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## Taking care of suicidal patients with new technologies and reaching-out means in the post-discharge period

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### Abstract

Suicide is a global public health problem with over one million people dying by suicide each year worldwide. Research efforts have focused on developing and testing novel suicide prevention strategies employing recent technological advances. In order to provide a review regarding the role of new technologies (*e.g.*, postcards/letters, text messages, crisis cards, telephone contacts, online interventions) in suicide prevention, we searched PubMed, ScienceDirect, ResearchGate, and Crisis to identify all papers in English from 1977 to 2016. Our results indicated that brief contact interventions show promise in reducing the number of episodes of repeated self-harm and/or suicide attempts following discharge from the Emergency Department or psychiatric units. Innovative methods of contact (*e.g.*, text messages) are easily implemented by clinicians and received by patients in the period of post discharge and have been shown to be beneficial. However, more research employing randomized clinical trials investigating the potential benefits of these novel suicide prevention methods is warranted. Future researchers should continue improving and testing new technologies in the prevention of suicide.

**Key words:** Suicide; Letters; Postcards; Emails; Sms; Telephone

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**Core tip:** Several studies have shown that several reaching-out means (*e.g.*, letters, postcards, sms, emails)



are useful and beneficial for healthcare professionals in preventing suicide and self-harm attempts. In this review we wanted to evaluate how these means could influence the number of episodes of repeated self-harm and/or suicide attempts after discharge from emergency department or psychiatric wards. We have shown that these innovative methods of contact are well accepted by patients in the post-discharge period and are easily used in preventing suicide and self-harm reattempts even though future researchers should continue improving and testing new technologies in the prevention of suicide.

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## INTRODUCTION

Suicide is a severe public health problem with more than one million deaths reported per year internationally<sup>[1]</sup>. Moreover, suicide ranks among the ten major causes of death worldwide and it is a leading cause of death among youth and young adults in many countries<sup>[2-5]</sup>. Individuals who have been admitted to psychiatric inpatient units are at a particularly high risk for suicide<sup>[6-8]</sup>. For these patients, the highest risk period for a relapse is immediately following discharge<sup>[9-20]</sup>. Cutcliffe *et al.*<sup>[21]</sup> aimed to understand why this time period has been identified as the highest risk. In their study, participants indicated a sense of feeling lost, disorientated, and uncertain after discharge. Some patients reported feeling "disoriented" in their daily lives. Accordingly, there is significant usefulness in making a post-discharge treatment plan in collaboration with the client, which can subsequently explore pragmatic issues such as "what will I have to do next?", "what issues must I face first?", and "where will I seek help?"

Some patients recognize an increased risk of reattempt following discharge because they become lonely when they return home. Indeed, patients recognize the need to interact with individuals (patients and staff) while on the unit. Even the mere presence of other patients and health care professionals is beneficial to those who have attempted suicide and need support. The hospitalization of a patient following a suicide attempt may be considered the first step in a long prevention strategy. It is critical that mental health professionals acknowledge that a substantial portion of recovery in suicidal patients occurs at the end of the acute period especially when they prepare for discharge and in the post-discharge period. Beautrais<sup>[22]</sup> observed that for many patients who have attempted suicide, the situation has not changed following a suicide attempt because they do not receive the help they need. Patients

who are discharged post-suicide attempt often encounter barriers during their recovery and may seriously consider suicide and/or make another attempt. Also, these patients often want to start over, but do not know where to begin, do not know what to do, and frequently do not know who to ask for help solving their problems. Individuals who have received some form of aid in the post-discharge period consider this a form of security. According to Cutcliffe *et al.*<sup>[21]</sup>, this kind of help is more useful when it is offered by mental health professionals. Moreover, it turns out to be very useful to the patient and professional(s) develop a treatment plan collaboratively, which includes determining which support method should be employed (e.g., telephone calls, e-mails, letters, SMS, etc.) immediately following discharge.

There is the need for the suicidology community to perhaps revisit what should be considered an appropriate timeframe for managing suicidality. In such a model, clinicians and researchers would acknowledge that the majority of the rehabilitation work for reducing suicide risk is likely to be undertaken in post-discharge period. All suicides and suicide attempts affect others, particularly "survivors", such as spouses, parents, children, relatives, friends, colleagues, and peers of those who have made a suicidal gesture, both immediately and in the long term. Suicide represents a major challenge for health care providers and society as a whole, especially in terms of prevention. New technologies have entered the field of suicide prevention with high expectations for the future, despite a relatively slow start.

