Risk of suicide completion in psychiatric patients according to the level of continuity of care and area deprivation: A population-based nested case-control study

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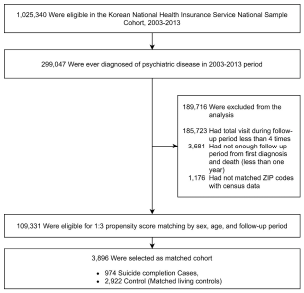
INTRODUCTION

- Suicide is a major global public health concern. Worldwide, approximately 800,000 people die by suicide every year.
- Even though the suicide rate appears to be decreasing since 2011, deaths by suicide in South Korea exceed the global average greatly (28·8 versus 11·6 per 100,000 deaths).
- Effective prevention particularly requires intervention for high-risk suicide groups, which are relatively vulnerable and easily detected.
- In early 2018, the South Korea government announced the 'Third National Action Plan for Preventing Suicide'. This entails support systems for high-risk suicide groups (e.g. bereaved families, those with psychiatric or physical illnesses, the unemployed, and the poor).
- Specifically, it emphasizes the importance of continuity of care (COC) by specialists for psychiatric patients and those who have attempted suicide, as well as improving communities' capacity to prevent and respond to suicide.
- However, there is convincing evidence in existing research that community capacity and COC for psychiatric patients have significant relationships with suicide mortality, especially in the case of South Korea.
- Accordingly, this study addresses the following research questions:
  (1) How does the relative risk of suicide completion vary among different levels of COC and AD?
  (2) Does COC and AD interactively affect risk of suicide completion?
  (3) Is relative risk modified by gender and age?
- We primarily hypothesized that poor COC and higher AD would be associated with increased risk of suicide completion.
- We also expected risk of suicide completion according to COC or AD to differ based on different gender and age groups, as most previous studies revealed that men or older adults are more likely to die by suicide in South Korea.

METHODS

- **Data source**: Korea National Health Insurance Service (KNHIS) National Sample Cohort, 2002-2013, (1,025,340 nationally representative random- sampled individuals (approximately 2·2% of the entire population).
- **Study population**: 3,896 study population (Flow Chart ->)
- **Outcome variables**: Suicide mortality ICD-10 code (X60–X84)
- **Independent variables of interest**:
  1) Bice-Boxerman Continuity of Care Index
  : poor (< 0·4), medium (≥ 0·4, < 0·75), and good (≥ 0·75)
  2) Area Deprivation Index
  : manually classified the AD levels into three groups: highest (91-100%, 3·52 < Z-score); middle (11-90%, -7·96 < Z-score ≤ 3·52); and lowest (0-10%, Z-score ≤ -7·96)
- **Included covariates:** income (quintiles Q1, Q2, Q3, Q4, and Q5), health insurance coverage (national health insurance or medical aid), severity of psychiatric illness (categorized by Global Assessment of Functioning score and classed as none, moderate [51–60], or severe [< 50]), initial diagnosis of psychiatric disorder identified through the main and first sub-diagnosis (ICD-10 code), the Charlson Comorbidity Index (0, 1, or ≥2), use of antidepressant medication (yes or no), use of antipsychotics (yes or no), use of anxiolytics or hypnotics (yes or no), use of mood stabilizers (yes or no), and length of stay (days; continuous variable).
- **Study design:** Incidence density sampling of the nested case-control design
- **Statistical analysis**: Conditional logistic regression analysis, Subgroup analysis



RESULTS

Table 1. Characteristics of the study population

Characteristic	Matched cohort (=3,896) [a]				
	Suicide completion cases		Matched living controls		P-value
	N	%	N	%	
Total	974	100.0%	2,922	100.0%	
Bice-Boxerman Continuity of Care Index [b]					
Poor (<0.4)	306	31.4%	543	18.6%	<.001
Medium (≥0.4, <0.75)	347	35.6%	938	32.1%	
Good (≥0.75)	321	33.0%	1,441	49.3%	
Area deprivation level					
Highest (91-100%: 3.52<Z score)	75	7.7%	293	10.0%	0.029
Middle (11-90%: -7.96<Z score≤3.52)	740	76.0%	2,222	76.0%	
Lowest (0-10%: Z score≤-7.96)	159	16.3%	407	13.9%	
Gender					
Male	550	56.5%	1,642	56.2%	0.911 [c]
Female	424	43.5%	1,280	43.8%	
Age					
20-34	143	14.7%	444	15.2%	0.961
35-49	249	25.6%	755	25.8%	
50-64	313	32.1%	916	31.3%	
65≤	269	27.6%	807	27.6%	
continued					
LOS (days)	Mean (SD)		Mean (SD)		<.001
	2.71 (5.18)		1.82 (4.74)		
Follow-up period (weeks)	Mean (SD)		Mean (SD)		0.831
	277.6 (146.2)		276.4 (145.8)		

