Chronic				
	Class	Mixed	A little mixed	Negative	Positive	Delusion	A little mixed	Negative	No-symptoms
Prob.	0.1567	0.2461	0.1620	0.3080	0.1273	0.2138	0.2610	0.2579	0.2673

**Summary table**

No. of Fixed Parameters	31
No. of Free Parameters	258
N	329
-2logL	12956.686
AIC	13472.686
BIC	14452.069
Entropy	0.683

Table 37: The summary resulting from LTA without covariates (cont.).

Covariate	A little mixed vs No-symptoms		Delusion vs No-symptoms		Negative vs No-symptoms	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
Intercepte	-17.01 **	1.01	-1.60	0.91	-0.79	0.57
Index of mixed class	18.03 **	1.52	1.52	1.72	1.85	1.33
Index of a little mixed class	17.40 **	1.21	2.23	1.15	1.34	1.06
Index of negative class	29.92 **	0.89	15.00	0	14.56 **	1.35
Index of positive class	16.32 **	1.00	1.32	1.00	-1.28	2.35

Note: 1. The standard error (S.E.) is equal to 0 when the parameter estimate in equation (15) is fixed at positive (15) or negative (-15).

2. \*: significantly different from 0 at the 0.05 level.

\*\*\*: significantly different from 0 at the 0.01 level.

**Average latent transition probabilities based on estimated model from equation (16).**

Class	Chronic			
	A little mixed	Delusion	Negative	No-symptoms
Mixed	0.365	0.121	0.382	0.132
A little mixed	0.242	0.309	0.285	0.164
Negative	0.200	0.327	0.474	0.000
Positive	0.210	0.317	0.053	0.420
Delusion	0.000	0.122	0.274	0.604



Table 38: The summary resulting from LTA with demographic variables.

Symptom	Acute										Chronic								
	Class		Mixed		A little mixed		Negative		Positive		Delusion		Delusion		Negative		No-symptoms		
	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	
P1 Delusions	<b>1.00</b>		<b>0.95</b>		<b>1.00</b>		<b>1.00</b>		<b>1.00</b>		<b>0.89</b>		<b>1.00</b>		0.70				<b>0.93</b>
P2 Conceptual disorganization	<b>1.00</b>		<b>0.89</b>								<b>0.89</b>								<b>0.97</b>
P3 Hallucinatory behavior	<b>0.97</b>		<b>0.92</b>		<b>0.89</b>		<b>0.79</b>												<b>0.89</b>
P4 Excitement	<b>0.93</b>				<b>0.90</b>		<b>0.86</b>												<b>1.00</b>
P5 Grandiosity																			<b>0.94</b>
P6 Suspiciousness/persecution	<b>1.00</b>		<b>0.81</b>		<b>0.88</b>		<b>0.67</b>												<b>0.94</b>
P7 Hostility	<b>1.00</b>		<b>0.98</b>		<b>1.00</b>		<b>0.74</b>												<b>0.93</b>
N1 Blunted affect	<b>0.91</b>		<b>0.94</b>		<b>1.00</b>														<b>0.89</b>
N2 Emotional withdrawal	<b>1.00</b>		<b>0.94</b>		<b>1.00</b>														<b>0.93</b>
N3 Poor rapport	<b>1.00</b>																		<b>0.99</b>
N4 Passive/apathetic social withdrawal	<b>0.91</b>		<b>0.93</b>		<b>1.00</b>														<b>0.79</b>
N5 Difficulty in abstract thinking	<b>1.00</b>		<b>0.90</b>		<b>0.78</b>														<b>0.72</b>
N6 Lack of spontaneity/flow of conversation	<b>0.89</b>		<b>0.76</b>		<b>0.83</b>														<b>0.89</b>
N7 Stereotyped thinking	<b>1.00</b>		<b>0.80</b>		<b>0.80</b>														<b>0.94</b>
G1 Somatic concern							<b>0.86</b>												<b>0.87</b>
G2 Anxiety	0.78		0.78		0.85		0.80		0.78		0.86		0.86		0.84		0.82		0.73
G3 Guilt feelings			<b>0.80</b>		<b>1.00</b>		<b>0.81</b>				<b>0.67</b>		<b>0.90</b>		<b>0.93</b>		<b>0.82</b>		<b>0.82</b>
G4 Tension											<b>0.82</b>		<b>0.94</b>		<b>0.83</b>		<b>0.86</b>		<b>0.86</b>
G5 Mannerisms and posturing					<b>0.96</b>						<b>0.82</b>		<b>1.00</b>		<b>0.92</b>		<b>0.98</b>		<b>0.98</b>
G6 Depression											<b>0.91</b>		<b>0.81</b>		<b>0.87</b>		<b>0.85</b>		<b>0.85</b>
G7 Motor retardation											<b>0.91</b>		<b>0.87</b>		<b>0.98</b>		<b>0.95</b>		<b>0.95</b>
G8 Uncooperativeness	<b>0.93</b>												<b>1.00</b>		<b>0.85</b>		<b>1.00</b>		<b>1.00</b>
G9 Unusual thought content	<b>1.00</b>		0.79						0.80		<b>0.98</b>		<b>1.00</b>		0.78		0.72		<b>0.93</b>
G10 Disorientation	0.77																		<b>0.97</b>
G11 Poor attention	<b>0.92</b>		0.78		<b>0.98</b>		<b>1.00</b>		<b>0.92</b>		<b>0.97</b>		<b>0.83</b>		<b>0.85</b>		<b>0.99</b>		<b>0.99</b>
G12 Lack of judgment and insight	<b>1.00</b>		<b>0.98</b>																<b>0.92</b>
G13 Disturbance of volition	<b>0.81</b>																		<b>0.97</b>
G14 Poor impulse control	<b>1.00</b>		<b>0.90</b>						0.66						<b>0.83</b>		<b>0.82</b>		<b>0.99</b>
G15 Preoccupation	<b>1.00</b>		<b>0.90</b>												<b>0.81</b>		<b>0.82</b>		<b>0.99</b>
G16 Active social avoidance	<b>0.97</b>		0.73												0.78		0.69		<b>0.92</b>

