Trajectories of pneumonia in a population-based study of Korean older adults

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ABSTRACT

The study aimed to determine trajectories of geriatric pneumonia in South Korea using group-based trajectory modeling. A total of 4007 individuals aged 65 or older were included. Of 4007 individuals, 2286 (57%) were females, with a mean baseline age of 72.48 years (SD = 6 years). Three pneumonia trajectories were identified across 10 years of follow-up: “low-flat” (n = 3858; 90.5), “low-to-high” (n = 90; 7.0%), and “high-to-low” (n = 59; 2.5%). Compared to the low-flat group, both low-to-high and high-to-low group members were more likely to have chronic respiratory disease when they first participated in the study. Also, high-to-low pneumonia group members were more likely to have disabilities compared to the low-flat pneumonia group. Pneumonia is one of the top leading causes of death worldwide, and geriatric pneumonia shows different aspects from younger patients. Therefore, our findings can help to understand and prepare for geriatric pneumonia.

BACKGROUND & INTRODUTION

Trajectory specifies evaluating one or more outcomes over age or time, and there are several statistical approaches for analyzing developmental trajectories. Group-based trajectory modeling (GBTM) is one of the methods of trajectory analysis. It is an application of finite mixture modeling which uses trajectory groups to find sub-group trajectories within a population. Group-based trajectory assumes that the population is composed of distinct groups, each with a different underlying trajectory, and each subject in the group is approximately following similar trajectories on an outcome over time. It can identify distinctive developmental paths in complex longitudinal data, which can be useful when handling non-monotonic trajectories.

The leading causes of death can be categorized broadly into three topics: cardiovascular, respiratory, and neonatal conditions. Pneumonia is a well-known respiratory disease that affects the lungs in forms of acute respiratory infection. For pneumonia, age is considered as a risk factor where people at most risk are adults aged ≥65 years, young children, and infants. As the population is aging, and geriatric pneumonia shows different aspects from younger patients, this study is focusing on geriatric pneumonia. In this study, 10 years of follow-up longitudinal study data was used to model the trajectories for geriatric pneumonia.

STUDY OBJECTIVES

Objective 1: To develop trajectories with binary outcomes using group-based trajectory modeling for geriatric pneumonia.

Objective 2: To compare the trajectory shape and membership differences in group-based trajectory model.

Objective 3: To identify relevant risk factors that may influence the trajectory groups.

MATERIALS AND METHODS

Method of Analysis

Group-based trajectory modeling is an application of finite mixture modeling. While the analysis aims to find sub-group trajectories within a population, the estimated parameters are not derived from cluster analysis, but they depend on maximum likelihood estimation. The maximization is performed using the quasi-Newton procedure.

If we assume there are J groups of trajectories from the population, the unconditional group-based trajectory modeling would be

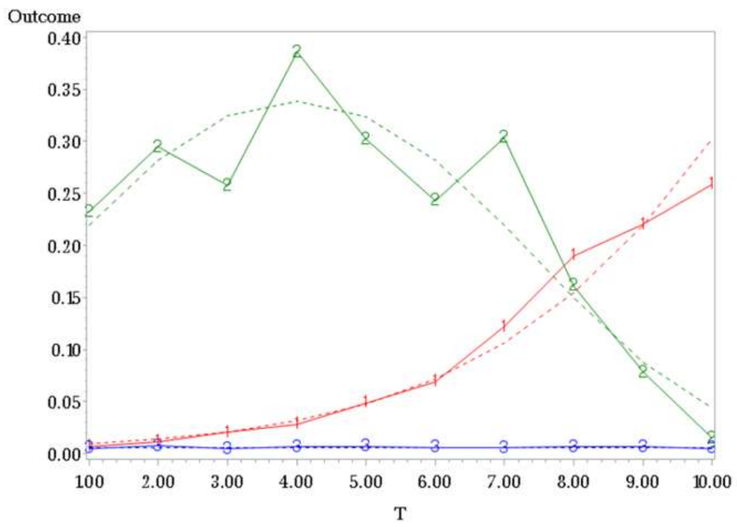
$$P(Y_i) = \sum_{j=1}^{J} \pi_j P^j (Y_i)$$

where π_j $(0 \leq \pi_j \leq 1)$, represents the probability of a randomly chosen population member belonging to group j.
The final model selection will be based on Bayesian Information Criteria (BIC) when selecting the groups and the shape. BIC = log(L) –0.5k log(N).

For comparing the trajectory shape and membership differences, chi-square test and ANOVA was used. To identify relevant risk factors, univariate and multivariate logistic regression was used. All the statistical analysis was completed using SAS 9.4(SAS Institute, Cary, NC), and α = 0.05 was selected for the significant level.

