

# Association between personality traits and suicidality by age groups in a nationally representative Korean sample

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## Abstract

Suicide is a leading health issue, which substantially contributes to the causes of death worldwide. Personality traits are some of the major risk factors for suicidality. We sought to identify the relationships between personality traits and suicidality by age group.

The Big-Five Inventory-10 traits were measured in community-dwelling individuals in a nationally representative sample in the Republic of Korea. Because personality traits are long-standing patterns throughout one's lifetime, suicidality was measured based on lifetime history, rather than in a recent period. To comprehensively examine independent influences of personality traits on suicidality, psychiatric comorbidity and sociodemographic data were adjusted for.

A total of 6022 subjects (3714 females and 2308 males) were included. Agreeableness (odds ratio (OR) [95% confidential intervals (CI)] = 0.79 [0.64–0.98]) was negatively associated with suicidal ideation, whereas neuroticism (1.27 [1.05–1.54]) and openness (1.36 [1.11–1.67]) were positively associated with suicidal ideation among young adults. Openness (1.25 [1.10–1.43]) had a positive association, and conscientiousness (0.86 [0.75–0.98]) had a negative association with suicidal ideation among the middle-aged group. Neuroticism is the only influencing factor for suicidal attempts among the young adult (1.88 [1.24–2.86]) and older (1.65 [1.24–2.20]) groups.

Given the differential associations between personality traits and suicidality by age groups, future studies are needed to comprehensively identify possible roles of personality in suicide by age.

**Abbreviations:** BFI-10 = Big-Five Inventory-10, CI = confidence intervals, DSM-IV = Diagnostic and Statistical Manual of Mental Disorders, 4<sup>th</sup> Edition, OR = odds ratio.

**Keywords:** neuroticism, openness, personality, risk factors, suicide

## 1. Introduction

Suicide is a leading health problem, which substantially contribute to the causes of death worldwide. It is estimated that suicide will contribute 2% or more to the global burden of disease

by 2020.<sup>[1]</sup> In 2017, the suicide rate in the Republic of Korea was 25.6 per 100,000, which is the highest among the Organization for Economic Co-operation and Development countries in the past 10 years.<sup>[2,3]</sup> Given the substantial socioeconomic and public health burden of suicide,<sup>[4]</sup> identifying and modifying contributing factors and protective factors for suicide is crucial for prevention strategies.

There are various contributing and protective factors for suicide,<sup>[5,6]</sup> and personality traits are some of the critical variables. A lot of studies have investigated personality trait associations with suicide.<sup>[7,8]</sup>

Although personality plays an important role in the suicide and suicide-related behavioral problems such as suicide attempt,<sup>[8]</sup> however, previous studies have several limitations. First, many studies have investigated associations between personality traits and suicidal risk within a specific subgroup, such as depressed patients,<sup>[9]</sup> or a specific age group.<sup>[10,11]</sup> Recently, the Ministry of Health and Welfare of Korea reported that suicidal risk factors, means of suicide, psychiatric symptoms associated with suicide, and communicating patterns of suicidal ideation differ by age group.<sup>[12]</sup> Secondly, few studies have adjusted for possible effects of comorbid psychiatric disorders on suicidality. Because anxiety disorders,<sup>[13]</sup> nicotine dependence,<sup>[14]</sup> and alcohol use disorder<sup>[15]</sup> are all associated with suicidal risk, lifetime history of psychiatric conditions should be adjusted for in the analysis.

Among various theories of personality, the big five-factor personality model, which was suggested by McCrae and Costa,<sup>[16]</sup> has been widely investigated in numerous areas in

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the field of psychiatry, including suicide.<sup>[17,18]</sup> The five-factor model conceptualizes personality as a hierarchical organization that consists of extraversion, agreeableness, conscientiousness, neuroticism, and openness. The validity of the five-factor personality model was also cross-culturally confirmed, suggesting that the results could be widely applied and generalized.<sup>[19]</sup> A recent study reported that five-factor-based personality has an important role in the development of suicidality.<sup>[20]</sup> Another recent study reported that higher neuroticism with lower extraversion raised suicide risk among Taiwanese soldiers.<sup>[21]</sup>

The pattern of personality traits differs by age, and the associations between personality traits and suicidality would be characteristic of specific age groups.

This study mainly aims at answering the question that whether age groups has any different personality traits between individuals with and without suicidal attempts in the community-dwelling population.

## 2. Materials and methods

### 2.1. Subjects and procedures

We used data from the Korean Epidemiologic Catchment Area Study, which was conducted between March 25 2011 and December 23 2011.<sup>[22]</sup> The Korean Epidemiologic Catchment Area Study was based on a stratified multistage area probability sample of the non-institutionalized Korean population 18 to 74 years old. Based on the administrative divisions of Korea, six primary sampling units were selected. Subsequently, twelve secondary sampling units were selected from within a primary sampling unit. Then, three to five tertiary sampling units were extracted. Census units were randomly assigned within the tertiary sampling units by probability proportional to the population size. Every household in each sampling unit was regarded as a target of this survey. Finally, 6022 individuals participated from a total of 246 sampling units.