Phase	Acute				Chronic			
	Class	Mixed	Positive	Negative	Class	Delusion	Negative	No-symptoms
Prob.	0.1493	0.2471	0.3130	0.1522	0.2657	0.2043	0.2513	0.2788

Average latent prevalence	
No. of Fixed Parameters	28
No. of Free Parameters	279
N	324
-2logL	12733.298
AIC	13291.298
BIC	14346.125
Entropy	0.699

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.  
2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.  
3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.  
4. The “+” and “-” of conditional probabilities are the “having symptom” and “no symptom” levels respectively.  
5. The conditional probabilities in bold are equal to or higher than 0.8.

Table 38: The summary resulting from LTA with demographic variables (cont.).

Covariate	A little mixed vs No-symptoms		Delusion vs No-symptoms		Negative vs No-symptoms	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
Intercept	-0.77	2.27	1.59	3.50	2.93	2.28
Index of mixed class	3.68 **	1.33	-15.00	0	2.18	1.52
Index of a little mixed class	2.00	1.25	1.58	1.36	1.65	1.20
Index of negative class	14.27 **	1.29	14.16 **	1.62	15.00	0
Index of positive class	1.11	1.07	0.74	1.06	-0.01	1.09
gender	0.34	0.51	-0.03	0.56	0.66	0.59
age	0.09 *	0.04	0.02	0.05	-0.04	0.05
education, yrs	-0.33 **	0.10	-0.32 **	0.12	-0.47 **	0.12
occupation	-1.61 *	0.69	-0.48	0.83	-1.39	0.75
age at onset	-0.08	0.06	-0.04	0.07	0.04	0.06
marital status	2.10 *	1.04	1.65	1.32	1.94	1.11

Note: 1: male, 0: female; occupation: 1: having occupation, 0: no occupation; marital status: 1: single, 0: married.

2. The standard error (S.E.) is equal to 0 when the parameter estimate in equation (15) is fixed at positive (15) or negative (-15).

3. \*: significantly different from 0 at the 0.05 level.

\*\*: significantly different from 0 at the 0.01 level.