Over the last decade, the internet has played an increasingly influential role in people's lives, particularly among young adults in middle and high income countries. Internet users now access the social media platforms to create, exchange and share their own content and experiences<sup>[23,24]</sup>. The Internet, mobile phones and self-help programs have the strong potential to achieve, sustain and help people who attempt suicide, their families, health professionals, and the suicide survivors. Globally, the use of new technologies have been demonstrated to be a useful and easily applicable approach to suicide prevention, which can be implemented by volunteers and professionals, from crisis lines, suicide prevention centers, mental health centers, researchers, and politicians<sup>[25]</sup>.

The aim of the present review is to understand the role of new technologies for reducing self-harm, suicide attempt, and death by suicide, while paying particular attention to post-discharge from an Emergency Department (ED) or Psychiatric Ward. We also assess usability, validity, and effectiveness of letters, text messages, crisis cards, telephone contacts, and online interventions compared to current prevention techniques.

## MAIN OUTCOME MEASURES

The primary outcomes considered in this review were: (1) The occurrence of any subsequent episode of self-

harm and/or suicide attempt post-discharge; (2) The number of repeated episodes of self-harm and/or attempted suicide per person post-discharge; and (3) the total number of suicide deaths.

## POSTCARD/LETTERS/CRISIS CARD/ GREEN CARD

Motto *et al.*<sup>[26]</sup> assessed the efficacy of a long-term contact program on the prevention of suicide. They randomly divided 843 patients hospitalized because of a depressive episode and/or suicidal state who had declined or discontinued treatment during the last 30 d (a total of 3005 individuals were contacted 30 d after discharge about follow-up treatment). Patients in the experimental group ( $n = 389$ ) were contacted through a short letter correspondence for five years. The schedule for these contacts was sent monthly for four months, then every two months for eight months, and finally every three months for four years (a total of 24 letters for five years). The control group ( $n = 454$ ) received no further contact. The authors found that patients in the intervention group had a lower suicide rate across all five years as compared to the control group, suggesting a preventative influence of the contacts. Conversely, reducing and/or discontinuing contacts may decrease and eventually eliminate this effect.

Hassanian-Moghaddam *et al.*<sup>[27,28]</sup> conducted a RCT to evaluate the efficacy of a postcard intervention plus treatment as usual (TAU) vs TAU of three primary outcomes: suicidal ideation, suicide attempts, and self-cutting (or self mutilation) in a follow up of 12 and 24 mo in two separate studies. They sent nine postcards over 12-24 mo to 1150 patients discharged from the Lohman-Hakim Poison Hospital. Eight postcards were sent at 1, 2, 3, 4, 6, 8, 10 and 12 mo after discharge. In the second study, a postcard was also sent 24 mo after discharge. Each participant received a ninth postcard on his birthday, with the other 1150 patients receiving TAU. The researchers found that suicidal ideation and suicide attempts were reduced by a postcard intervention. Specifically, there was a beneficial effect on suicidality during the 12-24 mo follow-up period.

Carter *et al.*<sup>[29]</sup> conducted a RCT to evaluate the effectiveness of an intervention using postcards (postcards from Edge project) in reducing repetitions of hospital treated deliberate self-poisoning in a follow up period of 1<sup>[29]</sup>, 2<sup>[30]</sup> and 5 years<sup>[31]</sup>. Participants ( $n = 772$ ) were randomized into an intervention group ( $n = 378$ ) and a control group ( $n = 394$ ). The intervention group received a postcard at 1, 2, 3, 4, 6, 8, 10 and 12 mo after discharge from the toxicology service with deliberate self-poisoning. The rate of hospital-treated-self-poisoning events was reduced by 50% over a 1-year, 2-years and 5-years period through the use of a postcard intervention, although it did not significantly reduce the proportion of individuals who repeated self-poisoning.

