



Original Article

The association between abortion experience and postmenopausal suicidal ideation and mental health: Results from the 5th Korean National Health and Nutrition Examination Survey (KNHANES V)

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ABSTRACT

Objective: The association between abortion and postmenopausal mental health has not been clearly established in Asian women. The objective of this study was to evaluate the effect of abortion experiences on suicidal ideation and mental health in Korean postmenopausal women.**Materials and methods:** This study included 5133 postmenopausal women registered in the Korean National Health and Nutrition Examination Survey between 2010 and 2012. Difference in suicidal ideation according to type and number of abortions was analyzed. We used survey multiple logistic regression analysis to evaluate the effect of abortion experiences on the risk for suicidal ideation expressed as adjusted odd ratios (ORs) with 95% confidence intervals (95% CIs).**Results:** The risk of suicidal ideation was significantly higher in women who experienced more than three abortions (27.9%). While the incidence of suicidal ideation was not significantly affected by the number of spontaneous abortions ($p = 0.718$), suicidal ideation was significantly more frequent in women who had undergone \geq three abortions ($p = 0.003$). After adjusting for demographic confounding factors, women who underwent \geq three induced abortions had higher risk for suicidal ideation (OR: 1.510; 95% CI: 1.189–1.919; $p = 0.031$). This risk remained elevated even after controlling for depression (OR: 1.391; 95% CI: 1.1086–1.871, $p = 0.002$). Moreover, the risk of experiencing a depressive mood in daily life was also increased with increasing number of induced abortions even after controlling for depression (OR: 1.657; 95% CI: 1.274–2.156, $p = 0.002$).**Conclusion:** Undergoing three or more induced abortions during reproductive age was associated with postmenopausal suicidal ideation, stress, and depression. However, such association was not noted in those with spontaneous abortion, even in women with more miscarriages. Thus, clinicians should evaluate depression and suicidal ideation in women with multiple induced abortions.© 2018 Taiwan Association of Obstetrics & Gynecology. Publishing services by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Suicide is a leading cause of death worldwide. Suicide rate in South Korea is higher than the average rate in developed countries. In addition, it tends to increase every year, causing significant public health concern [1]. It has been reported that young women are at higher risk of suicide if they are less educated, unmarried,

having a preexisting mental disorder, or fulfilling certain socio-demographic criteria known to be associated with increased risk [2,3]. Among these risk factors, preexisting mental disorder (such as depression) represents the strongest predictor of suicide-related events [4]. Menopausal transition is also associated with increased risk of depression. Postmenopausal women are known to have higher suicidal risk than younger women [5–7].

An abortion experience can cause anxiety and depression regardless whether the pregnancy is desired or not [8]. Women who have abortions are at higher risk of experiencing negative feelings such as grief and guilt [9]. Bellieni et al. [10] have reported that fetal loss increases a woman's risk for mental disorders to a

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higher extent than childbirth. Jung et al. [11] have shown that Korea women with more abortion experiences have increased risk for postmenopausal onset of depression. Depression is known as the main risk factor for suicidal ideation which in turn is strongly related to suicidal death [12].

Several studies have evaluated the relationship between abortion and suicidal ideation [13,14]. Although such studies are often limited by their small-scale or retrospective design, they are nonetheless valuable as they have found that women who have abortions are at higher risk of experiencing suicidal ideation compared to women with planned or unplanned childbirth [10,15]. However, most such studies have been conducted in premenopausal women. To our knowledge, few studies have evaluated the effect of abortion experience on suicidal ideation and mental health in postmenopausal women. Therefore, the objective of this cohort study was to evaluate such effect using data representative of Korean postmenopausal women.

Materials and methods

Data source and participants

We conducted a nationwide cross-sectional population-based study. Data were obtained from the fifth Korean National Health and Nutrition Examination Survey (KNHANES) between 2010 and 2012. KNHANES is performed by the Division of Chronic Disease Surveillance of the Korea Centers for Disease Control and Prevention. It consists of a personal health interview, a health examination, and a nutrition survey conducted by trained investigators. Survey participants were selected from the 2009 National Census Registry using complex, stratified, multistage, probability sampling based on geographic area, sex, and age. Analyzed data were weighted to ensure that they represented all noninstitutionalized female populations in Korea. In our analysis, the cohort of interest included postmenopausal women aged ≥ 40 years old. Data were collected after the Korea Centers for Disease Control and Prevention obtained informed consent from all participants. The Institutional Review Board of the Catholic University of Korea approved this study.