**Average latent transition probabilities based on estimated model from equation (16).**

	Chronic	
	Class A little mixed	Delusion Negative No-symptoms
Mixed	0.609	0.000
A little mixed	0.241	0.255
Negative	0.186	0.284
Positive	0.228	0.243
Delusion	0.117	0.169

Table 39: The summary resulting from LTA with significant demographic variables and environmental factors.

Symptom	Conditional probabilities									
	Acute					Chronic				
	Class	Mixed	A little mixed	Negative	Positive	Delusion	Delusion	Negative	No-symptoms	No-symptoms
P1 Delusions	1.00	0.93	0.93	1.00	1.00	1.00	0.81	0.70	0.70	1.00
P2 Conceptual disorganization	1.00	0.86	0.86	0.69	0.82	0.82	0.87	0.73	0.73	1.00
P3 Hallucinatory behavior	0.96	0.87	0.87	0.93	0.80	0.82	0.82	0.86	0.86	0.94
P4 Excitement	0.89	0.77	0.77	0.83	0.80	0.80	0.68	0.66	0.68	1.00
P5 Grandiosity	1.00	0.77	0.76	0.83	0.90	0.80	0.74	0.86	0.86	1.00
P6 uspioussness/persecution	1.00	0.77	0.76	0.83	0.90	0.80	0.74	0.86	0.86	0.98
P7 Hostility	1.00	0.77	0.76	0.83	0.90	0.80	0.74	0.86	0.86	0.98
N1 Blunted affect	1.00	0.98	0.98	1.00	0.83	0.81	0.75	0.83	0.87	0.88
N2 Emotional withdrawal	1.00	1.00	1.00	0.89	0.81	0.81	0.76	0.85	0.72	0.97
N3 Poor rapport	1.00	0.71	0.71	0.85	0.81	0.91	0.82	0.97	0.72	0.98
N4 Passive/apathetic social withdrawal	0.96	0.93	0.93	0.85	0.81	0.77	0.82	0.73	0.85	0.79
N5 Difficulty in abstract thinking	1.00	0.91	0.91	0.83	0.83	0.96	0.96	0.88	0.88	0.71
N6 Lack of spontaneity/flow of conversation	1.00	0.84	0.84	0.83	0.83	0.96	0.96	0.76	0.76	0.85
N7 Stereotyped thinking	1.00	0.78	0.78	0.83	0.83	0.73	0.77	0.74	0.74	0.98
G1 Somatic concern	0.73	0.77	0.77	0.93	0.69	0.70	0.73	0.65	0.79	0.93
G2 Anxiety	0.93	0.81	0.81	1.00	0.92	0.83	0.83	0.84	0.86	0.74
G3 Guilt feelings	0.93	0.81	0.81	1.00	0.92	0.83	0.72	0.84	0.92	0.80
G4 Tension	0.93	0.81	0.81	1.00	0.92	0.86	0.76	0.85	0.84	0.87
G5 Mannerisms and posturing	0.93	0.81	0.81	1.00	0.92	0.86	0.76	0.85	0.84	0.87
G6 Depression	0.93	0.81	0.81	1.00	0.92	0.86	0.76	0.85	0.84	0.87
G7 Motor retardation	0.89	0.86	0.86	0.81	0.88	0.88	0.88	0.81	0.86	0.81
G8 Uncooperativeness	1.00	0.78	0.78	0.82	0.85	0.82	0.88	1.00	0.94	0.94
G9 Unusual thought content	1.00	0.78	0.78	0.82	0.85	0.82	0.88	1.00	0.94	0.94
G10 Disorientation	0.85	0.78	0.78	0.75	0.85	0.96	0.73	0.97	0.83	1.00
G11 Poor attention	0.93	0.78	0.78	0.75	0.85	0.77	0.88	0.97	0.79	1.00
G12 Lack of judgment and insight	1.00	0.98	0.98	0.97	0.91	1.00	0.98	0.87	0.72	0.98
G13 Disturbance of volition	0.85	0.74	0.74	0.89	0.83	0.80	0.98	0.85	0.82	1.00
G14 Poor impulse control	1.00	0.83	0.83	0.89	0.83	0.80	0.72	0.88	0.81	0.89
G15 Preoccupation	1.00	0.83	0.83	0.90	0.77	0.79	0.72	0.85	0.83	1.00
G16. Active social avoidance	1.00	0.83	0.83	0.90	0.77	0.79	0.72	0.85	0.83	1.00