All subjects received comprehensive explanation about the purpose and methods of the study, and gave informed consent prior to participation. The Institutional Review Board of the Seoul National University College of Medicine approved this study.

A total of 78 interviewers were employed for this study. The training of the interviewers was conducted according to the World Health Organization guidelines.<sup>[23]</sup> All interviewers received a 5-day, 8-hour per day training program. The training mainly consisted of mock interviews and live interviews by role-playing, which aimed to improve interview skills. During the training, inter-rater reliability was checked and all interviewers received feedback from each other.

## 3. Assessments

### 3.1. Personality traits

Personality traits were assessed with the Big-Five Inventory-10 (BFI-10).<sup>[24]</sup> Since, McCrae and Costa (1987) developed a 240-item questionnaire for five-factor model personality traits,<sup>[16]</sup> subsequent researchers have developed shorter versions based on the model.<sup>[25]</sup> The Big-Five-based approach for personality is widely used in various social scientific field, such as criminology,<sup>[26]</sup> work-related stress such as burn-out syndrome,<sup>[27]</sup> and empathy.<sup>[28]</sup>

The BFI-10 is an abbreviated version of the 44-item version of the Big-Five Inventory (BFI-44)<sup>[25]</sup>; The BFI-10 is scored on a five-point scale ranging from 1 (disagree strongly) to 5 (agree

strongly), with a higher score indicating a higher level of each personality factor. The BFI-10 measures five personality dimensions, including extraversion, agreeableness, conscientiousness, neuroticism, and openness. Extraversion includes seeking interaction with other people, being energetic and active, and joyfulness. The questionnaires start with following instructions: “How well do the following statements describe your personality?” All answers start with “I see myself as someone who . . .” Questions for extraversion are “. . . is reserved” and “. . . is outgoing, sociable.” The former question is reverse-scored. Agreeableness consists of comfortable and harmonious interpersonal relationships. Questions for agreeableness are “. . . is generally trusting” and “tends to find fault with others.” The latter is reverse-scored. Conscientiousness consists of self-discipline and following social rules. Questions for conscientiousness are “. . . tends to be lazy” and “does a thorough job.” The former is reverse-scored. Neuroticism consists of emotional distress, dysphoria, and uncontrolled feelings. Questions for neuroticism are “. . . is relaxed, handles stress well” and “gets nervous easily.” The former is reverse-scored. Lastly, openness consists of seeking novel stimuli, intellectual exploration, and being imaginative. Questions for openness are “. . . has few artistic interests” and “has an active imagination.” The former is reverse-scored.

The reliability and validity of the BFI-10 are found to be good.<sup>[24]</sup> Due to the balanced number of questionnaires and variety of measuring factors, the BFI-10 has been still used widely at the moment.<sup>[29–32]</sup>

### 3.2. Comorbid psychiatric disorders

The lifetime history of psychiatric disorders was assessed with the Korean version of the Composite International Diagnostic Interview.<sup>[23,33]</sup> The Korean version of the Composite International Diagnostic Interview is a structured diagnostic interview designed to diagnose psychiatric disorders according to the Diagnostic and Statistical Manual of Mental Disorders, 4<sup>th</sup> Edition (DSM-IV)<sup>[34]</sup>; The Korean version of the Composite International Diagnostic Interview, which showed modest concordance with the Structured Clinical Interview for the DSM-IV,<sup>[33]</sup> has been used for a previous Korean Epidemiologic Catchment Area study.<sup>[35]</sup>

### 3.3. Suicidality

Because personality traits are long-standing patterns throughout one’s lifetime, suicidality was measured based on lifetime history, rather than in a recent period. Respondents’ lifetime histories of suicidal ideation and suicide attempts were assessed with a modified Suicide Prevention Multisite Intervention Study on Suicidal Behaviors (SUPRE-MISS)<sup>[36]</sup>; questionnaire. Among the items, suicidal ideation and attempts were measured. The suicidal ideation question was “Have you ever seriously thought about committing suicide?” Suicidal attempt was measured by the following question: “Have you ever attempted suicide?” We further used the following questions to differentiate suicidal attempts from suicidal gestures or self-harming behaviors: (a) I made a serious attempt to kill myself, and it was only by luck that I failed. (b) I tried to kill myself, but I knew the method was not foolproof. (c) My attempt was a cry for help. I did not want to die. According to previous studies,<sup>[37,38]</sup> we defined only (a) and (b) as a suicide attempt.

### 3.4. Statistical analysis

Sociodemographic variables, personality traits, and suicidality were compared across three age groups: young adults (18–34), middle-aged (35–54), and older (55–74). Dichotomous variables were analyzed with chi square analysis whereas continuous variables were compared using analyses of variance. Bonferroni correction was applied to the *post-hoc* analysis of the analyses of variance. Multivariate logistic regression analyses were used to examine the associations between personality traits and lifetime suicidality. Education ( $\leq 12$  years vs  $> 12$  years), cohabitation (living alone vs living together), employment (unemployed vs employed), a history of diagnosis of mood disorders, anxiety disorders, nicotine use disorders, and alcohol use disorders were included as covariates. Adjusted odds ratios (OR) and 95% confidence intervals (CI) were calculated based on these multiple logistic regression models in each group. Because the objective of this study was to investigate risk factors for suicidality, we used unweighted data for the statistical analysis. All statistical analyses were performed using SPSS software, version 16.0 (SPSS Inc., Chicago, IL).

