

fluphenazine or low-dose fluphenazine (Battaglia et al., 1999). Although rates of self-harm behaviors per month were reduced in both groups, there was no clear difference between the groups.

3.2.4. Miscellaneous group

We classified three trials into the "Miscellaneous group". One of the trials compared adherence to treatment between referral to a specialized suicide prevention center and continuous therapeutic contact with the original hospital therapist in an outpatient setting (Torhorst et al., 1987). The comparison was inspired by a finding of low adherence of suicide attempters to intervention (Kurz and Moller, 1984). The group of patients who received continuous therapeutic contact showed a lower rate of further suicidal behavior measured as a secondary outcome. Another study examined the effects of transfer to a general hospital compared with discharge home on the suicide repetition rate (Waterhouse and Platt, 1990). However, there were no differences in any of the measured outcomes. The third study examined the effect of referral for brief intervention for alcohol misuse on repetition of deliberate self-harm among patients with alcohol misuse presenting to an ED for deliberate self-harm (Crawford et al., 2010). Referral for brief intervention for alcohol misuse may not influence the likelihood of repeat self-harm.

3.3. Risk of bias

We assessed the risk of bias in the included studies according to the Cochrane Handbook for Systematic Reviews of Interventions (Cochrane Collaborative, 2011). The results are shown in Table 2.

Among nine trials (Beautrais et al., 2010; Carter et al., 2005; Cedereke et al., 2002; Hassanian-Moghaddam et al., 2011; Kapur et al., 2013; Morthorst et al., 2012; Vaiva et al., 2006; van der Sande et al., 1997; Van Heeringen et al., 1995) in the Active contact and follow-up group at 12 months ($n=5319$), three (Hassanian-Moghaddam et al., 2011; Morthorst et al., 2012; van der Sande et al., 1997), two (Vaiva et al., 2006; Van Heeringen et al., 1995), seven (Beautrais et al., 2010; Carter et al., 2005; Cedereke et al., 2002; Kapur et al., 2013; Morthorst et al., 2012; Vaiva et al., 2006; Van Heeringen et al., 1995), and seven trials (Beautrais et al., 2010; Carter et al., 2005; Cedereke et al., 2002; Kapur et al., 2013; Vaiva et al., 2006; van der Sande et al., 1997; Van Heeringen et al., 1995) were assessed as having a high risk of bias related to blinding of outcome assessment, incomplete outcome data, selective outcome reporting, and other potential sources, respectively. Among two (Allard et al., 1992; Carter et al., 2007) trials in the Active contact and follow-up at 24 months ($n=925$) for a repeat suicide attempt, one (Allard et al., 1992), two (Allard et al., 1992; Carter et al., 2007),

Table 2
Risk of bias.

	Random sequence generation	Allocation sequence concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective outcome reporting	Other potential sources of bias
Active contact and follow-up group (Intensive care plus outreach)							
Allard et al. (1992)	Unclear	Low	Unclear	Unclear	High	High	High
Van Heeringen et al. (1995)	Low	Unclear	Unclear	Unclear	High	High	High
van der Sande et al. (1997)	Low	Low	Unclear	High	Unclear	Low	High
Morthorst et al. (2012)	Low	Low	Unclear	High	Low	High	Low
Active contact and follow-up group (Brief intervention and contact)							
Fleischmann et al. (2008), Bertolote et al. (2010)	Low	Low	Unclear	Unclear	High	Low	High
Active contact and follow-up group (Letter or postcard)							
Carter et al. (2005, 2007, 2013)	Low	Low	Unclear	Low	Unclear	High	High
Beautrais et al. (2010)	Low	Low	Unclear	Low	Low	High	High
Hassanian-Moghaddam et al. (2011)	Low	Low	Low	High	Low	Low	Low
Active contact and follow-up group (Telephone)							
Cedereke et al. (2002)	Low	Low	Low	Low	Low	High	High
Vaiva et al. (2006)	Low	Low	Unclear	Low	High	High	High
Active contact and follow-up group (Composite of letter/postcard and telephone)							
Kapur et al. (2013)	Low	Low	Unclear	Low	Low	High	High
Psychotherapy group							
Gibbons et al. (1978)	High	High	Unclear	Low	High	High	Unclear
Lieberman and Eckman (1981)	Unclear	Unclear	Unclear	Unclear	Low	High	High
McLeavey et al. (1994)	Unclear	Unclear	Unclear	Low	Unclear	High	High
Guthrie et al. (2001)	Low	Unclear	Unclear	Low	Low	Low	High
Raj et al. (2001)	High	High	Unclear	Unclear	Unclear	High	High
Brown et al. (2005), Ghahramanlou-Holloway et al. (2012)	Low	Low	High	High	Low	Low	High
Bannan (2010)	Low	Low	High	Low	Unclear	High	High
Ougrin et al. (2011)	Low	Low	High	Low	High	Low	High
Wei et al. (2013)	Low	Unclear	Unclear	Unclear	High	High	High
Pharmacotherapy group							
Battaglia et al. (1999)	Unclear	Unclear	High	Unclear	High	High	High
Miscellaneous group							
Torhorst et al. (1987)	Unclear	Unclear	Unclear	Unclear	High	High	High
Waterhouse and Platt (1990)	Unclear	Low	Unclear	High	Low	High	Unclear
Crawford et al. (2010)	Low	Low	Unclear	Unclear	Low	Low	High