Phase	Acute					Chronic				
	Class	Mixed	A little mixed	Negative	Positive	Delusion	Delusion	Negative	No-symptoms	No-symptoms
Class	0.1088	0.2086	0.1363	0.2661	0.2617	0.2617	0.2617	0.2420	0.2173	0.2173
Prob.	0.1088	0.2086	0.1363	0.2661	0.2617	0.2617	0.2617	0.2420	0.2173	0.2173

Summary table	
No. of Fixed Parameters	35
No. of Free Parameters	281
N	310
-2logL	12315.048
AIC	12877.048
BIC	13927.025
Entropy	0.72

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.  
2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.  
3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.  
4. The "+" and "-" of conditional probabilities are the "having symptom" and "no symptom" levels respectively.  
5. The conditional probabilities in bold are equal to or higher than 0.8.

Table 39: The summary resulting from LTA with significant demographic variables and environmental factors (cont.).

Covariate	A little mixed vs No-symptoms		Delusion vs No-symptoms		Negative vs No-symptoms	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
Intercept	-0.88	2.49	1.08	2.01	5.07 *	2.20
Index of mixed class	21.05 **	2.01	-12.05 **	1.93	19.21 **	1.84
Index of a little mixed class	2.38 *	1.06	1.31	1.23	2.12	1.45
Index of negative class	3.72 *	1.59	2.95	1.93	4.21 *	1.84
Index of positive class	2.45	1.25	1.44	1.42	3.26 *	1.56
age	0.10 *	0.04	0.05	0.04	0.00	0.04
education, yrs	-0.29 *	0.12	-0.22 *	0.09	-0.45 **	0.13
occupation	-1.55 *	0.75	-0.50	0.53	-1.08	0.66
marital status	3.22 **	1.19	2.28	1.16	2.80 *	1.13
envir1	1.39	1.25	1.53	1.04	2.05	1.20
envir21	1.33	0.82	0.52	0.63	1.00	0.82
envir22	2.87 **	0.97	1.74 *	0.87	2.28	1.11
envir31	-0.96	0.88	0.07	0.69	-1.10	0.85
envir32	-0.92	0.73	-0.65	0.67	-1.08	0.95

Note: 1. dummy variable : envir1(having environmental factor 1); envir21 (slight environmental factor 2) ; envir22 (obvious environmental factor 2); envir31 (slight environmental factor 3) ; envir32 (obvious environmental factor 3).

2. The standard error (S.E.) is equal to 0 when the parameter estimate in equation (15) is fixed at positive (15) or negative (-15).

3. \*: significantly different from 0 at the 0.05 level.

\*\*: significantly different from 0 at the 0.01 level.

**Average latent transition probabilities based on estimated model from equation (16).**

	Chronic		
	Class A little mixed	Delusion	No-symptoms
Mixed	0.850	0.000	0.150
A little mixed	0.294	0.304	0.208
Negative	0.241	0.363	0.336
Positive	0.214	0.243	0.391
Delusion	0.127	0.301	0.115

Table 40: The summary resulting from LTA with significant demographic variables and the undegraded  $d'$  of the CPT performance.