## 4. Results

### 4.1. Sociodemographic variables, personality traits, and suicidality data

Sociodemographic data of the three groups are presented in Table 1.

Among the total sample, the mean (SD) age is 47.88 (15.38) years. The number of females was 3714 (61.7%). The female ratio of the young adult group was 778 (57.7), which is lower than middle aged and old-aged groups. The education level showed increasing tendency as the age groups goes older. The proportion of living alone was the lowest in the middle-aged group than younger and older groups.

The number of psychiatric conditions was 351 (5.8%) for nicotine use disorders, 647 (10.7%) for alcohol use disorders, 481 (8.0%) for mood disorders, and 549 (9.1%) for anxiety disorders among the total sample.

Mean (SD) scores on each of the personality trait were 3.07 (1.04) for extraversion, 3.39 (0.83) for agreeableness, 3.60 (0.98) for conscientiousness, 2.78 (0.92) for neuroticism, and 3.25 (0.89) for openness. There were significant differences in the five personality traits among the three age groups. In the *post-hoc* analysis, the young adult group had significantly higher scores on extraversion than did the middle-aged ( $P < .0001$ ) and older ( $P < .0001$ ) groups, respectively. There were no significant differences between the middle-aged and older groups ( $P = .111$ ). For agreeableness and conscientiousness, young adults had significantly lower scores than did the middle-aged group ( $P < .0001$ ) and the older group ( $P < .0001$ ), and the middle-aged group had significantly lower scores than did the older group ( $P < .0001$ ). For neuroticism, the young adult group had significantly higher scores than did the middle-aged ( $P = .041$ ) and older ( $P = .017$ ) groups, and there were no significant differences between the young adults and the older groups or between the middle-aged and older groups ( $P = 1.000$ ). For openness, young adults had significantly higher scores than did the middle-aged group ( $P < .0001$ ) and older group ( $P < .0001$ ), and the middle-aged group had significantly higher scores than did the older group ( $P < .0001$ ).

The mean frequency (%) of lifetime suicidal ideation and suicidal attempts is 937 (15.6%) and 156 (2.6%), respectively. There were no significant differences in suicidal ideation or suicidal attempts between the three groups.

### 4.2. Associations between personality traits and lifetime suicidal ideation by age group

Associations between personality traits and lifetime suicidal ideation adjusted for sociodemographic variables and major psychiatric disorders are presented in Table 2.

Extraversion and agreeableness were negatively associated with suicidal ideation, whereas neuroticism and openness were positively associated with suicidal ideation among young adults. Openness and neuroticism had positive associations with suicidal ideation in the middle-aged group and the older age group, respectively.

**Table 1**

**Sociodemographic variables, personality traits, and suicidality among three age groups.**

	18–34 (n=1349)	35–54 (n=2479)	54–74 (n=2194)	P value	$\chi^2$ or F
Gender, Female	778 (57.7)	1567 (63.2)	1369 (62.4)	.002	12.102
Education, $\leq 12$ years	397 (29.4)	1513 (61.0)	1951 (88.9)	<.0001	1302.60
Living alone	821 (61.5)	452 (18.3)	720 (33.1)	<.0001	728.08
Unemployed	561 (41.6)	340 (13.8)	793 (36.2)	<.0001	442.71
Personality trait					
Extraversion	3.18 (1.01)	3.03 (1.02)	2.97 (1.07)	<.0001	17.98
Agreeableness	3.26 (0.78)	3.41 (0.83)	3.60 (0.85)	<.0001	74.32
Conscientiousness	3.28 (0.86)	3.67 (0.85)	3.90 (0.85)	<.0001	216.35
Neuroticism	2.85 (0.90)	2.77 (0.92)	2.76 (0.96)	.014	4.257
Openness	3.41 (0.87)	3.23 (0.89)	3.09 (0.87)	<.0001	57.53
Suicidality					
Ideation	213 (15.9)	417 (16.9)	321 (14.7)	.128	4.108
Attempts	55 (4.1)	74 (3.0)	72 (3.3)	.198	3.236
Psychiatric disorders					
Nicotine use disorders	84 (6.2)	155 (6.3)	112 (5.1)	.193	3.295
Alcohol use disorders	205 (15.2)	294 (11.9)	148 (6.7)	<.0001	67.697
Mood disorders	103 (7.6)	196 (7.9)	182 (8.3)	.551	0.759
Anxiety disorders	146 (10.8)	211 (8.5)	192 (8.8)	.047	6.134

All data are presented as frequency (%) or mean (SD).