Abbreviations: Low, low risk of bias; plausible bias unlikely to seriously alter the results; Unclear, unclear risk of bias; plausible bias that raises some doubt about the results; High, high risk of bias; plausible bias that seriously weakens confidence in the results.

and two trials (Allard et al., 1992; Carter et al., 2007) were assessed as having a high risk of bias related to incomplete outcome data, selective outcome reporting, and other potential sources, respectively. Among five trials (Cedereke et al., 2002; Morthorst et al., 2012; Vaiva et al., 2006; van der Sande et al., 1997; Van Heeringen et al., 1995) in the Active contact and follow-up group at 12 months ($n=1854$) for suicidal death, two (Morthorst et al., 2012; van der Sande et al., 1997), two (Vaiva et al., 2006; Van Heeringen et al., 1995) four (Cedereke et al., 2002; Morthorst et al., 2012; Vaiva et al., 2006; Van Heeringen et al., 1995), and four trials (Cedereke et al., 2002; Vaiva et al., 2006; van der Sande et al., 1997; Van Heeringen et al., 1995) were assessed as having a high risk of bias related to blinding of outcome assessment, incomplete outcome data, selective outcome reporting, and other potential sources, respectively. Each or both of two Psychotherapy trials (Gibbons et al., 1978; Wei et al., 2013) for a repeat suicide attempt at 12 months ($n=559$) were assessed as having a high risk of bias related to random sequence generation, allocation sequence concealment, incomplete outcome data, selective outcome reporting, and other potential source.

The total number of participants in the target intervention group in 24 trials was 4169, and the median (range) of the sample size among the 24 trials was 72 (9–1150) (Supplementary Table 1). Ten trials (Beautrais et al., 2010; Bertolote et al., 2010; Carter et al., 2005, 2007, 2013; Cedereke et al., 2002; Fleischmann et al., 2008; Gibbons et al., 1978; Hassanian-Moghaddam et al., 2011; Morthorst et al., 2012; Vaiva et al., 2006; van der Sande et al., 1997; Van Heeringen et al., 1995) had more than 100 participants in the intervention group. All trials classified as psychotherapy (Bannan, 2010; Brown et al., 2005; Ghahramanlou-Holloway et al., 2012; Guthrie et al., 2001; Liberman and Eckman, 1981; McLeavey et al., 1994; Ougrin et al., 2011; Raj et al., 2001; Wei et al., 2013), except one by Gibbons et al. (1978), the one classified as pharmacotherapy (Battaglia et al., 1999) and the three classified as miscellaneous group (Crawford et al., 2010; Torhorst et al., 1987; Waterhouse and Platt, 1990), had less than 100 participants in the intervention group.

Several trials excluded patients with a high risk of suicide (Allard et al., 1992; Gibbons et al., 1978; McLeavey et al., 1994; Ougrin et al., 2011), and other trials excluded patients with psychosis (Bannan, 2010; Battaglia et al., 1999; Gibbons et al., 1978; Hassanian-Moghaddam et al., 2011; Kapur et al., 2013; Liberman and Eckman, 1981; McLeavey et al., 1994; Morthorst et al., 2012; Raj et al., 2001; Torhorst et al., 1987). Some studies examined the effect of

interventions in patients with repeat suicide attempts and multiple deliberate self-harm episodes (Bannan, 2010; Battaglia et al., 1999; Liberman and Eckman, 1981). A number of studies did not mention the proportion of participants who adhered to their intervention (Supplementary Table 2). Among the remaining studies showing information about adherence of participants to the intervention, the proportion was generally low.

Several studies set a repeat suicide attempt (Brown et al., 2005; Carter et al., 2005, 2007, 2013; Crawford et al., 2010; Ghahramanlou-Holloway et al., 2012; Hassanian-Moghaddam et al., 2011; Morthorst et al., 2012; Vaiva et al., 2006; van der Sande et al., 1997) and/or death by suicide (Bertolote et al., 2010; Fleischmann et al., 2008; Morthorst et al., 2012; Vaiva et al., 2006) as one of their primary outcomes (Supplementary Table 3). However, some trials reporting repeat suicide attempt and/or death by suicide did not clearly state which outcome was the primary outcome (Allard et al., 1992; Battaglia et al., 1999; Beautrais et al., 2010; Cedereke et al., 2002; Gibbons et al., 1978; Guthrie et al., 2001; Kapur et al., 2013; Liberman and Eckman, 1981; McLeavey et al., 1994; Van Heeringen et al., 1995; Wei et al., 2013). Some reported psychometric and other outcomes as their primary outcome, and suicide attempts and/or death by suicide were not measured (Ougrin et al., 2011; Raj et al., 2001; Waterhouse and Platt, 1990).

Among the trials examining the effect of the interventions on repetition of suicidal behavior as the outcome, the methods of measuring the repeat suicide attempt were different as shown in Supplementary Table 3.