GAF, Global Assessment of Functioning, ICD-10, International Classification of Disease 10th, LOS, Length of Stay, SD, Standard Deviation
[a] Propensity score based 1:3 matching by sex, age group, and follow-up period (week)
[b] Total visits less than 4 times during follow-up period were excluded
[c] Results from Fisher exact test
[d] Substance use disorder: F1-, Schizophrenia disorder: F2-, Bipolar disorder: F31, Depressive disorders: F32, F33, Other mental disorders: F30, F34, F38, F39, F4-, F5-, F6-, F9-

- The matched cohort included 3,896 individuals comprising 974 suicide completion cases and 2,922 living controls.
- Participants' average follow-up periods were not significantly different (cases: 277·6 weeks, SD = 146·2, controls: 276·4 weeks, SD = 145·8, p = 0·831) (Table 1).

Table 2. Risk of suicide completion of continuity of care and area deprivation level in a population-based case-control study [a], South Korea, 2002-2013.

Variables	Suicide mortality					
	Univariable model			Multivariable model		
	HR	95% CI		AHR	95% CI	
Bice-Boxerman Continuity of Care Index [b]						
Poor (<0.4)	2.75	(2.17	- 3.47)	3.38	(2.58	- 4.43)
Medium (0.4-0.75)	1.76	(1.42	- 2.18)	1.93	(1.53	- 2.44)
Good (≥0.75)	1.00			1.00		
Area deprivation level						
Highest (91-100%: 3.52<z score)	1.30	(0.89	- 1.90)	1.29	(0.83	- 1.98)
Middle (11-90%: -7.96<z score≤3.52)	1.12	(0.82	- 1.55)	1.14	(0.80	- 1.64)
Lowest (0-10%: z score≤-7.96)	1.00			1.00		
Income						
Quintile 1 (lowest)	1.24	(0.95	- 1.62)	1.32	(0.96	- 1.80)
Quintile 2	1.23	(0.93	- 1.63)	1.24	(0.91	- 1.70)
Quintile 3	1.15	(0.88	- 1.50)	1.07	(0.80	- 1.45)
Quintile 4	1.27	(0.99	- 1.64)	1.21	(0.92	- 1.60)
Quintile 5 (highest)	1.00			1.00		
Health insurance coverage						
Medical aid	0.40	(0.22	- 0.73)	0.19	(0.09	- 0.38)
National health insurance	1.00			1.00		
Severity of psychiatric illness (GAF)						
Severe	1.41	(0.91	- 2.17)	1.40	(0.87	- 2.28)
Moderate	1.40	(0.80	- 2.45)	1.94	(1.01	- 3.73)
None	1.00			1.00		
Initial diagnosis (ICD-10 codes) [c]						
Substance use disorder	2.69	(1.80	- 4.04)	1.87	(1.18	- 2.95)
Schizophrenia disorder	2.38	(1.57	- 3.62)	2.23	(1.40	- 3.57)
Bipolar disorder	1.00	(0.51	- 1.96)	1.07	(0.51	- 2.22)
Depressive disorders	0.95	(0.76	- 1.19)	0.99	(0.78	- 1.28)
Other mental disorders	1.00			1.00		
Charlson Comorbidity Index						
≥2	2.80	(2.16	- 3.63)	3.50	(2.64	- 4.64)
1	1.13	(0.83	- 1.54)	1.29	(0.93	- 1.80)
0	1.00			1.00		
Use of Antidepressant						
Yes	1.00			1.00		
No	1.10	(0.92	- 1.32)	1.31	(1.06	- 1.63)
Use of Antipsychotics						
Yes	1.00			1.00		
No	0.86	(0.71	- 1.04)	0.86	(0.68	- 1.08)
Use of Anxiolytics&Hypnotics						
Yes	1.00			1.00		
No	0.94	(0.78	- 1.14)	1.07	(0.85	- 1.34)
Use of Mood stabilizer						
Yes	1.00			1.00		
No	0.92	(0.72	- 1.16)	0.95	(0.72	- 1.25)
LOS (days)	1.04	(1.02	- 1.06)	1.02	(1.00	- 1.04)