**Table 2**  
**Multivariate logistic regression analysis of personality traits for lifetime suicidal ideation by age groups.**

	18–34 (n = 1349)			35–54 (n = 2479)			54–74 (n = 2194)					
	OR	(95% CI)	P	OR	(95% CI)	P	OR	(95% CI)	P			
Extraversion	0.85	0.72	1.01	.06	0.90	0.80	1.00	.06	0.93	0.82	1.05	.25
Agreeableness	0.79	0.64	0.98	.03	0.97	0.84	1.12	.69	0.99	0.84	1.16	.87
Conscientiousness	0.99	0.81	1.20	.89	0.86	0.75	0.98	.03	1.11	0.94	1.31	.20
Neuroticism	1.27	1.05	1.54	.01	1.12	0.98	1.27	.09	1.35	1.16	1.56	.00
Openness	1.36	1.11	1.67	.00	1.25	1.10	1.43	.00	1.07	0.91	1.25	.42
Gender, male	0.57	0.39	0.84	.00	0.69	0.52	0.91	.01	1.01	0.72	1.43	.94
Education, >12 years	0.57	0.40	0.80	.00	0.70	0.54	0.89	.00	1.23	0.80	1.91	.35
Living together	1.15	0.80	1.67	.44	0.58	0.44	0.76	.00	0.62	0.47	0.83	.00
Unemployment	1.23	0.86	1.77	.26	1.22	0.87	1.72	.25	0.70	0.52	0.93	.01
Nicotine use disorders	2.58	1.44	4.63	.00	1.36	0.86	2.16	.19	1.80	1.06	3.06	.03
Alcohol use disorders	2.03	1.33	3.10	.00	2.39	1.70	3.35	.00	1.93	1.19	3.14	.01
Mood disorders	7.74	4.71	12.72	.00	4.12	2.93	5.80	.00	8.33	5.72	12.12	.00
Anxiety disorders	1.27	0.78	2.06	.33	3.00	2.14	4.21	.00	2.24	1.50	3.34	.00

Reference values: female, education ≤12 years, living alone, employed, and not ever diagnosed for nicotine use disorders, alcohol use disorders, mood disorders, and anxiety disorders. CI = confidence intervals, OR = odds ratio.

### 4.3. Associations between personality traits and lifetime suicidal attempts by age group

Associations between personality traits and lifetime suicidal attempts adjusted for sociodemographic variables and major psychiatric disorders are presented in Table 3.

Among the personality traits, neuroticism significantly increased the OR for suicidal attempts in young adults and the older age groups, whereas openness was positively associated with suicidal attempts among the middle-aged group. Lifetime history of mood disorder commonly had a positive association with suicidal attempts across the three age groups.

Among psychiatric comorbidities, nicotine use disorders were only associated with suicidal attempts among the young adults group, whereas living alone and unemployed status only had negative associations with suicidal attempts in the older age group. Lifetime history of alcohol use disorder and mood disorder were commonly associated with suicidal attempts in all three age groups.

### 5. Discussion

In this study, we aimed to investigate different patterns of associations between personality traits and suicide by age groups in a nationally representative sample. There are several interesting findings in our results regarding the associations between personality and suicidality in each group.

For suicidal ideation, personality traits were closely associated with suicidal ideation among the young adults group. Among that group, low agreeableness, high neuroticism, and high openness were associated with increased suicidal ideation. However, among the middle-aged group, low conscientiousness and high openness were associated with suicidal ideation. Among the older age group, only high neuroticism was associated with suicidal ideation. These results suggest that the impact of personality on suicidal ideation is the strongest among young adults, then decreases with age.

Traditionally, individuals with high neuroticism and low extraversion has been considered to attempt and/or commit suicide,<sup>[7,39,40]</sup> whereas those with high openness have been

**Table 3**  
**Multivariate logistic regression analysis of personality traits for lifetime suicidal attempts by age groups.**

	18–34 (n = 1349)			35–54 (n = 2479)			54–74 (n = 2194)					
	OR	(95% CI)	P	OR	(95% CI)	P	OR	(95% CI)	P			
Extraversion	0.90	0.63	1.29	.56	1.05	0.80	1.39	.71	0.92	0.72	1.18	.52
Agreeableness	0.99	0.62	1.58	.97	1.12	0.80	1.56	.52	0.80	0.59	1.09	.16
Conscientiousness	1.19	0.79	1.78	.40	0.81	0.58	1.12	.20	1.36	0.99	1.88	.06
Neuroticism	1.88	1.24	2.86	.00	1.14	0.85	1.55	.38	1.65	1.24	2.20	.00
Openness	1.05	0.68	1.60	.83	1.63	1.17	2.27	.00	0.90	0.66	1.21	.48
Gender, male	0.42	0.17	1.03	.06	0.48	0.23	1.01	.05	1.72	0.86	3.44	.13
Education, >12 years	0.31	0.15	0.65	.00	0.75	0.41	1.39	.36	0.91	0.34	2.41	.85
Living together	0.80	0.37	1.73	.57	0.64	0.34	1.20	.17	0.41	0.23	0.73	.00
Unemployment	2.05	0.92	4.55	.08	1.00	0.46	2.15	1.00	1.03	0.58	1.85	.91
Nicotine use disorders	4.13	1.58	10.78	.00	0.47	0.15	1.50	.20	0.42	0.14	1.29	.13
Alcohol use disorders	1.99	0.86	4.60	.11	6.88	3.49	13.55	.00	2.67	1.21	5.91	.02
Mood disorders	8.46	3.76	19.02	.00	7.13	3.78	13.47	.00	2.93	1.49	5.78	.00
Anxiety disorders	1.15	0.46	2.87	.76	2.78	1.43	5.40	.00	3.27	1.64	6.49	.00