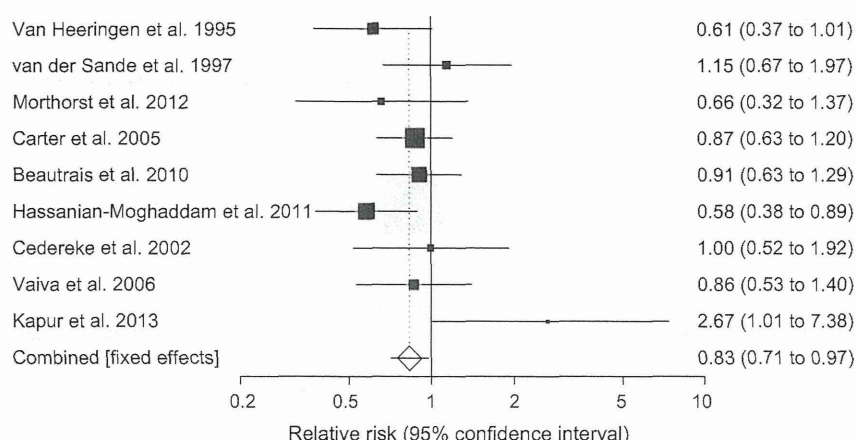
No publication bias was detected by the funnel plot or the Egger test.

3.4. Outcome findings

3.4.1. Repeat suicidal behavior

We performed a meta-analysis to examine the effect of each intervention group on repeat suicide within 12 months. Among the 24 trials, 11 reported the effects of interventions on a repeat suicide attempt within 12 months (Beautrais et al., 2010; Carter et al., 2005; Cedereke et al., 2002; Gibbons et al., 1978; Hassanian-Moghaddam et al., 2011; Kapur et al., 2013; Morthorst et al., 2012; Vaiva et al., 2006; van der Sande et al., 1997; Van Heeringen et al., 1995; Wei et al., 2013).

The results of a meta-analysis of nine trials ($n=5319$) of Active contact and follow-up group (Beautrais et al., 2010; Carter et al., 2005; Cedereke et al., 2002; Hassanian-Moghaddam et al., 2011;



Cochrane Q = 11.31 (df = 8) P = 0.18
 I^2 (inconsistency) = 29.2% (95% CI = 0 to 66.7)

Fig. 2. Repeat suicide attempt within 12 months in Active contact and follow-up intervention studies.

Kapur et al., 2013; Morthorst et al., 2012; Vaiva et al., 2006; van der Sande et al., 1997; Van Heeringen et al., 1995) are shown in Fig. 2. There was a statistically significant effect on prevention of a repeat suicide attempt (RR: 0.83; 95% CI: 0.71–0.97). Using the results of the medical chart review instead of the results of the telephone interview in the trial by Morthorst et al. (2012), the pooled RR (95% CI) increased to 0.90 (0.73–1.12), with no statistical significance. The pooled RR at 12 months of three trials ($n=1033$) of Intensive care plus outreach of Active contact and follow-up group (Morthorst et al., 2012; van der Sande et al., 1997; Van Heeringen et al., 1995) was 0.79 (95% CI: 0.52–1.19) (Cochrane $Q=3.00$, $p=0.22$; $I^2=33.1\%$, 95% CI=0–80.9). The pooled RR of six trials in the Letter/postcard and telephone intervention of Active contact and follow-up group ($n=4286$) (Beautrais et al., 2010; Carter et al., 2005; Cedereke et al., 2002; Hassanian-Moghaddam et al., 2011; Kapur et al., 2013; Vaiva et al., 2006) was 0.87 (95% CI: 0.68–1.12) (Cochrane $Q=8.13$, $p=0.15$; $I^2=38.5\%$, 95% CI=0–74.5).

The RR at 12 months of two psychotherapy trials ($n=559$) (Gibbons et al., 1978; Wei et al., 2013) was 0.86 (95% CI=0.54–1.37) as shown in Fig. 3.

Regarding repeat suicide attempts within 18 months, each group had no or only one trial.

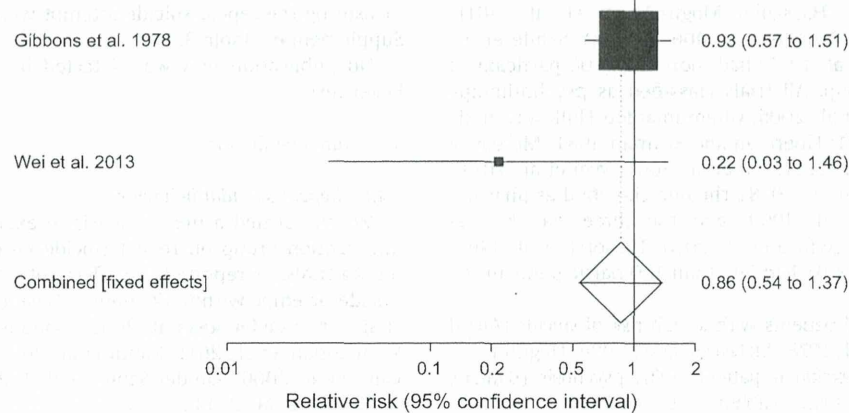
For repeat suicide attempts within 24 months, there were only two trials ($n=925$), both in the Active contact and follow-up group (Allard et al., 1992; Carter et al., 2007) (Fig. 4) and none in the other groups (Table 3). The pooled RR was 0.97 (95% CI: 0.76–1.22) as shown in Fig. 4.

3.4.2. Suicidal death

In the Active contact and follow-up intervention group, there were five trials ($n=1854$) reporting the outcome of death by suicide within 12 months (Cedereke et al., 2002; Morthorst et al., 2012; Vaiva et al., 2006; van der Sande et al., 1997; Van Heeringen et al., 1995). The pooled RR and the 95% CI are shown in Fig. 5 (RR: 0.83; 95% CI: 0.36–1.90).

