



# Risk Factors for Mortality in Patients with Severe Mental Illness in North Korean Refugee in South Korea

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## Introduction

- The mental health of North Korean Refugee (NKR) is one of the factors behind South Korea's settlement.
- Severe mental illness (SMI) is a public health problem with a great burden of personal and social.
- However, there are insufficient consequences for the risk factors and mortality effects on SMI.
- This study examined the risk factors of mortality in NKR with SMI.

## Methods

### Data and sources

- Used National Health Insurance Service (NHIS).
- Included only NKR who received medical treatment according to the category of NKR (code number of qualification: 14).
- Population consisted of householder and family members in NKR between 2002 and 2018.

### Definition of study participants

- 37,528 NKR patients were registered with the National Health Insurance. We analyzed 3,895 NKR patients who were main diagnosed with SMI out of 36,891 study target.
- The International Classification of Diseases, 10th revision (ICD-10) diagnosis codes used for SMI diagnosis were applied:
  - ✓ (1) Schizophrenia, schizotypal, delusional, and other non-mood psychotic disorders (F20.x-F29.x); (2) Manic episode and bipolar disorder (F30.x and F31.x); and (3) Major depressive disorder and recurrent major depressive disorder (F32.x, F33.x and F34.1).
  - ✓ (1) Schizophrenia (n=423); (2) bipolar disorders (n=426); and (3) major depressive disorders (n=3,466)

### Outcome variable

- Followed up for 17 years (2002 - 2018) to identify all causes and mortality.

### Covariates and confounding controls

- Subgroups were defined in reference to previously reported studies
- Baseline variables: sex, age, health insurance types; residence types; period of settlement in Korea; and major healthcare facilities use types
- Confounding controls: number of cardiovascular diseases risk factors; Charlson Comorbidity Index (CCI); diagnosed hypertension (ICD-10: I10-I15); diagnosed diabetes (ICD-10: E10-E14); diagnosed hyperlipidemia (ICD-10: E78); diagnosed sleep disorders (ICD-10: F51 and G47); diagnosed anxiety disorder (ICD-10: F40-F42); comorbidity in SMI; BMI; Smoking status; Alcohol intake; and physical activity.

## Results

Table 1 Univariate and multivariate analysis of mortality and risk factors with schizophrenia