Reference values: female, education ≤12 years, living alone, employed, and not ever diagnosed for nicotine use disorders, alcohol use disorders, mood disorders, and anxiety disorders. CI = confidence intervals, OR = odds ratio.

reported to be low-risk for suicide.<sup>[20]</sup> It is unusual to assume one with high neuroticism and low extraversion might have socially withdrawn, depressed, and pessimistic tendency. Despite neuroticism itself can be associated with suicide risk, authors suggested to consider neuroticism not as a single risk factor but contributing factors which raise suicidal risk when combined with other risk factors.<sup>[39]</sup> A recent study also supported the complicated role of neuroticism for suicide.<sup>[41]</sup> However, in another recent study, neuroticism was confirmed again as an independent risk factor for suicide regardless of having mood disorders such as bipolar disorder and depressive disorder.<sup>[42]</sup>

Interestingly, high neuroticism was associated with suicidal attempts in young adults and the older groups, whereas high openness had an association with suicidal attempts among the middle-aged population in our study. On the other hand, the combination of high neuroticism and high openness as shown in the young adults has been consistently reported concerning suicidality and self-injurious behaviors.<sup>[9,43,44]</sup> High neuroticism represents anxious, dysphoric, and depressed traits, and it has been consistently reported to be associated with depression and suicide.<sup>[7,45]</sup> In addition, a recent study revealed that high neuroticism can contribute to suicide by affecting on the help-seeking behavior.<sup>[46]</sup> Higher openness in suicidal subjects than in controls is a commonly reported finding.<sup>[9,43,44]</sup> In some cases, subjects with high openness may have a curiosity about novel ideas and intellectual stimuli. However, in some cases, high openness might be associated with thinking that is too odd, which often leads to schizotypal content or fantasies.<sup>[47]</sup> another study has suggested that high openness might be associated with obsessive-compulsive disorder, which suggests that high openness would reflect an association with fantasy.<sup>[48]</sup> A recent systematic review have reported those differences in the personality traits by age groups, particularly focusing on the old age.<sup>[49]</sup>

Low conscientiousness was associated with suicidal ideation among the young adults group. Because conscientiousness represents self-discipline and active coping skills for stressful situations, appropriate conscientiousness leads to adaption to social rules and personal responsibility. Because individuals with low conscientiousness would be incompetent to cope with stressful event, low conscientiousness could also be associated with suicide. Several previous studies have reported that low conscientiousness was associated with suicide.<sup>[50]</sup> However, maladaptively high conscientiousness could be associated with self-oriented perfectionism,<sup>[51]</sup> which in turn could lead to setting excessively high goals and striving to achieve them.<sup>[52]</sup> Many studies have suggested that perfectionism is closely associated with suicide.<sup>[53]</sup> It is also noteworthy that conscientiousness had a positive association with suicidal attempts in the older age group, although it was not statistically significant ( $P=.06$ ). We speculate that there would be specific groups or situations in which conscientiousness is positively or inversely associated with suicidality.

In terms of psychiatric comorbidities, alcohol use disorders, mood disorders, and anxiety disorders were associated with suicide ideation and attempts in nearly all age groups. Interestingly, nicotine use disorders had a significant association with suicidal attempts among the young adults group. Our results are in agreement that smoking raises subsequent suicidal risk among young people,<sup>[54]</sup> which emphasizes the importance of not initiating smoking in early adulthood. However, a recent study reported that smoking itself might not be associated suicide idea and attempt.<sup>[55]</sup> The discrepancy of results from ours and that

study may be mainly due to the sample characteristics (community-dwelling general population in our study vs patients with depressive disorder in that study) and size (6022 in ours and 269 in that study).

As for sociodemographic risk factors for suicidality, our results have implications for elderly suicide. As shown in our results, living alone was significantly associated with suicidal attempts only in the older age group. Unemployment was associated with suicidal ideation only in the elderly. Suicide in the elderly is substantial in Korea, as suicide rates increase by age. The prevalence of suicide per 100,000 is 19.25 in one's 20s, 26.94 in one's 30s, 30.41 in one's 40s, 35.52 in one's 50s, 42.45 in one's 60s, and 83.19 in one's 70s.<sup>[3]</sup> This age-specific pattern of suicide is distinguished from those of other countries such as the United States, Japan, and European countries.<sup>[56]</sup> Living alone is a well-known risk factor for depression<sup>[57]</sup> and suicide<sup>[58]</sup> in the elderly. Since Havighurst (1961) proposed the activity theory of aging,<sup>[59]</sup> active social participation and connectedness has been one of the key factors for healthy aging in modern society. We speculate that social withdrawal, such as living alone and being unemployed, would leave the elderly more vulnerable for suicide than other age groups.