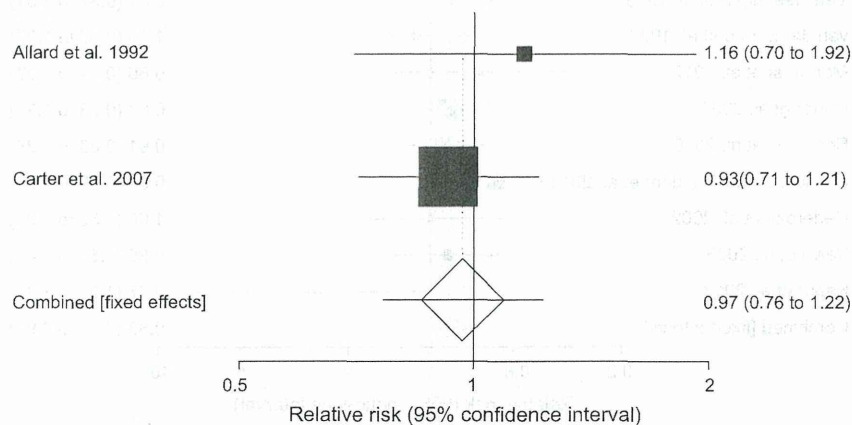
3.4.3. Outcome: any cause of death

Three trials ($n=2609$) reported outcomes of any cause of death within 12 months in the Active contact and follow-up intervention group (Hassanian-Moghaddam et al., 2011; Kapur et al., 2013; Morthorst et al., 2012). The pooled RR and 95% CI are shown in Fig. 6 (RR: 2.97; 95% CI: 0.89–9.90).



Cochrane $Q = 1.59$ ($df = 1$) $P = 0.21$

Fig. 3. Repeat suicide attempt within 12 months in Psychotherapy intervention studies.



Cochrane $Q = 0.59$ ($df = 1$) $P = 0.44$

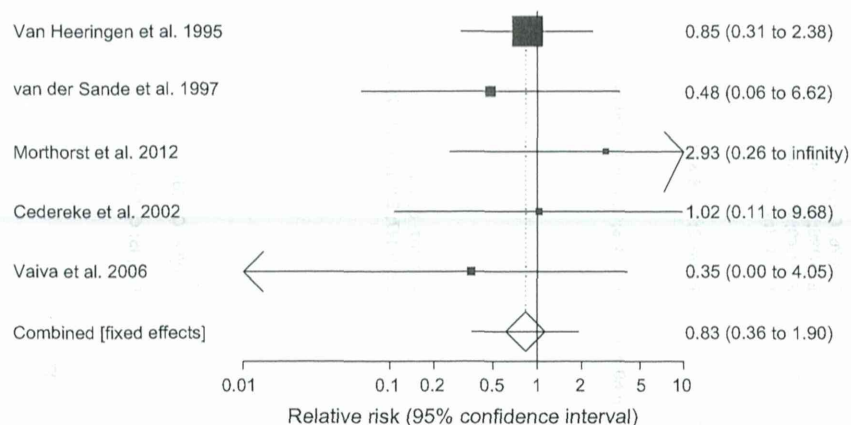
Fig. 4. Repeat suicide attempt within 24 months in Active contact and follow-up intervention studies.

Table 3
Results.