Outcome measures

Menopause was defined as the cessation of menstruation for more than 12 months. Mental health measurements were based on survey data on suicidal ideation, levels of recognized stress, and depressive mood. Patients who expressed a desire to die or commit suicide within the year leading up to the study were considered to have suicidal ideation. Stress was assessed by participants as nonexistent, mild, moderate, or severe. It was considered to represent recognized stress if it was reported as moderate or severe. Depressive mood was defined as feelings of sadness or despair that interfered with daily life for at least two consecutive weeks in the year leading up to the study. Patients who rated their mood as depressed were asked if they received a formal diagnosis of depression by physicians. Postmenopausal depression was defined as depression with an onset after menopause.

Spontaneous abortion was defined as a spontaneous pregnancy loss, that is, any pregnancy that was not viable or in which fetus was born before the 20th week of pregnancy. Induced abortion was defined as an abortion that was brought about intentionally before the 20th week of pregnancy. Abortion history was ascertained through a self-reported questionnaire asking women to list the total number of abortion experiences, the number of spontaneous abortions, and the number of induced abortions. Responses were divided into three categories: i) no abortion experiences; ii) 1 or 2

abortion experiences; and iii) \geq three abortion experiences. The relationship between mental health measurements and abortion experiences was subsequently analyzed.

For each participant, we recorded height (m) and weight (kg) and subsequently calculated body mass index (BMI; kg/m^2) as weight over height². Participants completed surveys about lifestyle and demographic factors including smoking, drinking, regular exercise, education level, and household income. Current smoking rate was defined as the proportion of participants who smoked at least 5 packs of cigarettes (100 cigarettes) in their lifetime and were smoking every day or some days at the time the survey was conducted. A high-risk drinking habit was defined as drinking at least 5 cups of alcohol (equivalent to three cans of beer) at least once a week. Occupation was defined as an activity performed for economic gain. Low household income level was defined as the income in the lowest quartile. Low education level was defined as not having graduated from elementary school. Regular exercise was defined as either moderate or more exertive physical activity than usual, undertaken for a minimum of 30 min a day for 5 days in a recent week, or high-intensity exercise undertaken for at least 20 min a day for three days in a recent week. Obesity was defined as a BMI $\geq 25 \text{ kg}/\text{m}^2$. The prevalence of underlying diseases including depression, hypertension, diabetes, rheumatoid arthritis, asthma, osteoarthritis, and cancer was calculated based on responses to a self-reported questionnaire.

Statistical analysis

Since KNHANES data were obtained using a multistage cluster probability approach, our analysis procedures necessarily included sampling weights, strata, and clusters. Baseline clinical characteristics described in terms of categorical variables were compared using Rao-Scott Chi-square test whereas those described in terms of continuous variables were evaluated using survey regression analyses according to the KNHANES guidelines for statistical evaluations. We applied survey multiple logistic regression analyses (SAS statement “proc surveyreg”) to assess associations between abortion history and mental health after adjusting for age, obesity, education level, presence of a spouse, household income, current smoking and drinking rates, and prevalence of hypertension, osteoarthritis, diabetes, and depression. Risks were expressed as adjusted odd ratios (ORs) with 95% confidence intervals (CI). All statistical analyses were performed using SAS version 9.4 (SAS Institute, Cary, NC, USA).

Results

A total of 13,918 women participated in the survey between 2010 and 2012. Of these, 5131 postmenopausal women were included in our study. The mean age of the study population was 62.8 years. The majority (72.1%, $n = 3703$) of women had at least one abortion experience which most commonly involved induced abortion (57.8%, $n = 2968$) or spontaneous abortion (22.9%, $n = 1176$). The proportion of women with \geq three spontaneous was 2.2% ($n = 114$) and that with induced abortions was 17.3% ($n = 888$). Among the entire study sample, 1079 (21.0%) women experienced suicide-related thoughts and 41 (0.8%) women reported having attempted suicide in the year leading up to the study.