Our study has several limitations. First, this study was conducted with a cross-sectional design, which could not examine causal relationships between personality traits, socio-demographic factors, and suicidality. Second, because this study was conducted based on a nationally representative sample with a common questionnaire, age-specific factors were not included. For example, unsupervised time had a significant influence on behavioral problems among elementary school students,<sup>[60]</sup> and familial connectedness and physical health are main factors for mental health and suicidality among the elderly.<sup>[61]</sup> Third, we did not include suicidal completers in our analysis. As our results suggest that there might be differences in personality traits between suicidal ideation and attempts, there may also be differences between suicidal attempters and completers. Regarding those differences, a previous study suggested that suicidal completers have lower neuroticism and higher conscientiousness than do suicidal attempters.<sup>[62]</sup> Fourth, because the BFI-10 consists of 10 items, comprehensive evaluation of personality traits was not possible. Fifth, we did not include several variables reported to be associated with suicide attempt.<sup>[63,64]</sup> Lastly, from a fundamental perspective, identifying risk factors for suicide might reach its limit. A recent meta-analysis and systematic review reported that no categorical domains predicted suicide far above change,<sup>[6]</sup> which means that mechanical combination of individual risk factors could not be applied to the real-world suicide prevention strategy. The authors of that study suggested to shift in focus from risk factors to machine learning-based risk algorithms. Although the machine learning based approach has also its weakness,<sup>[65]</sup> machine learning-based, data-driven approach is worth consideration in practically conducting suicide prevention strategy.

## 6. Conclusion

In conclusion, our results further extended previous notions that personality traits are associated with suicidality. We first revealed age group-stratified associations between personality traits and suicidality. Future studies with longitudinal designs are needed to identify the underlying mechanisms by which personality traits influence suicidality by age groups.