	Re-attempt	Death		
	No. of patients with re-attempt/No. of patients used in the analysis in each group	No. of re-attempts/No. of patients used in the analysis in each group	No. of any-cause deaths/No. of patients in the analysis in each group	No. of suicidal deaths/No. of patients used in the analysis in each group
Active contact and follow-up group (Intensive care plus outreach)				
Allard et al. (1992)	E: 22/63; C: 19/63	E: 60/63; C: 54/63	–	E: 3/76; C: 1/74
Van Heeringen et al. (1995)	E: 21/196; C: 34/195	–	15 died in both groups	E: 6/196; C: 7/195
van der Sande et al. (1997)	E: 24/140; C: 20/134	E: 32/140; C: 31/134	–	E: 1/140; C: 2/134
Morthorst et al. (2012)	E: 20/123; C: 13/120 (medical recorded) E: 11/95; C: 13/74 (self-reported)	–	E: 2/123; C: 1/120	E: 1/123; C: 0/120
Active contact and follow-up group (Brief intervention and contact)				
Fleischmann et al. (2008), Bertolote et al. (2010)	E: 66/863; C: 60/800	–	E: 11/872; C: 22/827	E: 2/872; C: 18/827
Active contact and follow-up group (Letter or postcard)				
Carter et al. (2005, 2007, 2013)	E: 57/378; C: 68/394 in 12 months	E: 101/378; C: 192/394 in 12 months	E: 22/378; C: 22/394 in 60 mo	E: 5/378; C: 6/394 in 60 mo
	E: 80/378; C: 90/394 in 24 months	E: 145/378; C: 310/394 in 24 months	–	–
	E: 94/378; C: 107/394 in 60 months	E: 252/378; C: 484/394 in 60 months	–	–
Beautrais et al. (2010)	E: 39/153; C: 49/174	E: 87/153; C: 136/174	–	–
Hassanian-Moghaddam et al. (2011)	E: 31/1043; C: 55/1070	E: 34/1043; C: 58/1070	E: 7/1150; C: 2/1150	–
Active contact and follow-up group (Telephone)				
Cedereke et al. (2002)	E: 14/83 vs. C: 15/89	E: 26/83 vs. C: 27/89	–	E: 1/107; C: 1/109
Vaiva et al. (2006)	E1: 24/147; E2: 20/146; C: 59/312	–	6 died in three groups	E1: 0/147; E2: 1/146; C: 2/312
Active contact and follow-up group (Composite of letter/postcard and telephone)				
Kapur et al. (2013)	E: 11/33; C: 4/32	E: 41/33; C: 7/32	E: 1/33; C: 0/32	–
Psychotherapy group				
Gibbons et al. (1978)	E: 27/200; C: 29/200	–	–	–
Liberman and Eckman (1981)	E1: 3/12; E2: 2/12	E1: 5/12; E2: 6/12	–	–
McLeavey et al. (1994)	^a E1: 2/19; E2: 5/20	–	–	–
Guthrie et al. (2001)	E: 5/58; C: 17/61	–	–	E: 0/58; C: 0/61
Raj et al. (2001)	–	–	–	–
Brown et al. (2005), Ghahramaniou-Holloway et al. (2012)	E: 13/45; C: 23/40	–	E: 1/45; C: 3/40	E: 0/45; C: 1/40
Bannan (2010)	E: 0/9; C: 0/9	–	–	–
Ougrin et al. (2011)	–	–	–	–
Wei et al. (2013)	E1: 1/25; E2: 1/36; C: 5/27	–	E1: 1/25; E2: 0/36; C: 0/27	–
Pharmacotherapy group				
Battaglia et al. (1999)	The numbers of patients with re-attempt were not shown ($p=0.15$ in change of numbers of "serious" self-harm/month between E1 and E2)	–	–	–
Miscellaneous group				
Torhorst et al. (1987)	E1: 12/65; E2: 4/68	–	–	–
Waterhouse and Platt (1990)	–	–	–	–
Crawford et al. (2010)	E1: 7/51; E2: 11/52	–	E1: 1/51; E2: 0/52	–

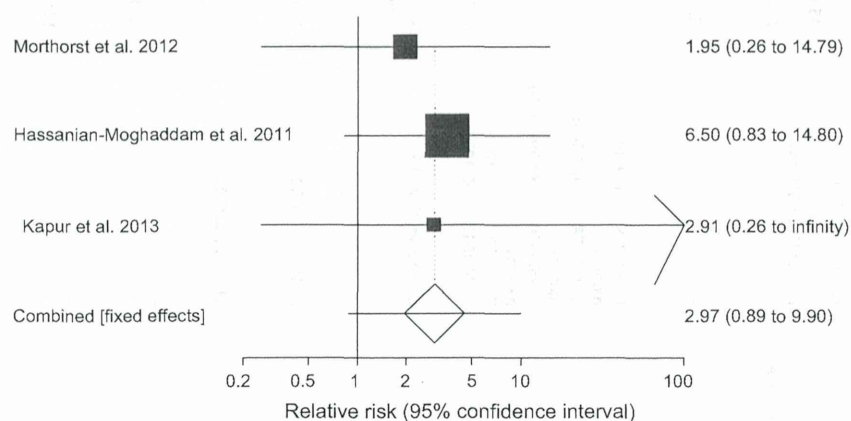
Abbreviations: E, experimental intervention group; C, control group.

^a Five patients who dropped out from treatment were not assessed.



Cochrane Q = 1.10 (df = 4) P = 0.89
 I^2 (inconsistency) = 0% (95% CI = 0 to 64.1)

Fig. 5. Suicide deaths within 12 months in Active contact and follow-up intervention studies.



Cochrane Q = 2.97 (df = 2) P = 0.92
 I^2 (inconsistency) = 0% (95% CI = 0 to 72.9)

Fig. 6. Any-cause deaths within 12 months in Active contact and follow-up intervention studies.

4. Discussion

4.1. Summary of results of the meta-analysis

Twenty-four trials were identified and classified into four intervention groups (Active contact and follow-up, Psychotherapy, Pharmacotherapy, and Miscellaneous). Our meta-analysis showed that active contact and follow-up type interventions were effective in preventing a repeat suicide within 12 months in patients admitted to EDs for a suicide attempt. However, the long-term effect at 24 months was not confirmed. Also, the effects of the interventions in preventing death by suicide has not been confirmed yet, because the number of trials assessing suicidal deaths was small, and the sample size of each trial was too small to detect significant differences in deaths by suicide.

The effects of the other interventions in preventing a repetition of suicidal behavior remain unclear. In some trials (Allard et al., 1992; Battaglia et al., 1999; Brown et al., 2005; Crawford et al., 2010; Ghahramanlou-Holloway et al., 2012; Gibbons et al., 1978; Guthrie et al., 2001; Torhorst et al., 1987; Wei et al., 2013), the proportion of adherence to interventions was relatively low. In addition, some trials examined only psychometric outcomes, and not suicidal behavior. The proportion of follow-up of outcomes in some trials (Brown et al., 2005; Cedereke et al., 2002;

Ghahramanlou-Holloway et al., 2012; Van Heeringen et al., 1995; Wei et al., 2013) was also low.