Baseline characteristics of the study participants stratified according to the presence or absence of suicidal ideation are described in Table 1. These groups differed with respect to age, number of childbirths, education level, presence of a spouse, household income level, and occupation (all $p < 0.05$). The group with suicidal ideation had a higher rate of current smoking. However, there was no between-group difference in rates of regular

Table 1
Baseline characteristics of postmenopausal women stratified according to suicidal ideation.

Variable	No suicidal ideation (4052/17502577)	Suicidal ideation (1079/4811020)	p-value
	N (weighted percent)	N (weighted percent)	
Age, years	62.11 ± 0.22	65.35 ± 0.42	<0.001
Body mass index, kg/m ²	24.30 ± 0.08	24.06 ± 0.14	0.787
Number of childbirths	3.18 ± 0.04	3.53 ± 0.07	<0.001
Low education level	2263 (55.0)	800 (72.7)	<0.001
Living spouse	2854 (73.9)	649 (63.7)	<0.001
Low household income	1260 (29.1)	507 (45.3)	<0.001
Occupation	1699 (45.6)	384 (38.7)	0.003
High-risk drinking habits	146 (4.5)	47 (4.5)	0.310
Currently smoking	129 (4.1)	71 (8.5)	<0.001
Regular exercise	1743 (42.3)	431 (40.2)	0.326
Depression	788 (18.5)	498 (45.8)	<0.001
Total abortions			0.035
0	1138 (28.5)	290 (26.6)	0.896
1–2	1955 (48.2)	476 (45.5)	0.030
≥3	959 (23.3)	313 (27.9)	0.023
Spontaneous abortions			0.718
0	3066 (76.4)	794 (75.0)	0.433
1–2	823 (21.3)	239 (22.8)	0.986
≥3	88 (2.3)	26 (2.2)	0.755
Induced abortions			0.005
0	1641 (42.0)	426 (40.3)	0.652
1–2	1677 (42.2)	403 (38.8)	0.006
≥3	657 (15.8)	230 (20.9)	0.003
Bilateral oophorectomy	182 (4.3)	51 (4.8)	0.599
Hormone replacement therapy	656 (14.6)	158 (14.8)	0.892
Underlying medical disease			
Hypertension	1659 (39.2)	530 (46.8)	<0.001
Diabetes	521 (12.5)	175 (16.0)	0.015
Cancer	258 (6.1)	77 (7.8)	0.107
Asthma	238 (5.8)	82 (8.3)	0.026
Osteoarthritis	1505 (35.6)	562 (49.6)	<0.001

Data are presented as mean ± standard error or number (weighted percentage).

exercise or high-risk drinking. Women who had ≥ three abortion experiences had higher ($p = 0.023$) rate of suicidal ideation than women without abortions. These associations were evident for induced abortion, but not for spontaneous abortion. Participants with suicidal ideation had high prevalence rates of diabetes, hypertension, asthma, osteoarthritis. However, there was no between-group difference in the prevalence of cancer.

Table 2 provides an overview of differences in postmenopausal mental health according to type and number of abortions. The group with ≥ three experiences of induced abortion had higher rates of suicidal ideation, stress, depressive mood, and depression (all $p < 0.05$) than groups with fewer induced abortions. In contrast, the number of spontaneous abortions did not affect postmenopausal mental health indicators. The type or number of abortions had no significant effect on the rate of suicidal attempts.

The risk of postmenopausal suicidal ideation according to abortion experience is described in Table 3. Women who underwent ≥ three abortions, regardless of type, showed an increased likelihood of suicidal ideation (OR: 1.288; 95% CI: 1.025–1.617). An increased risk of suicidal ideation was also noted

in the group with ≥ three induced abortions (OR: 1.377; 95% CI: 1.103–1.719), but not in the group with spontaneous abortions. After controlling for age, smoking, number of childbirths, education level, household income, presence of a spouse, occupation, and underlying disease (hypertension, diabetes, asthma, and osteoarthritis) (model 1), women who underwent ≥ three induced abortions were found to have higher risk for suicidal ideation (OR: 1.510; 95% CI: 1.189–1.919). After adding preexisting depression to the list of confounders in model 1 (model 2), the likelihood of suicidal ideation remained increased in the group with ≥ three induced abortions (OR: 1.391; 95% CI: 1.086–1.781), but not in the group with spontaneous abortions (OR: 1.241; 95% CI: 0.868–2.246).