HR, Hazard Ratio, AHR, Adjusted Hazard Ratio, CI, Confidence Interval, GAF, Global Assessment of Functioning, ICD-10, International Classification of Disease 10th, LOS, Length of Stay
[a] Propensity score matching by gender, age, and follow-up period
[b] Total visits less than 4 times during follow-up period were excluded
[c] Substance use disorder: F1-, Schizophrenia disorder: F2-, Bipolar disorder: F31, Depressive disorders: F32, F33, Other mental disorders: F30, F34, F38, F39, F4-, F5-, F6-, F9-

- The results of the univariable and multivariable conditional logistic regression analyses consistently showed that poor COC was associated with increased suicide mortality risk (poor adjusted HR [AHR]: 2·75, 95%, CI: 2·17–3·47; medium AHR: 1·76, 95%, CI: 1·42-2·18) (Table 2).
- However, higher AD did not show an association with increased suicide mortality risk (highest AHR: 1·29, 95%, CI: 0·83–1·98; middle AHR: 1·14, 95%, CI: 0·80–1·64).

RESULTS

Table 3. Risk of suicide completion by interaction between continuity of care and area deprivation

Interaction	Study participants, No (%)				Suicide mortality			
					Unadjusted		Adjusted [a]	
	Case (N = 974)		Control (N = 2,922)		HR	95% CI	AHR	95% CI
Continuity of Care [b]: Good	321	100.0%	1441	100.0%				
Area deprivation level								
Lowest	43	13.4%	134	9.3%	1.00 [Reference]		1.00 [Reference]	
Middle	250	77.9%	118	8.2%	0.99	(0.59 - 1.63)	0.81	(0.47 - 1.41)
Highest	28	8.7%	189	13.1%	1.04	(0.56 - 1.95)	0.83	(0.42 - 1.65)
Continuity of Care [b]: Medium	347	100.0%	938	100.0%				
Area deprivation level								
Lowest	60	17.3%	100	10.7%	1.55	(0.73 - 3.28)	1.33	(0.59 - 3.00)
Middle	262	75.5%	709	75.6%	1.69	(1.01 - 2.83)	1.44	(0.82 - 2.51)
Highest	25	7.2%	129	13.8%	2.13	(1.15 - 3.93)	2.06	(1.05 - 4.04)
Continuity of Care [b]: Poor	306	100.0%	543	100.0%				
Area deprivation level								
Lowest	56	18.3%	59	10.9%	2.00	(0.94 - 4.25)	1.32	(0.57 - 3.10)
Middle	228	74.5%	395	72.7%	2.84	(1.68 - 4.81)	2.81	(1.57 - 5.03)
Highest	22	7.2%	89	16.4%	2.70	(1.44 - 5.06)	2.88	(1.45 - 5.74)

HR, Hazard Ratio, AHR, Adjusted Hazard Ratio, CI, Confidence Interval
[a] Adjusted for income, health insurance coverage, severity of psychiatric illness, initial diagnosis, charlson comorbidity index, use of antidepressant, use of antipsychotics, use of anxiolytics & hypnotics, use of mood stabilizer, length of stay
[b] Total visits less than 4 times during follow-up period were excluded

- COC and AD were interactively associated with suicide mortality.
- Compared with the lowest suicide risk group ('good COC x lowest AD'), poor COC with higher AD showed increased suicide completion risk ('poor COC x highest AD' AHR: 2·88, 95%, CI: 1·45–5·74; 'poor COC x middle AD' AHR: 2·81, 95%, CI: 1·57–5·03; 'medium COC x highest AD' AHR: 2·06, 95%, CI: 1·05–4·04) (Table 3)

Table 4. Risk of suicide completion stratified by gender, age with continuity of care