Variables		Crude		Model 1		Model 2	
		No. of deaths	HR (95% HR confidence)	aHR (95% HR confidence)	aHR (95% HR confidence)	aHR (95% HR confidence)	aHR (95% HR confidence)
Sex	Male	18	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
	Female	17	0.692 (0.549-0.870)	0.752 (0.589-0.959)	0.763 (0.575-0.943)	0.763 (0.575-0.943)	0.763 (0.575-0.943)
Age (years)	≤10	1	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
	11-20	1	1.711 (0.766-3.822)	2.289 (1.005-5.211)	1.920 (0.816-4.519)	1.920 (0.816-4.519)	1.920 (0.816-4.519)
	21-30	8	1.750 (0.847-3.617)	2.358 (1.119-4.970)	2.058 (0.946-4.478)	2.058 (0.946-4.478)	2.058 (0.946-4.478)
	31-40	10	2.061 (1.002-4.240)	2.634 (1.261-5.503)	2.298 (1.061-4.977)	2.298 (1.061-4.977)	2.298 (1.061-4.977)
	41-50	2	1.584 (0.770-3.257)	2.506 (1.193-5.264)	2.094 (0.955-4.590)	2.094 (0.955-4.590)	2.094 (0.955-4.590)
	51-60	3	2.237 (1.010-4.954)	3.627 (1.596-8.244)	2.938 (1.254-7.094)	2.938 (1.254-7.094)	2.938 (1.254-7.094)
	61-70	10	2.323 (0.914-5.901)	2.796 (1.092-7.155)	2.320 (0.870-6.191)	2.320 (0.870-6.191)	2.320 (0.870-6.191)
	71-80	0	0.246 (0.064-0.942)	0.230 (0.059-0.899)	0.204 (0.050-0.836)	0.204 (0.050-0.836)	0.204 (0.050-0.836)
	≥81	0	n/a	n/a	n/a	n/a	n/a
	≥10	17	6.321 (3.051-13.094)	6.168 (2.812-13.530)	5.723 (2.586-12.668)	5.723 (2.586-12.668)	5.723 (2.586-12.668)
Settlement period in Korea (years)	≤1	0	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
	2-4	2	1.962 (0.911-4.227)	1.843 (0.819-4.146)	1.849 (0.818-4.175)	1.849 (0.818-4.175)	1.849 (0.818-4.175)
	5-9	16	3.542 (1.713-7.324)	3.427 (1.580-7.436)	3.324 (1.527-7.236)	3.324 (1.527-7.236)	3.324 (1.527-7.236)
	≥10	17	6.321 (3.051-13.094)	6.168 (2.812-13.530)	5.723 (2.586-12.668)	5.723 (2.586-12.668)	5.723 (2.586-12.668)
Number of risk factors CVD	None	9	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
	1	8	1.378 (1.023-1.857)	1.279 (0.943-1.736)	1.185 (0.856-1.641)	1.185 (0.856-1.641)	1.185 (0.856-1.641)
	2	7	1.463 (1.073-1.994)	1.256 (0.908-1.739)	1.133 (0.795-1.615)	1.133 (0.795-1.615)	1.133 (0.795-1.615)
	3	11	1.593 (1.129-2.247)	1.313 (0.903-1.907)	1.132 (0.748-1.711)	1.132 (0.748-1.711)	1.132 (0.748-1.711)
CCI	0	7	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
	1	7	1.088 (0.738-1.511)	1.082 (0.771-1.516)	1.052 (0.746-1.483)	1.052 (0.746-1.483)	1.052 (0.746-1.483)
	2	5	1.334 (0.930-1.913)	1.294 (0.887-1.888)	1.210 (0.821-1.785)	1.210 (0.821-1.785)	1.210 (0.821-1.785)
	3+	16	1.475 (1.122-1.939)	1.348 (0.999-1.819)	1.239 (0.888-1.728)	1.239 (0.888-1.728)	1.239 (0.888-1.728)
Comorbidity in SMI	None	23	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
	1	10	1.160 (0.939-1.433)	1.240 (0.996-1.543)	1.206 (0.964-1.510)	1.206 (0.964-1.510)	1.206 (0.964-1.510)
	2	2	1.199 (0.830-1.733)	1.204 (0.822-1.763)	1.176 (0.794-1.740)	1.176 (0.794-1.740)	1.176 (0.794-1.740)

Model 1: adjusted for baseline sex, age, settlement period in Korea, and major healthcare facilities use

Model 2: adjusted for all covariates in model1 and number of risk factors CVD, CCI, and comorbidity in SMI

Table 2 Univariate and multivariate analysis of mortality and risk factors with bipolar disorder