Beautrais *et al.*<sup>[32]</sup> conducted a RCT to determine if a postcard intervention reduced repeated self-harm in persons aged 16 and older, who admitted to psychiatric emergency services at Christchurch Hospital, New Zealand, following self-harm or attempted suicide. Participants ( $n = 327$ ) were randomized into two groups, one of which ( $n = 174$ ) received TAU; whereas, the other ( $n = 153$ ) received TAU plus the postcard intervention. The postcard intervention consisted of a set of six "postcards" sent by mail during the 12 mo following discharge at 2 and 6 wk; 3, 6, 9 and 12 mo. No significant differences were found between the control and intervention groups with regards to the proportion of participants re-presenting with self-harm to the psychiatric emergency department, ED, or to either the psychiatric emergency or ED. Moreover, the use of this intervention had not shown a reduction in the total number of re-presentations for self-harm to the ED or to either the psychiatric emergency service or the ED. However, a reduction in the total number of re-presentations to the psychiatric emergency service was associated with postcard intervention, although the significance of this effect must be considered marginal given that the significance level exceeded the adjusted boundary  $P$  value.

Evans *et al.*<sup>[33]</sup> conducted a RCT to evaluate, through a follow-up of 6 mo<sup>[33]</sup> and 12 mo<sup>[34]</sup>, the usefulness of crisis cards in the repetition of a self-harming group of hospital-admitted patients. In the RCT, the researchers recruited 827 patients admitted to hospital following self-harm. Approximately half of the study participants received a card crisis while all others received standard treatment. In addition to treatment as usual, the intervention group was offered telephone support should any further crises arise. The main outcome assessed in this study was represented by repetition of deliberate self-harm within 6 mo and 12 mo of the index event. At 6-mo follow-up, the authors had shown that sending a card offering 24-h crisis telephone consultation is not effective on the repetition of self-harm. However, among those presenting following a first episode, a possible benefit was reported. At 12 mo follow up, the results confirmed no overall benefit of the intervention. Among those with a first episode of self-harm, the possible benefit of the intervention had diminished although only a modest effect was detected.

Cotgrove *et al.*<sup>[35]</sup> evaluated the usefulness of an intervention for the prevention of suicide reattempts using green cards in adolescents 16 years of age or younger who were discharged from the hospital following a suicide attempt. After discharge, these adolescents were randomized into an experimental ( $n = 47$ ) and a control group ( $n = 58$ ). A green card which served as a passport to readmission into a pediatric ward at their local hospital was sent to the participants in the experimental group. If adolescents felt suicidal, they would be able to obtain immediate admission to the hospital. Adolescents in the control group received

standard treatment from their clinic or child psychiatric department. For one year after the suicide attempt, information was collected through green cards. In the year of follow up, only 3 (6%) patients in the experimental group made a suicide attempt and 5 (11%) made use of their green cards; whereas, in the control group, 7 (12%) attempted suicide. Although the repeat rate for those without green cards was twice that of those with green cards (12% vs 6%), this difference did not reach statistical significance ( $P = 0.26$ ). It was observed that adolescents used the green card properly, considering it as a solution to their problems, knowing that they could be hospitalized if necessary.

## LETTERS AND TELEPHONE CONTACT

Mouaffak *et al*<sup>[36]</sup> developed a follow-up intervention program called the organization of a suitable monitoring for suicide attempters (OSTA), which aimed to test the efficacy of a 1-year RCT. In this study individuals ( $n = 320$ ) admitted to the psychiatric ED and the Psychiatric Department of the University Hospital of Bicêtre, France, were randomly assigned to receive either the OSTA program ( $n = 160$ ) or a control treatment ( $n = 160$ ). On an intention to treat basis, the proportion of patients who reattempted suicide did not differ significantly at 12 mo, between the intervention arm and the control arm. There was also a nonsignificant difference found between the two groups in the number of suicide attempts in the intervention vs the control group. For the repeaters, the percentage of those who have attempted suicide in the experimental group is only slightly higher than that of the control group (23.4% vs 23.3%).

Kapur *et al*<sup>[37]</sup> carried out a pilot RCT to evaluate if periodic contact after an act of self-injury can influence self-destructive behavior. Participants were admitted to the ED after self-harm and then randomized to the control ( $n = 33$ ) or intervention group ( $n = 33$ ). The intervention included an information leaflet listing sources of help, two telephone calls during the first 2 wk, and letters sent at 1, 2, 4, 6, 8 and 12 mo. After 12 mo, the rate of repetition of self-harm behavior was higher in the intervention group than control group.