The risk for stress or depressive mood in daily life as a function of abortion experience is described in Table 4. Women who underwent ≥ three induced abortions had higher risk for depressive mood even after controlling for pre-existing depression. On the other hand, the number of spontaneous abortions did not affect the risk for suicidal ideation, stress in daily life, or depressive mood (Fig. 1).

Table 2
Mental health problems in postmenopausal women stratified according to number and type of abortion experiences.

Variable	Total abortions				Spontaneous abortions				Induced abortions			
	None	1–2	≥3	p-value	None	1–2	≥3	p-value	None	1–2	≥3	p-value
Suicidal ideation	20.4 (1.4)	20.6 (1.0)	24.8 (1.6)	0.051	21.3 (0.9)	22.7 (1.6)	21.2 (4.5)	0.728	20.9 (1.1)	20.2 (1.1)	26.7 (1.9)	0.010
Stress	23.9 (1.3)	26.2 (1.1)	31.0 (1.6)	0.003	25.7 (0.8)	29.5 (1.8)	29.7 (5.5)	0.123	25.2 (1.2)	26.2 (1.2)	31.1 (2.0)	0.036
Depression	20.1 (1.2)	24.5 (1.2)	19.3 (1.5)	<0.001	24.2 (0.9)	24.4 (1.7)	29.0 (5.2)	0.668	20.4 (1.0)	25.8 (1.3)	30.3 (1.9)	<0.000
Depressive mood	16.0 (1.1)	19.3 (1.0)	25.8 (1.5)	<0.001	19.0 (0.8)	22.0 (1.6)	22.6 (5.4)	0.178	17.1 (1.0)	19.7 (1.1)	26.4 (1.9)	<0.001

Data are presented as weighted percent (standard error).

Table 3
Postmenopausal suicidal ideation risk according to abortion experiences.

Variable	Crude OR	Adjusted OR (95% CI)	
		Model 1 ^a	Model 2 ^b
Total abortions			
None	1 (reference)	1 (reference)	1 (reference)
1–2	1.013 (0.835–1.229)	1.188 (0.961–1.470)	1.142 (0.918–1.421)
≥3	1.288 (1.025–1.617)	1.499 (1.163–1.931)	1.398 (1.078–1.815)
Spontaneous abortions			
None	1 (reference)	1 (reference)	1 (reference)
1–2	1.087 (0.885–1.335)	1.084 (0.869–1.351)	1.100 (0.880–1.376)
≥3	0.995 (0.569–1.739)	1.218 (0.694–2.136)	1.241 (0.686–2.246)
Induced abortions			
None	1 (reference)	1 (reference)	1 (reference)
1–2	0.959 (0.798–1.152)	1.075 (0.879–1.316)	1.044 (0.851–1.280)
≥3	1.377 (1.103–1.719)	1.510 (1.189–1.919)	1.391 (1.086–1.781)

OR, odds ratio; CI, confidence interval.

^a Model 1 adjusted for age, smoking status, number of childbirths, education, household income, presence of spouse, occupation, and underlying medical condition.^b Model 2 adjusted for age, smoking, number of childbirths, education, household income, presence of spouse, occupation, underlying medical condition, and depression.

Discussion

We found that suicidal ideation was high in Korean menopausal women who were elderly or had no spouse, no occupation, low education, low household income, and high birth rate. In addition, patients with chronic diseases (such as hypertension, diabetes, asthma, and osteoarthritis) and those with preexisting depression had high risk for suicidal ideation. Importantly, postmenopausal women who underwent \geq three induced abortions had high risk for suicidal ideation and experiencing depressive mood during daily life whereas spontaneous abortion experience alone did not increase these risks even in women with more abortions. Moreover, women with multiple induced abortions had higher rate of postmenopausal suicidal ideation even after adjusting for depression.