Variables		Crude		Model 1		Model 2	
		No. of deaths	HR (95% HR confidence)	aHR (95% HR confidence)	aHR (95% HR confidence)	aHR (95% HR confidence)	aHR (95% HR confidence)
Sex	Male	10	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
	Female	5	0.902 (0.708-1.150)	0.943 (0.735-1.210)	0.843 (0.653-1.086)	0.843 (0.653-1.086)	0.843 (0.653-1.086)
Age (years)	≤10	0	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
	11-20	1	2.460 (1.140-5.310)	3.129 (1.432-6.834)	3.502 (1.596-7.685)	3.502 (1.596-7.685)	3.502 (1.596-7.685)
	21-30	1	2.171 (1.087-4.335)	2.994 (1.476-6.071)	2.915 (1.418-5.991)	2.915 (1.418-5.991)	2.915 (1.418-5.991)
	31-40	6	3.069 (1.550-6.077)	4.128 (2.063-8.262)	3.810 (1.887-7.691)	3.810 (1.887-7.691)	3.810 (1.887-7.691)
	41-50	2	2.794 (1.400-5.576)	4.242 (2.074-8.602)	3.211 (1.552-6.646)	3.211 (1.552-6.646)	3.211 (1.552-6.646)
	51-60	1	2.709 (1.290-5.689)	4.594 (2.142-9.856)	4.540 (2.064-9.986)	4.540 (2.064-9.986)	4.540 (2.064-9.986)
	61-70	4	1.972 (0.876-4.441)	2.839 (1.247-6.465)	2.068 (0.892-4.792)	2.068 (0.892-4.792)	2.068 (0.892-4.792)
	71-80	0	2.410 (0.518-11.212)	2.839 (0.607-13.266)	1.641 (0.343-7.850)	1.641 (0.343-7.850)	1.641 (0.343-7.850)
	≥81	0	n/a	n/a	n/a	n/a	n/a
	≥10	10	4.622 (2.398-8.909)	4.710 (2.361-9.398)	3.744 (1.848-7.584)	3.744 (1.848-7.584)	3.744 (1.848-7.584)
Settlement period in Korea (years)	≤1	0	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
	2-4	1	1.574 (0.788-3.143)	1.461 (0.712-2.997)	1.267 (0.614-2.617)	1.267 (0.614-2.617)	1.267 (0.614-2.617)
	5-9	4	3.122 (1.622-6.010)	2.936 (1.484-5.806)	2.403 (1.201-4.811)	2.403 (1.201-4.811)	2.403 (1.201-4.811)
	≥10	10	4.622 (2.398-8.909)	4.710 (2.361-9.398)	3.744 (1.848-7.584)	3.744 (1.848-7.584)	3.744 (1.848-7.584)
Diagnosed hypertension	No	8	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
	Yes	7	1.382 (1.117-1.709)	1.275 (1.009-1.610)	1.009 (0.787-1.295)	1.009 (0.787-1.295)	1.009 (0.787-1.295)
Diagnosed diabetes	No	7	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
	Yes	8	1.530 (1.245-1.881)	1.531 (1.231-1.904)	1.271 (1.000-1.615)	1.271 (1.000-1.615)	1.271 (1.000-1.615)
Diagnosed hyperlipidemia	No	5	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
	Yes	10	1.751 (1.391-2.203)	1.646 (1.283-2.111)	1.449 (1.116-1.881)	1.449 (1.116-1.881)	1.449 (1.116-1.881)
Diagnosed anxiety disorders	No	9	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
	Yes	6	1.289 (1.060-1.568)	1.300 (1.061-1.593)	1.175 (0.949-1.456)	1.175 (0.949-1.456)	1.175 (0.949-1.456)
CCI	0	2	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
	1	5	1.125 (0.801-1.580)	1.069 (0.757-1.510)	0.947 (0.667-1.344)	0.947 (0.667-1.344)	0.947 (0.667-1.344)
	2	4	1.318 (0.956-1.817)	1.136 (0.811-1.592)	0.910 (0.648-1.277)	0.910 (0.648-1.277)	0.910 (0.648-1.277)
	3+	4	1.664 (1.275-2.171)	1.399 (1.042-1.878)	1.044 (0.764-1.426)	1.044 (0.764-1.426)	1.044 (0.764-1.426)
Comorbidity in SMI	None	6	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
	1	7	2.104 (1.709-2.590)	2.244 (1.805-2.788)	2.177 (1.744-2.717)	2.177 (1.744-2.717)	2.177 (1.744-2.717)
	2	2	2.743 (1.889-3.983)	2.651 (1.796-3.913)	2.323 (1.555-3.470)	2.323 (1.555-3.470)	2.323 (1.555-3.470)

Model 1: adjusted for baseline sex, age, settlement period in Korea, and major healthcare facilities use