Symptom		Acute						Chronic					
		Class	Mixed	A little mixed	Negative	Positive	Delusion	A little mixed	Delusion	Negative	No-symptoms		
P1	Delusions	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	<b>0.75</b>	<b>1.00</b>	<b>1.00</b>	<b>0.97</b>	<b>0.93</b>	<b>0.69</b>	<b>0.93</b>		
P2	Conceptual disorganization	<b>1.00</b>				<b>0.87</b>		<b>0.79</b>			<b>0.98</b>		
P3	Hallucinatory behavior	<b>0.95</b>	<b>0.88</b>		<b>0.77</b>	<b>1.00</b>	<b>0.81</b>	<b>0.92</b>		<b>0.85</b>	<b>0.91</b>		
P4	Excitement	<b>0.68</b>				<b>1.00</b>			<b>0.68</b>	<b>0.98</b>	<b>1.00</b>		
P5	Grandiosity		<b>0.87</b>		<b>0.82</b>		<b>0.76</b>		<b>0.84</b>	<b>0.85</b>	<b>0.96</b>		
P6	Suspiciousness/persecution	<b>0.89</b>		<b>0.79</b>	<b>0.79</b>	<b>0.96</b>	<b>0.80</b>	<b>0.84</b>		<b>0.88</b>	<b>0.92</b>		
P7	Hostility			<b>0.75</b>			<b>0.73</b>		<b>0.88</b>	<b>0.88</b>	<b>0.92</b>		
N1	Blunted affect	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	<b>0.93</b>		<b>0.81</b>	<b>0.77</b>	<b>0.90</b>	<b>0.88</b>	<b>0.91</b>		
N2	Emotional withdrawal	<b>1.00</b>	<b>0.92</b>	<b>0.96</b>	<b>0.88</b>		<b>0.76</b>	<b>0.77</b>	<b>0.87</b>	<b>0.73</b>	<b>0.96</b>		
N3	Poor rapport	<b>0.87</b>	<b>0.96</b>				<b>0.93</b>		<b>1.00</b>	<b>0.67</b>	<b>0.98</b>		
N4	Passive/apathetic social withdrawal	<b>0.95</b>	<b>0.96</b>		<b>0.88</b>		<b>0.78</b>	<b>0.90</b>	<b>0.74</b>	<b>0.88</b>	<b>0.98</b>		
N5	Difficulty in abstract thinking	<b>1.00</b>		<b>0.75</b>	<b>0.87</b>			<b>0.90</b>	<b>0.90</b>	<b>0.90</b>	<b>0.74</b>		
N6	Lack of spontaneity/flow of conversation	<b>0.91</b>			<b>0.79</b>	<b>0.85</b>	<b>0.95</b>	<b>0.90</b>	<b>0.97</b>	<b>0.75</b>	<b>0.91</b>		
N7	Stereotyped thinking	<b>1.00</b>					<b>0.72</b>	<b>0.69</b>	<b>0.74</b>		<b>0.98</b>		
G1	Somatic concern			<b>0.85</b>				<b>0.67</b>		<b>0.73</b>	<b>0.89</b>		
G2	Anxiety	<b>0.80</b>						<b>0.79</b>	<b>0.81</b>	<b>0.85</b>	<b>0.74</b>		
G3	Guilt feelings		<b>0.72</b>	<b>1.00</b>	<b>0.88</b>	<b>0.95</b>	<b>0.83</b>		<b>0.87</b>	<b>0.92</b>	<b>0.77</b>		
G4	Tension	<b>0.92</b>			<b>1.00</b>		<b>0.79</b>	<b>0.82</b>	<b>1.00</b>	<b>0.83</b>	<b>0.85</b>		
G5	Mannerisms and posturing						<b>0.91</b>	<b>0.77</b>	<b>0.91</b>	<b>0.92</b>	<b>0.98</b>		
G6	Depression						<b>0.78</b>		<b>0.91</b>	<b>0.83</b>	<b>0.83</b>		
G7	Motor retardation	<b>0.86</b>		<b>0.82</b>		<b>0.83</b>	<b>1.00</b>		<b>1.00</b>	<b>0.83</b>	<b>0.96</b>		
G8	Uncooperativeness				<b>0.79</b>	<b>0.87</b>	<b>0.81</b>		<b>0.94</b>	<b>0.79</b>	<b>1.00</b>		
G9	Unusual thought content	<b>0.93</b>		<b>0.84</b>		<b>0.92</b>	<b>0.80</b>	<b>0.95</b>	<b>0.97</b>	<b>0.77</b>	<b>1.00</b>		
G10	Disorientation	<b>0.75</b>					<b>0.98</b>	<b>0.72</b>	<b>0.97</b>	<b>0.75</b>	<b>0.98</b>		
G11	Poor attention	<b>0.92</b>				<b>0.86</b>	<b>0.86</b>		<b>0.87</b>	<b>0.67</b>	<b>0.98</b>		
G12	Lack of judgment and insight	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	<b>0.97</b>	<b>0.95</b>	<b>0.91</b>	<b>0.95</b>	<b>0.81</b>		<b>0.66</b>		
G13	Disturbance of volition	<b>0.82</b>					<b>0.76</b>		<b>0.80</b>	<b>0.81</b>	<b>0.92</b>		
G14	Poor impulse control				<b>0.87</b>	<b>0.95</b>	<b>0.74</b>		<b>0.87</b>	<b>0.81</b>	<b>0.96</b>		
G15	Preoccupation	<b>0.97</b>				<b>1.00</b>			<b>0.87</b>	<b>0.83</b>	<b>1.00</b>		
G16	Active social avoidance	<b>0.83</b>					<b>0.73</b>	<b>0.69</b>	<b>0.74</b>	<b>0.69</b>	<b>0.94</b>		