RESULTS

Group-based trajectory modeling



Group (n,%)
1. Low-to-High (90, 7.0%)
2. High-to-Low (59, 2.5%)
3. Low-flat (3858, 90.5%)

Trajectory group comparison of characteristics

Variable	Low-to-High (n=90, 7.0%)	High-to-Low (n=59, 2.5%)	Low-flat (n=3858, 90.5%)	p-value
Gender				
Male	48 (53.3)	32 (54.2)	1541 (42.5)	0.0260*
Female	42 (46.7)	27 (45.8)	2217 (57.5)	
Age	72.24 (5.7)	74.15 (6.8)	72.46 (6.0)	0.0922
Age (Categorical)				
65-69	35 (38.9)	17 (28.8)	1477 (38.3)	0.7849
70-74	26 (28.9)	19 (32.2)	1175 (30.5)	
75-79	19 (21.1)	13 (22.0)	717 (18.5)	
80+	10 (11.1)	10 (17.0)	489 (12.7)	
# of household members				
1	8 (8.9)	5 (8.5)	677 (17.5)	0.0187*
2	42 (46.7)	29 (49.2)	1953 (50.6)	
3	23 (25.5)	9 (15.2)	556 (14.4)	
4	6 (6.7)	5 (8.5)	269 (7.0)	
5+	11 (12.2)	11 (18.6)	403 (10.5)	
Smoking				
Current	17 (18.9)	7 (14.6)	490 (13.7)	0.1147
Previous	31 (34.4)	15 (31.2)	930 (26.1)	
No	42 (46.7)	26 (54.2)	2148 (60.2)	
Disability				
No	82 (91.1)	43 (72.9)	3332 (86.4)	0.0046*
Yes	8 (8.9)	16 (27.1)	526 (13.6)	
Chronic respiratory disease				
No	78 (86.7)	49 (83.1)	3626 (94.0)	<.0001*
Yes	12 (13.3)	10 (16.9)	232 (6.0)	

* p-value < 0.05

Univariate / Multivariate logistic regression

• Univariate logistic regression analysis (Low-flat group is the reference group)

Variable	Low-to-High (n=90, 7.0%)		High-to-Low (n=59, 2.5%)	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Gender				
Male	-	-	-	-
Female	0.65 (0.43, 0.99)	0.0422	0.63 (0.37, 1.05)	0.0738
Age				
65-69	-	-	-	-
70-74	0.93 (0.56, 1.56)	0.7936	1.41 (0.73, 2.72)	0.3118
75-79	1.12 (0.64, 1.97)	0.6984	1.58 (0.76, 3.26)	0.2209
80+	0.86 (0.42, 1.76)	0.6843	1.78 (0.81, 3.91)	0.1507
# of household members				
1	-	-	-	-
2	1.82 (0.85, 3.90)	0.1231	2.01 (0.78, 5.21)	0.1510
3	3.50 (1.55, 7.89)	0.0025	2.19 (0.73, 6.58)	0.1617
4	1.89 (0.65, 5.49)	0.2437	2.52 (0.72, 8.76)	0.1471
More than 5	2.31 (0.92, 5.79)	0.0742	3.70 (1.28, 10.7)	0.0161
Smoking				
No	-	-	-	-
Current	1.78 (1.00, 3.14)	0.0494	1.18 (0.51, 2.74)	0.6992
Previous	1.71 (1.07, 2.73)	0.0263	1.33 (0.71, 2.53)	0.3792
Disability				
No	-	-	-	-
Yes	0.62 (0.30, 1.29)	0.1974	2.36 (1.32, 4.22)	0.0038
Chronic respiratory disease				
No	-	-	-	-
Yes	2.41 (1.29, 4.48)	0.0057	3.19 (1.60, 6.38)	0.0010

• Multivariate logistic regression analysis (Low-flat group is the reference group)

Variable	Low-to-High (n=90, 7.0%)		High-to-Low (n=59, 2.5%)	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Disability				
No			-	-
Yes			2.34 (1.31, 4.19)	0.0042
Chronic respiratory disease				
No	-	-	-	-
Yes	2.41 (1.29, 4.48)	0.0057	3.17 (1.58, 6.34)	0.0012

CONCLUSION

- From the group-based trajectory modeling, three geriatric pneumonia trajectories were identified with: “low-flat” (90.5%), “low-to-high” (7.0%), and “high-to-low” (2.5%).
- Based on the overall chi-square test, gender (p=0.0260), number of household members (p=0.0187), disability (p=0.0046), and chronic respiratory disease (p<0.0001) were significantly different among the groups.
- Significant predictors for the “Low-to-High” pneumonia trajectory group are gender, number of household members, smoking status, having chronic respiratory disease. For “High-to-Low” group, the predictors are having disability, having chronic respiratory disease.
- In multivariate logistic regression analysis, the members from “Low-to-High” group were more likely to have chronic respiratory disease (OR=2.41, p=0.0057), and “High-to-Low” group members were more likely to have disability (OR=2.34, p=0.0042) and have chronic respiratory disease (OR=3.17, p=0.0012).

REFERENCES

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