## TELEPHONE CONTACT

De Leo *et al*<sup>[38]</sup> conducted a study that showed encouraging results regarding the use of telephone contact to reduce suicidal behavior. The researchers compared the suicide rate between people connected to the service and the general population in the Veneto region of Italy. Tele-Help/Tele-Check included both an active help system to call and a service that provided a phone call about twice a week. During the 4 years of follow up, only one death by suicide was reported in the intervention group compared with the expected value of 7.44 for the general population. This study was replicated by De Leo *et al*<sup>[39]</sup>, which evaluated the

impact of telephone contact after 10 years of follow up (from 1988 to 1998). Only 6 deaths by suicide occurred during this time period, which were less than expected ( $n = 20.86$ ) and confirmed the benefit of the Tele-Help/Tele-Check service.

Cedereke *et al*<sup>[40]</sup> conducted a randomized controlled trial to determine if telephone contacts can have an effect on suicidal behavior after a suicide attempt. Patients ( $n = 107$ ) received a telephone call at 4 and 8 mo following discharge from a Medical Emergency Inpatient Unit and 109 subjects did not receive the intervention. Two suicide deaths occurred during the 12 mo-follow up: One woman belonging to the intervention group and one man belonging to the control group. There were no significant differences in subjects who died by suicide: 14 subjects in the intervention group (17%) and 15 in the control group (17%).

Vaiva *et al*<sup>[41]</sup> conducted a randomized controlled trial in order to demonstrate that a telephone call can reduce numbers of reattempted suicide. Subjects discharged from the ED after a suicide attempt by drug overdose were randomly assigned to three different groups: One group received telephone contact at one month; another group received telephone contact at three months and the last group did not receive any telephone contact (control group). Numbers of reattempted suicides was significantly lower in the group that received a telephone call after one month than the control group (12% vs 22%). For people contacted at three months, the difference was not significantly lower than control group (17% vs 22%).

Fleischmann *et al*<sup>[42]</sup> recruited 1867 suicide attempters from emergency departments at 5 different countries: (Brazil, India, Sri Lanka, Islamic Republic of Iran, China) and conducted a RCT to investigate the role of periodic contact on suicidal behavior. All participants were randomly assigned to receive 1 h of brief intervention as close to the time of discharge as possible and nine follow-up contacts after discharge or to receive only treatment of somatic symptoms related to a suicide attempt (control group receiving treatment as usual - TAU). The primary outcome measure was the number of deaths by suicide. At 18-mo follow-up, 18 participants (2%) in the control group died by suicide vs 2 subjects (0.2%) in the intervention group.

Bertolote *et al*<sup>[43]</sup>, starting from the RCT of Fleischmann *et al*<sup>[42]</sup>, evaluated rates of repeated suicide attempts as the secondary outcome during 18-mo of follow up. No significant difference between the two groups was shown in the results of this study. This result did not confirm the encouraging reduction of suicide mortality previously demonstrated by Fleischmann *et al*<sup>[42]</sup>.

Cebrià *et al*<sup>[44]</sup> conducted a case-control study to evaluate the efficacy of a telephone contact program. Patients discharged from the ED following a suicide attempt were included. Participants of the intervention group ( $n = 296$ ) received a telephone call after 1 wk, thereafter at 1, 3, 6, 9 and 12-mo intervals.

The patients in the control group ( $n = 218$ ) received treatment as usual without additional telephone contact during 1-year follow-up. Results showed that the telephone contact program was associated with a low rate of patients who reattempted suicide compared to the previous year and to the control population. The telephone management program also delayed suicide reattempts in the intervention group compared the control population. Cebria *et al.*<sup>[45]</sup> called all the participants in the previous study again after 5 years in order to evaluate the benefit of telephone contact on the suicidal behavior over the long term. There was not a statistically significant difference in the number of people who reattempted suicide after 5 years (intervention group: 31.4% vs control group: 34.4%). This result suggests that telephone contact after a suicide attempt was effective after one year, but this benefit was not maintained after 5 years.