4.2. Comparison with other systematic reviews

Previously, Luxton et al. performed a systematic review to examine the effect of follow-up interventions on suicidal behavior in patients discharged from inpatient psychiatry departments and EDs (Luxton et al., 2013). However, they did not perform a meta-analysis. They reported that repeated follow-up contact reduced suicidal behavior, based on the finding that three of 11 trials showed a statistically significant reduction in repeat suicidal attempts, and two studies reported a reduction in suicidal deaths. Our findings are consistent with their report. Therefore, our present study confirmed and extended their initial findings with meta-analysis.

Several systematic reviews have previously been published, although the participants were not limited to patients admitted to the ED after suicidal injury. Hawton et al. (1998, 2009) performed a systematic review to examine the effects of psychosocial and pharmacological interventions on deliberate self-harm. However, the number of trials was too small at that time, and the review concluded that there remains considerable uncertainty regarding the outcome of the interventions. Crawford et al. (2007)

performed another systematic review of psychosocial interventions following self-harm. The meta-analysis included 18 trials with various intervention types and suggested that psychosocial interventions had no marked effect on suicide deaths. O'Connor et al. (2013) showed a significant effect of psychotherapy and a positive trend of the effect of enhanced usual care on suicide attempts in primary care settings (pooled RR: 0.86; 95% CI: 0.56–0.83 in 11 trials). Therefore, our present study confirms the beneficial effect of interventions at least for patients admitted to the ED with suicidal injury.

4.3. Strengths and limitations of study

This is the first systematic review and meta-analysis assessing the effects of interventions in patients admitted to the ED for injury caused by their suicidal behavior. The results of the meta-analysis suggest that interventions of active contact and follow-up reduce the risk of a repeat suicide attempt at 12 months. The findings may have implications for future clinical policy-making to prevent repeat suicidal behavior in patients admitted to the ED for a suicide attempt.

There are several limitations of this review. We classified the type of interventions for convenience into Active contact and follow-up, Psychotherapy, Pharmacotherapy, and Miscellaneous groups, but many of the trials combined several interventions. Although the I^2 and Cochrane Q statistics were smaller than 30% and more than 0.10, respectively, in most of the meta-analyses, caution is needed regarding the heterogeneity of the effects and the interpretation of the results. In addition, for the outcome of suicidal deaths, the statistical power was too weak to conclude that there was a beneficial effect of intervention because the number of deaths by suicide was very low even in the high-risk ED population.

4.4. Implication for research

Although our present systematic review showed the effectiveness of active contact and follow-up interventions to reduce the risk of a repeat attempt at 12 months, a large, quality, randomized controlled trial is needed to confirm our findings. In addition, a long-term effect of the intervention has not been confirmed in this study. When a long-term effect is not demonstrated, further studies are required to develop a novel intervention to reduce the long-term risk of a repeat suicide attempt.

The proportion of follow-up interviews with participants was relatively low compared with the proportion of medical records used for follow-up. A previous study reported paradoxical results between results obtained from medical record and those from self-report (Morthorst et al., 2012). Given that the validity of each assessment measure may be different, a valid and consistent assessment measure is needed for future trials.

Many trials did not measure and/or report adherence to intervention, even though some trials hypothesized that increasing adherence to intervention is a key process in preventing suicide. There may be room for improvement in increasing adherence to intervention to increase the effectiveness of intervention in preventing suicidal behavior and death by suicide.

In this study, the effects of interventions on death by suicide were unclear, because the number of trials assessing suicidal deaths was small. More studies are needed to determine the effect of interventions on suicidal deaths.

4.5. Implication for practice

Interventions of active contact and follow-up are recommended to reduce the risk of a repeat suicide attempt in patients

admitted to the ED for a suicide attempt at 12 months. It is already known that a majority of suicide attempters suffer from severe psychiatric disorders including mood disorders (Beautrais et al., 1996; Haw et al., 2001; Hawton et al., 2003; Kawashima et al., 2014; Rihmer et al., 2009; Suominen et al., 1996; Yamada et al., 2007). However, suicide attempters are often discharged from EDs without undergoing a psychiatric assessment, despite their risk of suicide (Hickey et al., 2001; Olfson et al., 2013). In EDs, it can be difficult to assess patients who often leave without a psychiatric evaluation or who are admitted to the ED on evenings and weekends when psychiatric staff availability may be limited (Bennewith et al., 2004; Hickey et al., 2001). Even though patients may be referred for outpatient treatment follow-up after ED discharge, only 25–50% actually attend outpatient appointments within 1 month of the suicide attempt (Van Heeringen et al., 1995). Implementation of procedures for assessment of patients and for monitoring adherence to interventions would be expected.

5. Conclusion

This meta-analysis suggests that interventions of active contact and follow-up may reduce the risk of a repeat suicide attempt at 12 months in patients admitted to the ED with suicidal injury. However, the long-term effects in preventing further suicidal behavior and death by suicide were not confirmed. Therefore, large, randomized, controlled trials with better quality and comparable outcome measures are needed to confirm the effectiveness of interventions.