Various studies have determined the impact of abortion on women's mental health. However, results are inconclusive. Coleman et al. [15] have reported that having an abortion increases the risk for mental health problems, with substance abuse and suicidal ideation being among the most notable problems. On the contrary, Charles et al. [16] have evaluated existing reports on the relationship between abortion and mental health and found that most published studies have a high selection bias and relatively few sources of reliable evidence whereas most studies with a strong

evidence base have concluded that the relationship between abortion and mental health is neutral. Only a few studies have reported negative effects. The majority of studies described above evaluated mental health in women of reproductive age. Only a few studies have investigated mental health of postmenopausal women [15,17–19].

Jung et al. [11,20] have evaluated mental health of postmenopausal Korean women using two population-based data sets and found that the risk for postmenopausal onset of depression is increased in women with increasing number of abortion experiences. The present study also found that participants with more abortion experiences had higher prevalence of depression and higher rate of postmenopausal onset of depression. The present study also showed that postmenopausal women who underwent \geq three abortions had higher suicidal ideation risk even after adjusting for preexisting depression, a major risk factor for suicidal ideation.

In general, suicidal ideation correlates with age, female sex, stress, depression, behaviors such as high-risk drinking and smoking, reduced physical activity, and lack of occupation [2,3]. People with chronic diseases such as diabetes, hypertension, chronic obstructive pulmonary disease, and arthritis also have higher suicidal ideation risk [21–24]. In our study of Korean postmenopausal women, suicidal ideation was also associated with age, level of education, household income, living with the spouse, smoking, depression, and underlying disease, but not associated with drinking habit.

Some studies have demonstrated that subjects with abortion experiences are at higher risk of suicidal behaviors [15,25,26]. In a study of 212 pregnancy-associated deaths, Gissler et al. [25] have reported that rates of suicide after induced abortions or spontaneous abortions are higher than mortality rates of non-pregnant women of reproductive age. In a nationwide survey, Mota et al. [13] have found that the risk for suicidal ideation and suicidal attempt is higher in women who have abortions than women who do not have abortions. However, there were no significant relationship between postmenopausal suicidal ideation and spontaneous abortion experience in our study.

The present study had sufficient statistical strength because we not only controlled for demographic factors and underlying disease, but also controlled for preexisting mental disorder. Indeed, after controlling for preexisting depression, the experience of undergoing \geq three induced abortions was associated with higher risk for postmenopausal suicidal ideation and depressive mood while no such effect was noted for spontaneous abortions.

Our approach for stratifying participants according to the number of abortion experiences (i.e., no abortions, one or two abortions, \geq three abortions) was based on the definition of habitual abortion [12]. However, we could not identify the effect of subsequent pregnancy loss. Most studies were consistent in describing a negative effect of abortion on mental health [27–29], although these studies were small-scale or lacking an appropriate control group. In the present study, the number of spontaneous abortions was not associated with an increased risk for postmenopausal mental health problems. However, the number of induced abortions was correlated with the risk of suicidal ideation, depression with postmenopausal onset, and depressive mood. Our results on Korean women suggest that, although spontaneous abortion might have a short-term negative impact on mental health, its long-term impact on mental health is negligible.

Recently, a new perspective has emerged stating that women who have abortions are more likely to have preexisting mental health disorders. In an analysis of national comorbidity survey data, Steinberg et al. [14] have suggested that, although women who have abortions have higher risk for suicidal ideation, women who

Table 4
Risk for postmenopausal mental health problems according to abortion experiences.

Variable	Adjusted OR (95% CI)		
	Suicidal ideation	Stress	Depressive mood
Total abortions			
None	1 (reference)	1 (reference)	1 (reference)
1–2	1.097 (0.872–1.379)	1.140 (0.931–1.397)	1.286 (1.048–1.578)
≥3	1.318 (1.012–1.714)	1.300 (1.035–1.632)	1.762 (1.373–2.261)
Spontaneous abortions			
None	1 (reference)	1 (reference)	1 (reference)
1–2	1.092 (0.869–1.372)	1.247 (1.021–1.535)	1.216 (0.972–1.521)
≥3	1.112 (0.629–1.967)	1.313 (0.761–2.265)	1.377 (0.778–2.437)
Induced abortions			
None	1 (reference)	1 (reference)	1 (reference)
1–2	1.006 (0.814–1.244)	1.050 (0.861–1.280)	1.187 (0.965–1.461)
≥3	1.304 (1.018–1.669)	1.175 (0.928–1.488)	1.657 (1.274–2.156)

OR, odds ratio; CI, confidence interval.