Subgroups	Bice-Boxerman Continuity of Care Index [a]				
	Poor (<0.4)		Medium (0.4-0.75)		Good (≥0.75)
	AHR	95% CI	AHR	95% CI	AHR
Gender					
Male	3.30	(2.29 - 4.76)	2.21	(1.61 - 3.02)	1.00 [Reference]
Female	3.56	(2.33 - 5.43)	1.71	(1.18 - 2.48)	1.00 [Reference]
Age					
20-34	4.22	(1.75 - 10.20)	2.56	(1.16 - 5.67)	1.00 [Reference]
35-49	6.31	(3.45 - 11.55)	2.52	(1.51 - 4.21)	1.00 [Reference]
50-64	2.87	(1.77 - 4.64)	1.59	(1.05 - 2.43)	1.00 [Reference]
65≤	2.55	(1.53 - 4.27)	1.74	(1.11 - 2.74)	1.00 [Reference]

HR, Hazard Ratio, AHR, Adjusted Hazard Ratio, CI, Confidence Interval
Adjusted for area deprivation level, income, health insurance coverage, severity of psychiatric illness, initial diagnosis, charlson comorbidity index, use of antidepressant, use of antipsychotics, use of anxiolytics & hypnotics, use of mood stabilizer, length of stay
[a] Total visits less than 4 times during follow-up period were excluded

- The effect of poor COC on suicide completion risk showed that younger psychiatric patients may be at greater risk. This tendency got weaker as participants' age increased (Table 4).
- There was no difference in suicide completion due to poor COC based on gender.

Table 5. Risk of suicidal death stratified by gender, age with area deprivation level

Subgroups	Area deprivation level [a]				
	Highest		Middle		Lowest
	AHR	95% CI	AHR	95% CI	AHR
Gender					
Male	1.34	(0.75 - 2.42)	1.19	(0.71 - 1.97)	1.00 [Reference]
Female	1.30	(0.65 - 2.57)	1.10	(0.64 - 1.87)	1.00 [Reference]
Age					
20-34	0.42	(0.10 - 1.71)	0.43	(0.16 - 1.22)	1.00 [Reference]
35-49	1.53	(0.58 - 4.08)	1.62	(0.81 - 3.23)	1.00 [Reference]
50-64	1.99	(0.88 - 4.48)	1.23	(0.60 - 2.52)	1.00 [Reference]
65≤	1.03	(0.43 - 2.46)	1.17	(0.53 - 2.59)	1.00 [Reference]

HR, Hazard Ratio, AHR, Adjusted Hazard Ratio, CI, Confidence Interval
Adjusted for Bice-Boxerman continuity of care index level, income, health insurance coverage, severity of psychiatric illness, initial diagnosis, charlson comorbidity index, use of antidepressant, use of antipsychotics, use of anxiolytics & hypnotics, use of mood stabilizer, length of stay
[a] Highest (91-100%): 3.52<z score, Middle (11-90%): -7.96<z score≤3.52, Lowest (0-10%): z score≤-7.96

- Additionally, 50–64 aged patients residing in area with higher deprivation showed a higher suicide risk (highest AHR: 1·99, 95%, CI: 0·88–4·48) (Table 5).

DISCUSSION

- To contribute to the effectiveness of suicide prevention strategies for high-risk groups and the rationale for elevating community capacity to prevent and to respond to suicide, this study evaluated the relationship between COC and AD and suicide mortality using a population based nested case-control study.
- As hypothesized, this study revealed an increased risk of suicide completion due to poor COC and residing in a more deprived area, assuming the associations are causal.
- Furthermore, the combined effect of COC and AD on suicide mortality was determined.
- Psychiatric patients with poor COC who also reside in a more deprived area were at increased risk of suicide completion.
- Evidence of effect modifications considering gender and age were also uncovered, where younger patients were at increased risk due to poor COC and males were at increased risk due to higher AD level.
- Furthermore, a higher Bice-Boxerman COC index score means that a patient received psychiatric treatment from fewer providers. This implies that the patient-provider interpersonal relationship may be stronger.

CONCLUSION

- The results confirm that poor COC in psychiatric patients could increase the risk of suicide completion.
- Moreover, considering patients with poor COC as well as increased AD, the risk increases even more.
- These findings offer policy makers important insights concerning ways to reduce suicide mortality by suggesting that strong patient-provider relationships with good COC may lower suicide risk in psychiatric patients.
- Moreover, improving community capacity to prevent and respond to suicide should be addressed.
- This will enable health policy makers to build better strategies for lowering the suicide rate in South Korea. Based on these suggestions, the current government action plan for preventing suicide may need to include more elaborate and multifaceted strategies.