Role of funding source

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Conflict of interest

Dr. Inagaki reports grants from the Ministry of Health, Labour and Welfare, personal fees from Pfizer Japan Inc., personal fees from Mochida Pharmaceutical Co., Ltd., personal fees from Nippon Hyoron Sha Co., Ltd., personal fees from Nanzando Co., Ltd., personal fees from Seiya Shoten Co., Ltd., personal fees from Igaku-shoin Ltd., and personal fees from Technomics, Inc., outside the submitted work. Dr. Kawanishi reports grants from The Ministry of Health, Labour and Welfare, Japan, grants from The Ministry of Education, Culture, Sports, Science and Technology, Japan, grants from The Japan Science and Technology Agency, personal fees from Meiji Seika Pharma Co., Ltd., personal fees from GlaxoSmithKline K.K., and personal fees from Pfizer K.K., outside the submitted work. Dr. Ikeshta reports personal fees from Mochida Pharmaceutical Co., Ltd., outside the submitted work. Dr. Yamada reports grants from The Ministry of Health, Labour and Welfare, Japan, during the conduct of the study; grants from The Ministry of Education, Culture, Sports, Science and Technology, Japan, grants from The Japan Science and Technology Agency, grants from National Center of Neurology and Psychiatry, personal fees from Meiji Seika Pharma Co., Ltd., personal fees from MSD K.K., personal fees from Asahi Kasei Pharma Corporation, personal fees from Seishin Shobo, personal fees from Seiya Shoten Co., Ltd., personal fees from Igaku-shoin Ltd., personal fees from Chogai Igakusha, and personal fees from Sentan Igakusha, outside the submitted work. No other authors report potential conflict of interest.

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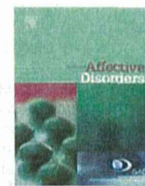
Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.jad.2014.12.048>.

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Research report

Prevalence of suicide attempters in emergency departments in Japan: A systematic review and meta-analysis

Yoshitaka Kawashima^a, Naohiro Yonemoto^b, Masatoshi Inagaki^c, Mitsuhiko Yamada^{a,*}

^a Department of Neuropsychopharmacology, National Institute of Mental Health, National Center of Neurology and Psychiatry, 4-1-1, Ogawahigashimachi, Kodaira, Tokyo 187-8553, Japan

^b Department of Epidemiology and Biostatistics, Translational Medical Center, National Centre of Neurology and Psychiatry, Kodaira, Tokyo, Japan

^c Department of Neuropsychiatry, Okayama University Hospital, Kita-ku, Okayama, Japan

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ABSTRACT

Background: The number of hospital admissions related to suicide attempts is increasing worldwide. The Emergency Department (ED) is recognized in Japan as an opportunity to intervene with suicide attempters however, the prevalence of suicide attempters in the ED is unknown. Therefore, a meta-analysis was conducted to provide this information.

Methods: We conducted searches of databases (PubMed, PsycINFO, CINAHL, ICHUSHI, CiNii) to identify studies about suicide attempters in the ED in Japan. A meta-analysis was used to calculate the pooled prevalence proportion of suicide attempters in the ED, and their prevalence proportion of psychiatric disorder and method of suicide in suicide attempters.

Results: The search of Japanese studies identified 3338 records, of which 70 were included in the meta-analysis. A total of 25 studies reported the psychiatric diagnosis and 62 studies reported the method of suicide. The pooled prevalence proportion of suicide attempters was 4.7%. Mood disorders were the most frequent psychiatric disorders (ICD: 30%, DSM: 35%), and poisoning was the most frequent method of attempting suicide (52%).

Limitations: There might be a publication bias because only published studies were included. There also might be an information bias, such as reporting bias or misclassification, because most of studies included in the analysis used retrospective designs.

Conclusions: The results provide clear evidence of the prevalence of suicide attempters in the ED in Japan. The results indicate that suicide attempters in the ED have a higher proportion of mood disorders, and that the most common method of suicide is poisoning.

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1. Background

It is widely recognized that prior suicide attempts and a history of non-suicidal, self-harm behaviors are risks for death by suicide and repeated self-harm behaviors (Ekeberg et al., 1991; Isometsa and Lonnqvist, 1998; Nielsen et al., 1990; Nordstrom et al., 1995; Beautrais, 2004). For suicide attempters, the emergency department (ED) frequently functions as the primary, or sole point of contact with the health care system (Kurz and Moller, 1984; Talor and Stansfeld, 1984). In recent years, the number of hospital admissions attributable to attempted suicides and self-inflicted injuries has been increasing worldwide.

In the UK, it has been estimated that approximately 220,000 patients with self-inflicted injuries visit hospitals annually (Hawton et al., 2007). The average number of ED visits for attempted suicide and self-inflicted injuries, per year, in the United States of America (US) more than doubled from approximately 244,000 in 1993–1996 to 538,000 in 2005–2008 (Ting et al., 2012a). A national registry study in Ireland reported that the increased rate of deliberate self harm among Irish men in 2008 and 2009 coincided with the advent of the economic recession in Ireland (Perry et al., 2012).

A national US survey estimated there were approximately 412,000 annual ED visits for attempted suicide and self-inflicted injury during the 5-year period between 1997 and 2001, which was 0.4% of all ED visits (Doshi et al., 2005). The data were obtained from the National Hospital Ambulatory Medical Care Survey in the US, which is a national probability sample of ED visits.

* Corresponding author. Tel.: +81 42 341 2711; fax: +81 42 346 1994.

E-mail addresses: kawashima@ncnp.go.jp (Y. Kawashima), nyonemoto@gmail.com (N. Yonemoto), masatoshiinagaki@okayama-u.ac.jp (M. Inagaki), mitsu@ncnp.go.jp (M. Yamada).