Analysis adjusted for age, smoking, number of childbirths, education, household income, living spouse, occupation, underlying medical condition, and depression.

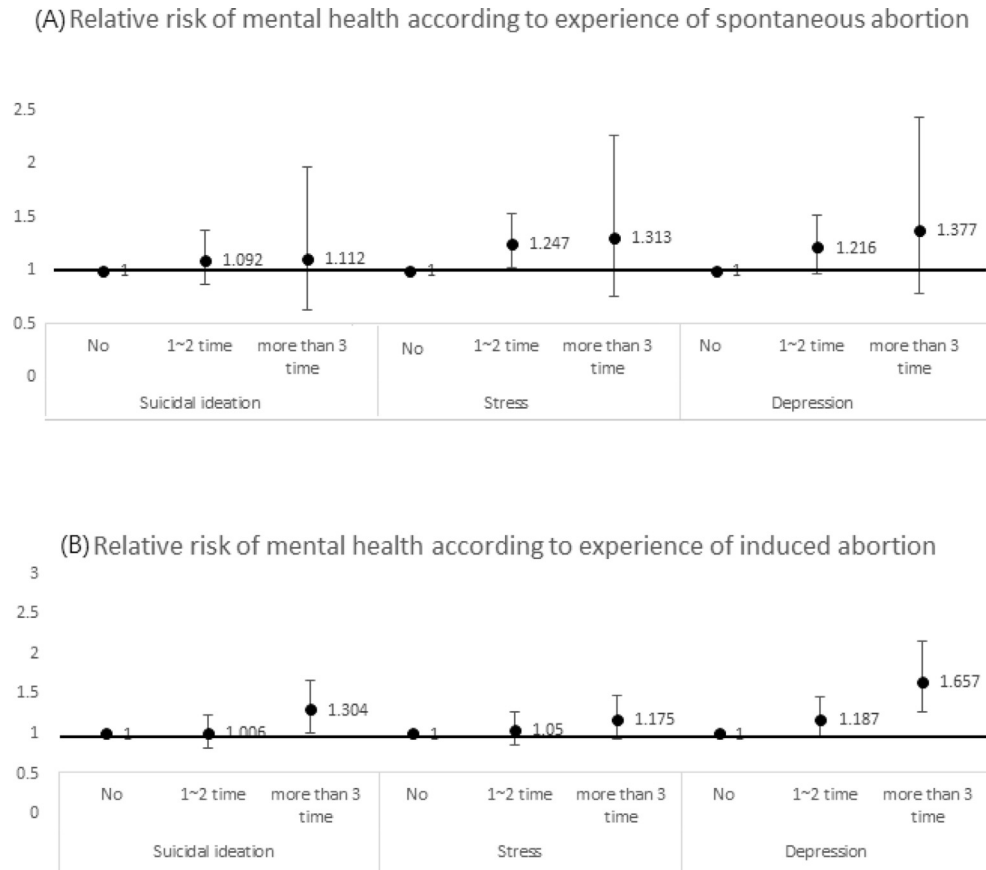


Fig. 1. Postmenopausal mental health status according to experience of abortions. (A) Adjusted odds ratio describing the risk of postmenopausal mental health was calculated according to the number of spontaneous abortions. (B) Adjusted odds ratio describing the risk of postmenopausal mental health was calculated according to history of induced abortions.

have higher rates of suicidal ideation are more likely to have mental health problems preceding pregnancy while abortion experience alone does not increase suicide risk. According to a Danish population-based study, women who underwent induced abortion in the first trimester of pregnancy had higher rates of psychiatric contact before pregnancy compared to women who gave birth while the frequency of psychiatric contact did not increase after women had an abortion [30,31]. The present study revealed that the group with \geq three induced abortions had higher risk for suicidal ideation even after controlling for pre-existing depression, a well-known major risk factor for suicide. Taken together, these findings suggest that the experience of induced abortion and suicidal ideation might be related to other mental problems besides depression.

