Table 2 Precipitating factors of suicide attempts and gender differences

	Total (N = 193)	Males (N = 88)	Females (N = 105)	Significance	
Age ± SD	41.1 ± 16.3	42.4 ± 16.3	40.1 ± 16.4	NS[§]	
Mean number of precipitating factors ± SD	1.11 ± 0.78	1.20 ± 0.87	1.04 ± 0.69	NS[§]	
Under psychiatric treatment	131	50	81	$p = 0.003$[¶]	$\chi^2 = 9.070$
Employment status					
Employed	60	39	21	$p = 0.000$[¶]	$\chi^2 = 13.216$
Unemployed	97	39	58	NS[¶]	
Housewife or house-husband	17	0	17	$p = 0.000$[¶]	$\chi^2 = 15.624$
Student	19	10	9	NS[¶]	
Methods of suicide attempt					
Drug overdose	101	36	65	$p = 0.004$[¶]	$\chi^2 = 8.460$
Jumping from a high place	33	17	16	NS[¶]	
Cutting	16	10	6	NS[¶]	
Poisonous gas	15	13	2	$p = 0.001$[¶]	$\chi^2 = 11.060$
Hanging	11	7	4	NS[¶]	
Poisoning	9	4	5	NS[†]	
Other methods	11	2	9	NS[¶]	
DSM-IV-TR					
Substance-induced disorders	16	11	5	NS[¶]	
Schizophrenia and other psychotic disorders	45	22	23	NS[¶]	
Major depressive disorder, bipolar disorder	42	26	16	$p = 0.016$[¶]	$\chi^2 = 5.756$
Dysthymic disorder	26	7	19	$p = 0.040$[¶]	$\chi^2 = 4.224$
Adjustment disorders	27	13	14	NS[¶]	
Personality disorders	22	2	20	$p = 0.000$[¶]	$\chi^2 = 13.339$
Other psychiatric disorders	14	6	8	NS[¶]	
None	11	6	5	NS[¶]	
Precipitating factors					
Family problems	62	20	42	$p = 0.010$[¶]	$\chi^2 = 6.551$
Parent–child relations	14	2	12	$p = 0.015$[¶]	$\chi^2 = 5.965$
Health problems	8	7	1	$p = 0.024$[†]	
Financial problems	40	24	16	$p = 0.040$[¶]	$\chi^2 = 4.220$
Debt (others)	4	4	0	$p = 0.042$[†]	
Work problems	27	18	9	$p = 0.018$[¶]	$\chi^2 = 5.618$
Unwanted transfer	4	4	0	$p = 0.042$[†]	
Love problems	20	7	13	NS[¶]	
School problems	6	3	3	NS[†]	
Other problems	29	12	17	NS[¶]	
Loneliness	12	2	10	$p = 0.038$[¶]	$\chi^2 = 4.317$

[§]Welch's t-test, [¶]chi-square test, [†]Fisher's exact test.

was significantly higher in females (chi-square test, $\chi^2 = 15.624$, $p = 0.000$).

The rate of subjects attempting suicide by drug overdose was significantly higher in females (chi-square test, $\chi^2 = 8.460$, $p = 0.004$), and the rate of those attempting suicide by poisonous gas was significantly higher in males (chi-square test, $\chi^2 = 11.060$, $p = 0.001$).

The number of subjects under psychiatric treatment was 50 in males (56.8%) and 81 in females (77.1%), with the rate being significantly higher in females (chi-square

test, $\chi^2 = 9.070$, $p = 0.003$). Table 3 shows the differences in the methods of suicide attempt due to the presence or absence of psychiatric treatment. The rate of subjects attempting suicide by drug overdose was significantly higher in the subjects under psychiatric treatment (chi-square test, $\chi^2 = 12.479$, $p = 0.000$). On the other hand, the rates of those attempting suicide by cutting (chi-square test, $\chi^2 = 4.657$, $p = 0.031$) and poisoning (Fisher's exact test, $p = 0.032$) were significantly lower in the subjects under psychiatric treatment.

The rate of subjects diagnosed with "major depressive disorder" or "bipolar disorder" (chi-square test, $\chi^2 = 5.756$, $p = 0.016$) was significantly higher in males, and the rate of those diagnosed with "personality disorders" (chi-square test, $\chi^2 = 13.339$, $p = 0.000$) or "dysthymic disorder" (chi-square test, $\chi^2 = 4.224$, $p = 0.040$) was significantly higher in females.

Among major categories of precipitating factors, the rates of subjects with "health problems" (Fisher's exact test, $p = 0.024$), "financial problems" (chi-square test, $\chi^2 = 4.220$, $p = 0.040$) and "work problems" (chi-square test, $\chi^2 = 5.618$, $p = 0.018$) were significantly higher in males, whereas the rate of those with "family problems" (chi-square test, $\chi^2 = 6.551$, $p = 0.010$) was significantly higher in females. Among sub-classifications of precipitating factors, the rate of subjects who had "debts (others)" ("financial problems") (Fisher's exact test, $p = 0.042$) or "unwanted transfer" ("work problems") (Fisher's exact test, $p = 0.042$) was significantly larger in males; the rate of subjects with "parent–child relations" ("family problems") (chi-square test, $\chi^2 = 5.965$, $p = 0.015$) or "loneliness" ("other problems") (chi-square test, $\chi^2 = 4.317$, $p = 0.038$) was significantly higher in females.