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## References

- [1] Bertolote JM, Fleischmann A, Wasserman D, Wasserman C. A global perspective on the magnitude of suicide mortality. *Oxford Textbook of Suicidology and Suicide Prevention: A Global Perspective* Oxford: Oxford University Press; 2009;91–8.
- [2] Organisation for Economic Co-operation and Development. OECD. StatExtracts. 2013. Available at: [http://stats.oecd.org/index.aspx?DataSetCode=HEALTH\\_STAT](http://stats.oecd.org/index.aspx?DataSetCode=HEALTH_STAT).
- [3] Statistics Korea . 2016 Death and Cause of Death in Korea. Daejeon, Korea: Statistics Korea; 2017.
- [4] Claassen CA, Pearson JL, Khodyakov D, et al. Reducing the Burden of Suicide in the U.S.: The Aspirational Research Goals of the National Action Alliance for Suicide Prevention Research Prioritization Task Force. *Am J Prev Med* 2014;47:309–14.
- [5] Hawton K, Casanas ICC, Haw C, et al. Risk factors for suicide in individuals with depression: a systematic review. *J Affect Disord* 2013;147:17–28.
- [6] Franklin JC, Ribeiro JD, Fox KR, et al. Risk factors for suicidal thoughts and behaviors: a meta-analysis of 50 years of research. *Psychol Bull* 2017;143:187–232.
- [7] Brezo J, Paris J, Turecki G. Personality traits as correlates of suicidal ideation, suicide attempts, and suicide completions: a systematic review. *Acta Psychiatr Scand* 2006;113:180–206.
- [8] Giner L, Blasco-Fontecilla H, De La Vega D, et al. Cognitive, emotional, temperament, and personality trait correlates of suicidal behavior. *Curr Psychiatry Rep* 2016;18:102.
- [9] Heisel MJ, Duberstein PR, Conner KR, et al. Personality and reports of suicide ideation among depressed adults 50 years of age or older. *J Affect Disord* 2006;90:175–80.
- [10] Svensson T, Inoue M, Charvat H, et al. Coping behaviors and suicide in the middle-aged and older Japanese general population: the Japan Public Health Center-based Prospective Study. *Ann Epidemiol* 2014;24:199–205.
- [11] Na KS, Oh SJ, Jung HY, et al. Alexithymia and low cooperativeness are associated with suicide attempts in male military personnel with adjustment disorder: a case-control study. *Psychiatry Res* 2013;205:220–6.
- [12] Ministry of Health and Welfare . An Investigation of Suicide in 2013. Sejong. 2014.
- [13] Kanwar A, Malik S, Prokop LJ, et al. The association between anxiety disorders and suicidal behaviors: a systematic review and meta-analysis. *Depress Anxiety* 2013;30:917–29.
- [14] Li D, Yang X, Ge Z, et al. Cigarette smoking and risk of completed suicide: a meta-analysis of prospective cohort studies. *J Psychiatr Res* 2012;46:1257–66.
- [15] Wilcox HC, Conner KR, Caine ED. Association of alcohol and drug use disorders and completed suicide: an empirical review of cohort studies. *Drug and alcohol dependence* 2004;76(suppl):S11–9.
- [16] McCrae RR, Costa PT Jr. Validation of the five-factor model of personality across instruments and observers. *J Pers Soc Psychol* 1987;52:81–90.
- [17] Voracek M. Regional analysis of big five personality factors and suicide rates in Russia. *Psychol Rep* 2013;113:1043–7.
- [18] Vanyukov PM, Szanto K, Hallquist M, et al. Perceived burdensomeness is associated with low-lethality suicide attempts, dysfunctional interpersonal style, and younger rather than older age. *Int J Geriatr Psychiatry* 2017;32:788–97.
- [19] Jolijn Hendriks AA, Perugini M, Angleitner A, et al. The five-factor personality inventory: cross-cultural generalizability across 13 countries. *Eur J Pers* 2003;17:347–73.
- [20] Baertschi M, Costanza A, Canuto A, et al. The function of personality in suicidal ideation from the perspective of the interpersonal-psychological theory of suicide. *Int J Environ Res Public Health* 2018;15:
- [21] Huang KC, Tzeng DS, Lin CH, et al. Interpersonal-psychological theory, alexithymia, and personality predict suicide ideation among maladjusted soldiers in Taiwan. *Suicide Life Threat Behav* 2017;47:603–11.
- [22] Seoul National University . The Epidemiological Survey of Mental Disorders in Korea. Seoul: Seoul National University; 2011.
- [23] World Health, Organization . Procedures for the Development of New Language Versions of the WHO Composite International Diagnostic Interview (WHO-CIDI). Geneva, Switzerland: World Health Organization; 1997.
- [24] Rammstedt B, John OP. Measuring personality in one minute or less: a 10-item short version of the Big Five Inventory in English and German. *J Res Pers* 2007;41:203–12.
- [25] John OP, Srivastava S, Pervin LA, John OP. The Big-Five trait Taxonomy: History, Measurement, and Theoretical Perspective. New York: Guilford Press; 1999.
- [26] Furnham A, Crump J. A Big Five facet analysis of a psychopath: the validity of the HDS mischievous scale of sub-clinical psychopathy. *Scand J Psychol* 2016;57:117–21.
- [27] van der Wal RA, Bux MJ, Hendriks JC, et al. Psychological distress, burnout and personality traits in Dutch anaesthesiologists: a survey. *Eur J Anaesthesiol* 2016;33:179–86.
- [28] Costa P, Alves R, Neto I, et al. Associations between medical student empathy and personality: a multi-institutional study. *PLoS One* 2014;9:e89254.
- [29] Kleinstaub M, Weise C, Andersson G, et al. Personality traits predict and moderate the outcome of Internet-based cognitive behavioural therapy for chronic tinnitus. *Int J Audiol* 2018;57:538–44.
- [30] Di Lodovico L, Dubertret C, Ameller A. Vulnerability to exercise addiction, socio-demographic, behavioral and psychological characteristics of runners at risk for eating disorders. *Compr Psychiatry* 2018; 81:48–52.
- [31] Yu Y, Wang Y, Zhang J. Relationship between work-family balance and job satisfaction among employees in China: a moderated mediation model. *Psych J* 2017;6:194–204.
- [32] Sadeq NA, Valdes EG, Harrison Bush AL, et al. The role of personality in a regular cognitive monitoring program. *Alzheimer Dis Assoc Disord* 2018;32:226–31.
- [33] Cho MJ, Hahm B-J, Suh D-W, et al. Development of a Korean Version of the Composite International Diagnostic Interview (K-CIDI). *J Korean Neuropsychiatr Assoc* 2002;41:123–37.
- [34] American Psychiatric Association . Diagnostic and Statistical Manual of Mental Disorders. 4th ed. Washington, DC: American Psychiatric Press; 1994.
- [35] Cho MJ, Kim JK, Jeon HJ, et al. Lifetime and 12-month prevalence of DSM-IV psychiatric disorders among Korean adults. *J Nerv Ment Dis* 2007;195:203–10.
- [36] Bertolote JM, Fleischmann A, De Leo D, et al. Suicide attempts, plans, and ideation in culturally diverse sites: the WHO SUPRE-MISS community survey. *Psychol Med* 2005;35:1457–65.
- [37] Nock MK, Kessler RC. Prevalence of and risk factors for suicide attempts versus suicide gestures: analysis of the National Comorbidity Survey. *J Abnorm Psychol* 2006;115:616–23.
- [38] Borges G, Angst J, Nock MK, et al. Risk factors for the incidence and persistence of suicide-related outcomes: a 10-year follow-up study using the National Comorbidity Surveys. *J Affect Disord* 2008;105:25–33.
- [39] Fang L, Heisel MJ, Duberstein PR, et al. Combined effects of neuroticism and extraversion: findings from a matched case control study of suicide in rural China. *J Nerv Ment Dis* 2012;200:598–602.
- [40] Draper B, Kolves K, De Leo D, et al. A controlled study of suicide in middle-aged and older people: personality traits, age, and psychiatric disorders. *Suicide Life Threat Behav* 2014;44:130–8.
- [41] Rappaport LM, Flint J, Kendler KS. Clarifying the role of neuroticism in suicidal ideation and suicide attempt among women with major depressive disorder. *Psychol Med* 2017;47:2334–44.
- [42] Su MH, Chen HC, Lu ML, et al. Risk profiles of personality traits for suicidality among mood disorder patients and community controls. *Acta Psychiatr Scand* 2018;137:30–8.
- [43] Bluml V, Kapusta ND, Doering S, et al. Personality factors and suicide risk in a representative sample of the German general population. *PLoS One* 2013;8:e76646.
- [44] Brown SA. Personality and non-suicidal deliberate self-harm: trait differences among a non-clinical population. *Psychiatry Res* 2009; 169:28–32.
- [45] Oliffe JL, Hannan-Leith MN, Ogrodniczuk JS, et al. Men's depression and suicide literacy: a nationally representative Canadian survey. *J Ment Health* 2016;25:520–6.
- [46] Drapeau CW, Cerel J, Moore M. How personality, coping styles, and perceived closeness influence help-seeking attitudes in suicide-bereaved adults. *Death Stud* 2016;40:165–71.
- [47] Kwapil TR, Barrantes-Vidal N, Silvia PJ. The dimensional structure of the Wisconsin Schizotypy Scales: factor identification and construct validity. *Schizophr Bull* 2008;34:444–57.
- [48] Samuels J, Nestadt G, Bienvenu OJ, et al. Personality disorders and normal personality dimensions in obsessive-compulsive disorder. *Br J Psychiatry* 2000;177:457–62.
- [49] Szucs A, Szanto K, Aubry JM, et al. Personality and suicidal behavior in old age: a systematic literature review. *Front Psychiatry* 2018;9:128.