The present study has several limitations. First, our data were obtained from self-reported questionnaires. Thus, some results might have been underreported and some answers might have been recorded incorrectly. Second, we were unable to determine at which week of gestation the abortion occurred or whether pregnancies were planned. Third, we did not utilize standardized assessment tools to evaluate suicidal ideation, depressive mood, or diagnosis of depression. Fourth, we did not collect information about comorbid mental health conditions such as anxiety, schizophrenia, and bipolar disorder known to affect suicide risk. We did control for the presence of co-morbid depression [32]. Finally, since this was a cross-sectional study, we were unable to establish causality.

Despite these limitations listed above, the present study has several notable strengths. First, this was a large-scale study based

on data from a national survey that included a representative sample of all postmenopausal women in South Korea. Second, this study adjusted for well-known suicidal ideation risk factors including age, smoking, occupation, household income, number of childbirths, living spouse, and medical comorbidities such as cancer, diabetes, hypertension, osteoarthritis, and depression [24,32].

In conclusion, a history of three or more induced abortions, but not spontaneous abortions, during reproductive lifetime of Korean women increased the risk for suicidal ideation and experiencing a depressive mood in daily life after menopause. Thus, clinicians should consider vulnerability for depression and suicidal ideation in women who have multiple induced abortions. Further prospective longitudinal research is needed to clarify the association of multiple induced abortions with postmenopausal suicidal ideation and mental health.

Conflicts of interest

The authors have no competing conflicts of interest to disclose.