Average latent prevalence		Acute			Chronic		
Class	Mixed	A little mixed	Negative	Positive	Delusion	Negative	No-symptoms
Prob.	0.2340	0.1595	0.1959	0.1382	0.2724	0.2890	0.2741

Summary table	
No. of Fixed Parameters	24
No. of Free Parameters	280
N	255
-2logL	9447.022
AIC	10007.022
BIC	10998.576
Entropy	0.735

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.  
 2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.  
 3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.  
 4. The “+” and “-” of conditional probabilities are the “having symptom” and “no symptom” levels, respectively.  
 5. The conditional probabilities in bold are equal to or higher than 0.8.

Table 40: The summary resulting from LTA with significant demographic variables and the undegraded  $d'$  of the CPT performance (cont.).

Covariate	A little mixed vs No-symptoms		Delusion vs No-symptoms		Negative vs No-symptoms	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
Intercept	-0.85	2.39	4.43	3.26	6.64	3.98
Index of mixed class	1.40	1.10	-0.18	1.40	2.15	1.34
Index of a little mixed class	16.66 **	2.08	15.00	0	21.37 **	1.89
Index of negative class	1.61	1.17	2.40	1.66	4.20 *	1.68
Index of positive class	1.60	1.07	-15.00	0	-2.16	1.75
age	0.07	0.04	-0.01	0.06	-0.05	0.07
education, yrs	-0.21	0.12	-0.51 *	0.22	-0.74 **	0.28
occupation	-1.59 **	0.61	-0.19	0.81	-0.69	0.98
marital status	2.62 *	1.25	0.98	1.40	1.51	1.53
undegraded $d'$	-0.71 **	0.25	0.10	0.29	0.01	0.32

Note: 2. The standard error (S.E.) is equal to 0 when the parameter estimate in equation (15) is fixed at positive (15) or negative (-15).

3. \*: significantly different from 0 at the 0.05 level.

\*\*: significantly different from 0 at the 0.01 level.

**Average latent transition probabilities based on estimated model from equation (16).**

	Chronic		
	Class A little mixed	Delusion	No-symptoms
Mixed	0.376	0.086	0.245
A little mixed	0.082	0.219	0.699
Negative	0.197	0.277	0.395
Positive	0.585	0.000	0.011
Delusion	0.251	0.218	0.075
			0.456





Table 41: The summary resulting from LTA with significant demographic variables and the degraded  $d'$  of the CPT performance.