Discussion

Previous studies have shown that mental disorders are the most common precipitating factor for suicide-related behavior regardless of gender [3,20,21]. Yamada et al. reported that 95% and 65% of suicide attempters had mental disorders and were under psychiatric treatment, respectively [3]. In the present study, 94.3% of the subjects had mental disorders and 67.9% were under psychiatric treatment, percentages similar to those of the previous study. Pompili et al. reported that suicide in eating disorders is a major cause of death [22], but there was no subject with eating disorders in the present study.

The rate of subjects diagnosed with "major depressive disorder, bipolar disorder" was significantly lower, and that of subjects diagnosed with "personality disorders" and "dysthymic disorder" was significantly higher in females. Isometsä et al. compared suicide committers with unipolar depression not fulfilling the criteria of major depressive disorder with those with major depressive disorder [23]. They reported that problems in recent life events were observed more commonly among suicide committers with non-major depressive disorders, and particularly during the final week. Further, patients with personality disorder, especially borderline personality disorder, typically have high impulsivity. Considering these findings, it is possible that females might tend to attempt suicide without major depressive disorder but rather in connection with life events or impulsivity.

In the present study, the rate of subjects attempting suicide by drug overdose was significantly higher in females. It is known that females are more likely to attempt suicide by poisoning than males [8,9], but we can infer from the high rate of female subjects under psychiatric treatment that they could get drugs for suicide attempts more easily than acquire items for other suicidal methods.

Male suicide attempters tend to be influenced by societal problems like "financial problems" or "work problems" and female suicide attempters by social problems

Table 3 Differences in methods of suicide attempt due to the presence or absence of psychiatric treatment

	Total (N = 184)	Under psychiatric treatment (N = 131)	No psychiatric treatment (N = 62)	Significance	
Methods of suicide attempt					
Drug overdose	101	80*	21	$p = 0.000$¶	$\chi^2 = 12.479$
Jumping from a high place	33	24	9	NS¶	
Cutting	16	7	9	$p = 0.031$¶	$\chi^2 = 4.657$
Poisonous gas	15	7	8	NS†	
Hanging	11	5	6	NS†	
Poisoning	9	3	6	$p = 0.032$†	
Other methods	11	6	5	NS†	

¶chi-square test, †Fisher's exact test.
*53 females (81.5%) and 27 males (75.0%) under psychiatric treatment attempted suicide by drug overdose.

like "parent–child relations" or "loneliness." These findings indicate that male suicide attempters tended to attempt suicide in societal situations, while female suicide attempters tended to attempt suicide in social situations. This difference between males and females may reflect the structure of Japanese society, in which social participation of females is still insufficient — the recent labor force participation rate of those aged 15–64 years is about 80% in males and about 60% in females [24]. In the present study, the rate of those who were employed was significantly higher in males and the rate of the subjects who were housewives or house-husbands was significantly higher in females.

In the present study, the distinct gender differences were confirmed in psychiatric diagnoses, methods of suicide attempt and psychosocial problems, indicating the necessity of suicide prevention measures corresponding to these gender differences, e.g., support for solving societal problems for males and preventing psychosocial isolation for females.

Limitations

The main limitation of the present study is that the subjects were suicide attempters, i.e., they did not commit suicide. It could be argued, therefore, that the results may not accurately reflect the characteristics of suicide committers. However, suicide attempt, and especially repetitious suicide attempts, is known as a high-risk factor for subsequent suicide [25-27]. Furthermore, all of the subjects were high-lethality suicide attempters and clearly intended to kill themselves (most suicide attempters admitted to the critical care medical center use highly lethal methods in their suicide attempts), so we believe that they had very similar characteristics to those of persons who committed suicide, indicating that our results truly reflect the characteristics of suicide committers in Japan. In addition, the advantage of investigating suicide attempters is that we can directly confirm precipitating factors for suicide attempts from the attempters themselves, as well as perform psychiatric assessment regarding their mental state at the time of their suicide attempts. Therefore, investigating suicide attempters such as in the present study is considered to be an effective method for clarifying the characteristics of suicide-related behaviors.

Another limitation of the present study is that we collected the subjects' information from their medical records and did not use objective methods like structured interviews when we assessed their psychiatric diagnoses and precipitating factors for suicide attempts. Instead, we assessed the subjects' psychiatric diagnoses and precipitating factors for suicide attempts by agreement among two or more psychiatrists.

Previous suicide attempt is known as a risk factor for suicide, while it is not considered to be a precipitating factor for suicide and is not included in the classification items of the NPA's suicide statistics. Therefore, we did not include previous suicide attempt in the analysis of the present study. This might be a limitation of the present study.

Conclusions

Mental disorders were the most common precipitating factor for suicide attempts regardless of gender. This indicates the necessity for reinforcement of the mental health system as a basic suicide prevention measure. Gender differences were significantly observed in psychiatric diagnoses, methods of suicide attempt and psychosocial problems. Suicide prevention measures based on these gender differences should be performed.

Abbreviations

NPA: National police agency; C-CASA: Columbia classification algorithm of suicide assessment.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

All authors contributed to the conception and design of the study. RN, YK and YO contributed to data collection. RN performed the statistical analyses and wrote the first and final drafts based on a review and comments from all authors listed. All authors read and approved the final manuscript.

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