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References

- [1] World Health Organization. Preventing suicide: a global imperative. 2014. http://www.who.int/mental_health/suicide-prevention/world_report_2014/en/. [Accessed 20 March 2017].
- [2] Bernal M, Haro JM, Bernert S, Brugha T, de Graaf R, Bruffaerts R, et al. Risk factors for suicidality in Europe: results from the ESEMED study. *J Affect Disord* 2007;101:27–34.
- [3] Nock MK, Borges G, Bromet EJ, Alonso J, Angermeyer M, Beautrais A, et al. Cross-national prevalence and risk factors for suicidal ideation, plans and attempts. *Br J Psychiatr* 2008;192:98–105.
- [4] Hawton K, Casanas ICC, Haw C, Saunders K. Risk factors for suicide in individuals with depression: a systematic review. *J Affect Disord* 2013;147:17–28.
- [5] Kornstein SG, Young EA, Harvey AT, Wisniewski SR, Barkin JL, Thase ME, et al. The influence of menopause status and postmenopausal use of hormone therapy on presentation of major depression in women. *Menopause* 2010;17:828–39.
- [6] Bagalkot TR, Park JI, Kim HT, Kim HM, Kim MS, Yoon MS, et al. Lifetime prevalence of and risk factors for suicidal ideation and suicide attempts in a Korean community sample. *Psychiatry* 2014;77:360–73.
- [7] Vivian-Taylor J, Hickey M. Menopause and depression: is there a link? *Maturitas* 2014;79:142–6.
- [8] Geller PA, Klier CM, Neugebauer R. Anxiety disorders following miscarriage. *J Clin Psychiatr* 2001;62:432–8.
- [9] Wilcox AJ, Weinberg CR, O'Connor JF, Baird DD, Schlatterer JP, Canfield RE, et al. Incidence of early loss of pregnancy. *N Engl J Med* 1988;319:189–94.
- [10] Bellieni CV, Buonocore G. Abortion and subsequent mental health: review of the literature. *Psychiatr Clin Neurosci* 2013;67:301–10.
- [11] Jung SJ, Shin A, Kang D. Hormone-related factors and post-menopausal onset depression: results from KNHANES (2010–2012). *J Affect Disord* 2015;175:176–83.
- [12] Klonsky ED, May AM, Saffer BY. Suicide, suicide attempts, and suicidal ideation. *Annu Rev Clin Psychol* 2016;12:307–30.
- [13] Mota NP, Burnett M, Sareen J. Associations between abortion, mental disorders, and suicidal behaviour in a nationally representative sample. *Can J Psychiatr* 2010;55:239–47.
- [14] Steinberg JR, McCulloch CE, Adler NE. Abortion and mental health: findings from the national comorbidity survey-replication. *Obstet Gynecol* 2014;123:263–70.
- [15] Coleman PK. Abortion and mental health: quantitative synthesis and analysis of research published 1995–2009. *Br J Psychiatr* 2011;199:180–6.
- [16] Charles VE, Polis CB, Sridhara SK, Blum RW. Abortion and long-term mental health outcomes: a systematic review of the evidence. *Contraception* 2008;78:436–50.
- [17] Broen AN, Moum T, Böttker AS, Ekeberg O. Predictors of anxiety and depression following pregnancy termination: a longitudinal five-year follow-up study. *Acta Obstet Gynecol Scand* 2006;85:317–23.
- [18] Reardon DC, Cogle JR, Rue VM, Shuping MW, Coleman PK, Ney PG. Psychiatric admissions of low-income women following abortion and childbirth. *CMAJ* 2003;168:1253–6.
- [19] Pedersen W. Childbirth, abortion and subsequent substance use in young women: a population-based longitudinal study. *Addiction* 2007;102:1971–8.
- [20] Jung SJ, Shin A, Kang D. Menarche age, menopause age and other reproductive factors in association with post-menopausal onset depression: results from Health Examinees Study (HEXA). *J Affect Disord* 2015;187:127–35.
- [21] Pompili M, Innamorati M, Lamis DA, Erbutto D, Venturini P, Ricci F, et al. The associations among childhood maltreatment, "male depression" and suicide risk in psychiatric patients. *Psychiatr Res* 2014;220:571–8.
- [22] Chang JC, Yen AM, Lee CS, Chen SL, Chiu SY, Fann JC, et al. Metabolic syndrome and the risk of suicide: a community-based integrated screening samples cohort study. *Psychosom Med* 2013;75:807–14.
- [23] Strid JM, Christiansen CF, Olsen M, Qin P. Hospitalisation for chronic obstructive pulmonary disease and risk of suicide: a population-based case-control study. *BMJ Open* 2014;4, e006363.
- [24] Erlangsen A, Stenager E, Conwell Y. Physical diseases as predictors of suicide in older adults: a nationwide, register-based cohort study. *Soc Psychiatr Psychiatr Epidemiol* 2015;50:1427–39.
- [25] Gissler M, Berg C, Bouvier-Colle MH, Buekens P. Injury deaths, suicides and homicides associated with pregnancy, Finland 1987–2000. *Eur J Publ Health* 2005;15:459–63.
- [26] Fergusson DM, Horwood LJ, Ridder EM. Abortion in young women and subsequent mental health. *J Child Psychol Psychiatr* 2006;47:16–24.
- [27] Kolte AM, Olsen LR, Mikkelsen EM, Christiansen OB, Nielsen HS. Depression and emotional stress is highly prevalent among women with recurrent pregnancy loss. *Hum Reprod* 2015;30:777–82.
- [28] Toffol E, Koponen P, Partonen T. Miscarriage and mental health: results of two population-based studies. *Psychiatr Res* 2013;205:151–8.
- [29] Kagami M, Maruyama T, Koizumi T, Miyazaki K, Nishikawa-Uchida S, Oda H, et al. Psychological adjustment and psychosocial stress among Japanese couples with a history of recurrent pregnancy loss. *Hum Reprod* 2012;27:787–94.
- [30] Munk-Olsen T, Laursen TM, Pedersen CB, Lidegaard Ø, Mortensen PB. Induced first-trimester abortion and risk of mental disorder. *N Engl J Med* 2011;364:332–9.
- [31] Davies S, Naik PC, Lee AS. Depression, suicide, and the national service framework. *Bmj* 2001;322:1500–1.
- [32] Bolton JM, Gunnell D, Turecki G. Suicide risk assessment and intervention in people with mental illness. *Bmj* 2015;351:h4978.