Symptom	Acute							Chronic						
	Class		Mixed	A little mixed	Negative	Positive	Delusion	A little mixed		Delusion	Negative	No-symptoms	Chronic	
	+	-	+	-	+	-	+	+	-	+	-	+	-	+
P1 Delusions	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	<b>0.89</b>					<b>0.96</b>
P2 Conceptual disorganization	<b>1.00</b>	<b>0.86</b>		<b>0.77</b>			<b>1.00</b>	<b>1.00</b>		<b>0.73</b>				<b>1.00</b>
P3 Hallucinatory behavior	<b>0.91</b>	<b>1.00</b>		<b>0.97</b>	<b>0.80</b>		<b>0.80</b>	<b>1.00</b>		<b>0.88</b>	<b>0.77</b>			<b>0.90</b>
P4 Excitement			<b>0.87</b>	<b>0.79</b>	<b>0.83</b>		<b>0.77</b>	<b>0.66</b>		<b>0.79</b>	<b>0.89</b>			<b>1.00</b>
P5 Grandiosity	<b>0.90</b>		<b>0.81</b>		<b>0.83</b>		<b>0.90</b>	<b>0.87</b>						<b>0.96</b>
P6 Suspiciousness/persecution	<b>0.86</b>		<b>0.78</b>		<b>1.00</b>		<b>0.77</b>			<b>1.00</b>	<b>0.77</b>			<b>0.93</b>
P7 Hostility	<b>1.00</b>		<b>0.87</b>		<b>1.00</b>		<b>0.79</b>			<b>0.82</b>	<b>0.91</b>			<b>0.91</b>
N1 Blunted affect	<b>1.00</b>		<b>0.97</b>		<b>0.95</b>		<b>0.72</b>		<b>0.87</b>	<b>0.94</b>	<b>0.90</b>			<b>0.93</b>
N2 Emotional withdrawal	<b>1.00</b>		<b>0.86</b>		<b>0.95</b>		<b>0.74</b>	<b>0.67</b>		<b>0.97</b>	<b>0.76</b>			<b>0.94</b>
N3 Poor rapport	<b>1.00</b>		<b>0.86</b>		<b>0.95</b>		<b>0.74</b>	<b>0.93</b>		<b>0.81</b>	<b>0.96</b>			<b>0.77</b>
N4 Passive/apathetic social withdrawal	<b>1.00</b>		<b>0.86</b>		<b>0.91</b>		<b>0.96</b>			<b>0.87</b>	<b>0.82</b>			<b>0.73</b>
N5 Difficulty in abstract thinking	<b>1.00</b>		<b>0.86</b>		<b>0.92</b>		<b>0.73</b>	<b>0.67</b>		<b>0.87</b>	<b>0.65</b>			<b>0.89</b>
N6 Lack of spontaneity/flow of conversation	<b>1.00</b>		<b>0.72</b>		<b>0.79</b>		<b>0.73</b>			<b>0.87</b>	<b>0.65</b>			<b>0.82</b>
N7 Stereotyped thinking	<b>1.00</b>		<b>0.83</b>		<b>0.87</b>		<b>0.79</b>			<b>0.72</b>	<b>0.65</b>			<b>0.98</b>
G1 Somatic concern			<b>0.83</b>	<b>0.87</b>		<b>0.77</b>	<b>0.93</b>	<b>0.86</b>		<b>0.88</b>				<b>0.74</b>
G2 Anxiety			<b>1.00</b>	<b>0.83</b>		<b>1.00</b>	<b>0.93</b>	<b>0.77</b>		<b>0.90</b>				<b>0.83</b>
G3 Guilt feelings			<b>0.74</b>		<b>0.95</b>		<b>0.76</b>	<b>0.93</b>		<b>0.86</b>	<b>0.68</b>			<b>0.86</b>
G4 Tension			<b>0.84</b>		<b>0.77</b>		<b>0.77</b>	<b>0.93</b>		<b>0.94</b>	<b>0.86</b>			<b>0.74</b>
G5 Mannerisms and posturing			<b>0.77</b>		<b>0.93</b>		<b>0.77</b>	<b>0.96</b>		<b>0.72</b>	<b>0.74</b>			<b>0.83</b>
G6 Depression			<b>0.84</b>	<b>0.75</b>	<b>0.93</b>		<b>0.93</b>	<b>0.96</b>		<b>1.00</b>	<b>0.96</b>			<b>0.96</b>
G7 Motor retardation			<b>0.77</b>		<b>0.84</b>		<b>0.84</b>	<b>0.96</b>		<b>0.74</b>	<b>0.67</b>			<b>1.00</b>
G8 Uncooperativeness			<b>1.00</b>	<b>0.82</b>	<b>0.87</b>		<b>0.80</b>	<b>0.97</b>	<b>0.72</b>	<b>0.94</b>	<b>0.74</b>			<b>0.97</b>
G9 Unusual thought content			<b>0.78</b>		<b>0.87</b>		<b>0.80</b>	<b>0.97</b>		<b>0.94</b>	<b>0.74</b>			<b>0.96</b>
G10 Disorientation			<b>0.92</b>	<b>0.86</b>	<b>0.97</b>		<b>0.86</b>	<b>0.97</b>		<b>0.96</b>	<b>0.93</b>			<b>0.98</b>
G11 Poor attention			<b>1.00</b>	<b>0.87</b>	<b>0.97</b>		<b>0.89</b>	<b>0.86</b>		<b>0.81</b>	<b>0.75</b>			<b>0.68</b>
G12 Lack of judgment and insight			<b>0.87</b>	<b>0.75</b>	<b>0.87</b>		<b>0.77</b>	<b>0.79</b>		<b>0.85</b>	<b>0.75</b>			<b>0.90</b>
G13 Disturbance of volition			<b>0.96</b>	<b>0.93</b>	<b>0.89</b>		<b>0.70</b>	<b>0.77</b>		<b>0.94</b>	<b>0.67</b>			<b>0.98</b>
G14 Poor impulse control			<b>1.00</b>	<b>0.75</b>	<b>0.75</b>		<b>0.73</b>	<b>0.70</b>		<b>0.94</b>	<b>0.67</b>			<b>0.96</b>
G15 Preoccupation			<b>0.96</b>	<b>0.93</b>	<b>0.75</b>		<b>0.73</b>	<b>0.73</b>		<b>0.73</b>	<b>0.67</b>			<b>0.96</b>
G16 Active social avoidance			<b>1.00</b>	<b>0.75</b>	<b>0.75</b>		<b>0.73</b>	<b>0.73</b>		<b>0.73</b>	<b>0.67</b>			<b>0.96</b>