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The suicide rate in Japan at approximately 25.0 per 100,000 individuals is the highest among developed countries (National Police Agency, 2012; World Health Organization, 2012). Therefore, ED visits are increasingly recognized in Japan as an opportunity for psychiatrists and clinical psychologists to intervene with suicide attempters. Indeed, the care of suicide attempters is specifically emphasized in the General Principles of Suicide Prevention Policy (GPSP), which was adopted in Japan (Cabinet Office, Government of Japan, 2007, 2012). Given this situation, a number of small studies have examined the prevalence of suicide attempters in the ED, as shown in the result section of this manuscript. However, the prevalence of suicide attempters among all individuals in the ED is still unknown in Japan.

Therefore, in this study, we conducted a systematic review and meta-analysis of the prevalence of suicide attempters among all individuals who are treated at the ED in Japan. In addition, the study examined: (a) the prevalence of psychiatric disorders among the suicide attempters; and (b) the methods of suicide.

2. Methods

2.1. Search strategies

We searched for published studies related to suicide in the following electronic databases, from their inception to March 2013: PubMed (from 1949), PsycINFO (from 1806), and CINAHL (from 1981). The search phrase was: ((suicid*) OR (self-harm*) OR (self harm*)) AND ((emergency) OR (critical care)) AND (japan*).

Two additional databases were also searched: ICHUSHI (from 1983) and CiNii (from 1881). ICHUSHI (<http://search.jamas.or.jp/>) contains bibliographic citations and abstracts from biomedical journals and other serial publications published in Japan. CiNii (<http://ci.nii.ac.jp/>) provides information about academic articles published in academic society journals, university research bulletins or articles included in the National Diet Library's Japanese Periodicals Index Database and other databases. Since these two databases are electronic databases in Japanese, we used comparable Japanese search terms without the term (japan*) to search them. In addition, we examined the list of references included in the articles.

2.2. Definition of terms used in this study

The terminology for suicide attempt and self-harm has been inconsistent (Hawton et al., 2012). Therefore, we defined suicide attempters as individuals who survived a suicide attempt or self-harm, and our definition of suicide attempt included self-harm.

2.3. Inclusion criteria

We included studies if they met the following inclusion criteria: (1) All participants had been treated at an emergency department because of a suicide attempt; (2) The study was conducted in Japan; and (3) The study was an original article.

2.4. Exclusion criteria

We excluded studies if they met the following exclusion criteria: (1) The number of all individuals treated at the ED was not described in manuscripts; (2) The subjects included only psychiatric patients with specific psychiatric diagnoses and specific methods of suicide.

2.5. Review process

All records that were identified from searches of the electronic databases and hand searches were loaded into the ENDNOTE software version X5 (Thomson Reuters, USA). After the records were loaded, we removed duplicate records and all the authors independently screened the titles and abstracts to identify potentially eligible studies. Then, articles that were potentially eligible for inclusion in the review were obtained and independently assessed for inclusion by all authors. In cases of disagreement, a decision was reached by mutual consent after discussion.

2.6. Extraction of data

All authors independently extracted data about the number of total individuals in the ED, suicide attempters, and psychiatric diagnosis. The diagnoses were classified in the studies, according to International Statistical Classification of Diseases and Related Health Problems (ICD, WHO) or the Diagnostic and Statistical Manual of Mental Disorders (DSM, APA), including the Mini-International Neuropsychiatric Interview (MINI) and the Structured Clinical Interview for the DSM-IV (SCID). We also extracted data about the method of suicide mentioned in the studies. Any disagreements about extraction of data were resolved by consensus after discussion.

2.7. Data synthesis and statistical analysis

Our primary outcome was the pooled prevalence proportion of suicide attempters in all individuals treated at the ED. The pooled prevalence proportion of deaths after admission to the ED was also calculated. Additionally, we calculated the pooled prevalence proportion of psychiatric disorder according to the ICD and the DSM in suicide attempters.

Using the ICD classification, we identified and extracted the data for: F1 disorders (mental and behavioral disorders due to psychoactive substance use), F2 disorders (schizophrenia, schizotypal and delusional disorders), F3 disorders (mood disorders), F4 disorders (neurotic, stress-related and somatoform disorders), F5 disorders (behavioral syndromes associated with physiological disturbances and physical factors), F6 disorders (disorders of adult personality and behavior). We identified substance-related disorders, schizophrenia, mood disorders, adjustment disorders, anxiety disorders, eating disorders, and personality disorders, according to the DSM from the extracted data. We did not divide the data into subcategories among the psychiatric diagnosis in the ICD and DSM, because some studies had few data about the subcategories among the psychiatric diagnoses.

Furthermore, we calculated the pooled prevalence proportion of method of suicide in suicide attempters. We identified the data about poisoning, cutting, jumping, hanging, and burning from the extracted data. The meta-analysis and related statistical analyses were carried out with the StatsDirect statistical software version 2.7.9 (Cheshire, UK). We calculated the pooled prevalence proportion and its 95% confidence intervals (CIs) with a fixed effects model and a random effects model (DerSimonian and Laird, 1986). If the heterogeneity was low, we used a fixed effects model to calculate the pooled prevalence proportion. Otherwise, we used a random effects model. We used the I^2 statistic and its 95% CIs to estimate heterogeneity. The I^2 was considered to be low when it was 0–24% (Higgins et al., 2003). We performed subgroup analysis by hospital type (university or others) or urban density (rural or urban areas).