- [50] Duberstein PR, Conwell Y, Seidlitz L, et al. Personality traits and suicidal behavior and ideation in depressed inpatients 50 years of age and older. *J Gerontol B* 2000;55:18–26.
- [51] Stoeber J, Otto K, Dalbert C. Perfectionism and the Big Five: conscientiousness predicts longitudinal increases in self-oriented perfectionism. *Pers Individ Differ* 2009;47:363–8.
- [52] Hewitt PL, Flett GL. Perfectionism in the self and social contexts: conceptualization, assessment, and association with psychopathology. *J Pers Soc Psychol* 1991;60:456–70.
- [53] O'Connor RC. The relations between perfectionism and suicidality: a systematic review. *Suicide Life Threat Behav* 2007;37:698–714.
- [54] Breslau N, Schultz LR, Johnson EO, et al. Smoking and the risk of suicidal behavior: a prospective study of a community sample. *Arch Gen Psychiatry* 2005;62:328–34.
- [55] Holma KM, Holma I, Ketokivi M, et al. The relationship between smoking and suicidal behavior in psychiatric patients with major depressive disorder. *Arch Suicide Res* 2018;23:590–604.
- [56] World Health Organization. *Suicide Prevention and Special Programmes*. Geneva, Switzerland: World Health Organization; 2013.
- [57] Fukunaga R, Abe Y, Nakagawa Y, et al. Living alone is associated with depression among the elderly in a rural community in Japan. *Psychogeriatrics* 2012;12:179–85.
- [58] Conwell Y, Duberstein PR, Caine ED. Risk factors for suicide in later life. *Biol Psychiatry* 2002;52:193–204.
- [59] Havighurst RJ. Successful aging. *Gerontologist* 1961;1:8–13.
- [60] Na KS, Lee SI, Hong HJ, et al. The influence of unsupervised time on elementary school children at high risk for inattention and problem behaviors. *Child Abuse Negl* 2014;38:1120–7.
- [61] Purcell B, Heisel MJ, Speice J, et al. Family connectedness moderates the association between living alone and suicide ideation in a clinical sample of adults 50 years and older. *Am J Geriatr Psychiatry* 2012;20:717–23.
- [62] Useda JD, Duberstein PR, Conner KR, et al. Personality differences in attempted suicide versus suicide in adults 50 years of age or older. *J Consult Clin Psychol* 2007;75:126–33.
- [63] Cleary A. Help-seeking patterns and attitudes to treatment amongst men who attempted suicide. *J Ment Health* 2016;26:220–4.
- [64] Jones S, Krishna M, Rajendra RG, et al. Nurses' attitudes and beliefs to attempted suicide in Southern India. *J Ment Health* 2015;24:423–9.
- [65] Kim YK, Na KS. Application of machine learning classification for structural brain MRI in mood disorders: critical review from a clinical perspective. *Prog Neuropsychopharmacol Biol Psychiatry* 2018;80(Pt B): 71–80.