Note: 1. P1-P7: Positive symptoms, N1-N7: Negative symptoms, G1-G16: General psychopathological symptoms.

2. The conditional probabilities are equal to 1 or 0 when  $\gamma$  in equation (5) is fixed at positive or negative infinite, respectively.

3. The conditional probabilities are shown while the parameter estimates of equation (5) are significantly different from 0 at the 0.05 level.

4. The “+” and “-” of conditional probabilities are the “having symptom” and “no symptom” levels, respectively.

5. The conditional probabilities in bold are equal to or higher than 0.8.

#### Average latent prevalence

Phase	Acute			Chronic					
	Class	Mixed	A little mixed	Delusion	Negative	No-symptoms			
Prob.	0.1694	0.1915	0.1473	0.2020	0.2898	0.1101	0.1973	0.3863	0.3063

#### Summary table

No. of Fixed Parameters	37
No. of Free Parameters	267
N	237
-2logL	8630.978
AIC	9164.978
BIC	10090.950
Entropy	0.731

Table 41: The summary resulting from LTA with significant demographic variables and the degraded  $d'$  of the CPT performance (cont.).

Covariate	A little mixed vs No-symptoms		Delusion vs No-symptoms		Negative vs No-symptoms	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
Intercept	4.96	2.44	-22.60 **	2.96	-1.22	3.13
Index of mixed class	-15.00	0	-15.00	0	4.64 *	2.13
Index of a little mixed class	0.24	1.35	0.97	1.28	2.60	1.60
Index of negative class	-15.00	0	2.62	1.59	4.13 *	1.91
Index of positive class	0.22 *	1.07	-15.00	0	1.91	1.71
age	-0.04	0.05	-0.04	0.08	0.07	0.06
education, yrs	-0.33	0.18	-0.31 *	0.13	-0.45 **	0.16
occupation	-0.01	0.87	1.05	1.21	-2.27	1.22
marital status	0.06	1.07	15.00	0	3.08 *	1.32
degraded d'	-0.52 *	0.21	-0.09	0.27	-0.05	0.21

Note: 2. The standard error (S.E.) is equal to 0 when the parameter estimate in equation (15) is fixed at positive (15) or negative (-15).

3. \*: significantly different from 0 at the 0.05 level.

\*\*: significantly different from 0 at the 0.01 level.

**Average latent transition probabilities based on estimated model from equation (16).**

	Chronic		
	Class A little mixed	Delusion	No-symptoms
Mixed	0.000	0.000	0.829
A little mixed	0.099	0.297	0.368
Negative	0.000	0.411	0.473
Positive	0.192	0.000	0.378
Delusion	0.181	0.275	0.102



Figure 1: AIC and BIC criteria for selecting the number of classes in the acute and chronic phases.