Model 2: adjusted for all covariates in model1 and diagnosed hypertension, diagnosed diabetes, diagnosed hyperlipidemia, CCI, diagnosed anxiety disorders, and comorbidity in SMI

Table 3 Univariate and multivariate analysis of mortality and risk factors with major depressive disorder

Variables		Crude		Model 1		Model 2	
		No. of deaths	HR (95% HR confidence)	aHR (95% HR confidence)	aHR (95% HR confidence)		
Sex	Male	35	1.0 (ref)	1.0 (ref)	1.0 (ref)		
	Female	38	1.042 (0.943-1.152)	1.089 (0.983-1.206)	1.105 (0.996-1.226)		
Age (years)	≤10	0	1.0 (ref)	1.0 (ref)	1.0 (ref)		
	11-20	3	1.555 (1.100-2.197)	1.636 (1.156-2.314)	1.620 (1.145-2.292)		
	21-30	10	1.826 (1.355-2.461)	1.983 (1.468-2.678)	1.968 (1.456-2.660)		
	31-40	19	2.345 (1.745-3.152)	2.539 (1.885-3.421)	2.365 (1.752-3.193)		
	41-50	13	2.193 (1.628-2.952)	2.624 (1.943-3.544)	2.282 (1.682-3.097)		
	51-60	6	2.508 (1.838-3.423)	3.155 (2.303-4.323)	2.699 (1.958-3.721)		
	61-70	15	2.091 (1.468-2.978)	2.341 (1.641-3.338)	1.865 (1.296-2.684)		
	71-80	7	1.606 (0.941-2.741)	1.057 (0.970-2.832)	1.284 (0.745-2.215)		
	≥81	0	0.332 (0.046-2.409)	0.283 (0.039-2.056)	0.215 (0.030-1.545)		
	Settlement period in Korea (years)	≤1	1	1.0 (ref)	1.0 (ref)	1.0 (ref)	
2-4		9	1.559 (1.232-1.972)	1.530 (1.206-1.940)	1.380 (1.087-1.753)		
5-9		31	2.150 (1.729-2.675)	2.167 (1.737-2.703)	1.817 (1.450-2.276)		
≥10		32	2.937 (2.363-3.649)	3.159 (2.533-3.940)	2.527 (2.012-3.173)		
Diagnosed hypertension	No	24	1.0 (ref)	1.0 (ref)	1.0 (ref)		
	Yes	49	1.288 (1.196-1.387)	1.173 (1.081-1.272)	1.083 (0.996-1.179)		
Diagnosed diabetes	No	30	1.0 (ref)	1.0 (ref)	1.0 (ref)		
	Yes	43	1.325 (1.235-1.420)	1.201 (1.117-1.293)	1.113 (1.029-1.204)		
Diagnosed hyperlipidemia	No	19	1.0 (ref)	1.0 (ref)	1.0 (ref)		
	Yes	54	1.367 (1.268-1.474)	1.210 (1.118-1.310)	1.075 (0.987-1.171)		
Diagnosed anxiety disorders	No	38	1.0 (ref)	1.0 (ref)	1.0 (ref)		
	Yes	35	1.186 (1.108-1.270)	1.143 (1.066-1.224)	1.061 (0.988-1.138)		
CCI	0	9	1.0 (ref)	1.0 (ref)	1.0 (ref)		
	1	5	1.177 (1.049-1.321)	1.081 (0.962-1.215)	1.063 (0.945-1.196)		
	2	3	1.308 (1.163-1.471)	1.159 (1.028-1.307)	1.100 (0.973-1.243)		
	3+	56	1.641 (1.492-1.805)	1.339 (1.206-1.487)	1.196 (1.068-1.338)		
Comorbidity in SMJ	None	64	1.0 (ref)	1.0 (ref)	1.0 (ref)		
	1	7	1.526 (1.354-1.719)	1.544 (1.368-1.742)	1.500 (1.328-1.693)		
	2	7	1.860 (1.376-2.608)	1.903 (1.352-2.678)	1.747 (1.238-2.465)		