Amadéo *et al.*<sup>[46]</sup> conducted a RCT to test the efficacy of brief intervention and telephone contact after a suicide attempt. Two hundred patients admitted to the ED for self-harm behaviors were randomly assigned to the control group ( $n = 100$ ) or to the intervention group ( $n = 100$ ). Participants of the control group received treatment as usual. Patients in the intervention group received care as usual plus one hour of information session and 9 telephone contacts at 1, 2, 4, 7 and 11 wk and at 4, 6, 12 and 18 mo. It was found no significant difference in the frequency of suicidal behavior between the two groups. Two deaths by suicide occurred in the control group vs none in the intervention group.

## TELEPHONE, EMAIL, TEXT MESSAGE, LETTERS

Hvid *et al.*<sup>[47]</sup> conducted a quasi-experimental prospective design study to evaluate the utility and efficacy of a Baerum-model like intervention after attempted suicide. The Baerum model is a form of cooperation between Baerum hospital and the municipal health services in Asker and Bærum municipalities. The Bærum model consists of four stages: Medical treatment and monitoring; psychosocial/psychiatric intervention; aftercare by a public health nurse; continued residential or non-residential treatment. In this prospective study, patients who attempted suicide (intervention group;  $n = 93$ ) were provided follow-up care by a program offering home visits and contacts. The patient identified a primary contact while in the hospital and follow-up visits were conducted after discharge by personal contact, telephone calls, letters, text messaging and e-mails. A control group ( $n = 58$ ) received TAU, which included a psychiatric assessment followed by a decision on whether to offer the patient psychiatric treatment. Results revealed a significantly lower repetition rate in the intervention group; the proportion of repetitive patients fell from 34% to 14%. There were also fewer suicidal acts, in total 37 acts in the control group and 22 acts in intervention group.

The Baerum model like intervention has a good chance of being a suicide prevention intervention of high acceptability and adherence, and was found to have acceptable effectiveness in the follow-up period of 1 year. As Hvid *et al.*<sup>[48]</sup> have found encouraging results from the previous quasi-experimental prospective study conducted on the Baerum model, they decided to assess this model also through an RCT. They decided to evaluate the above-mentioned model based on the same model of intervention to assess it on the prevention of new suicide attempts in patients who had already made an attempt. During a two year period, 133 participants were randomized to the experimental group ( $n = 69$ ) and they received the OPAC program and 64 to the (non-intervention) control group. The intervention in the experimental group was implemented as soon as possible following the suicide attempt. In the intervention group was observed a significantly lower proportion (proportion 8.7%) of patients who repeated a suicide attempt than in the control group (proportion 21.9%). Also the number of repetitive acts was significantly lower (8 repetitions in the intervention group vs 22 in the control group) (Table 1).

## DISCUSSION

The present review sought to shed light on the role of new technologies as a means of preventing suicide in patients discharged from EDs and/or psychiatric wards. A systematic and meta-analytic review was conducted by Milner *et al.*<sup>[49]</sup> to synthesize the evidence regarding the efficacy in reducing self-harm, suicide attempt and suicide deaths of brief contact interventions (*e.g.*, letters, green cards, telephone calls and postcards). However, unlike our study, Miller and colleagues did not focus on the evaluation of these means of prevention in the post discharge from an ED or psychiatric ward. Although the results of this review demonstrated how brief contact interventions have had a significant effect on the number of episodes of repeated self-harm or suicide attempts, these brief contact interventions cannot yet be recommended for widespread clinical implementation.

Based on the main findings of the present review, different types of new technologies have been used and evaluated in several studies as a means of suicide prevention. From this review, 10 studies examined the role of postcards, letters, crisis cards/green cards, 9 studies investigated the role of telephones, 2 studies the role of the telephones and letters (simultaneously) and 2 assessed the role of the telephones, letters, and text messages (simultaneously).

Regarding studies based on the use of postcard/crisis card/green card as a means of suicide prevention, only three of these studies have shown that these means may reduce the rate of suicide<sup>[26]</sup> and suicide ideation<sup>[27,28]</sup> in the experimental group to follow up. The other seven studies found that the intervention does not



**Table 1** Summary of studies reporting contact with patients involving new technologies and reaching-out means in the post-discharge period

Ref.	Study design	Sample	Criteria	Methods	Outcomes	Follow-up	Results
Postcard/ letters/crisis card/green card Motto <i>et al</i> <sup>[26]</sup> , RCT 2001		843 participants	843 patients who had refused ongoing care after hospitalization because of a depressive or suicidal state	843 patients randomized to Intervention group: ( <i>n</i> = 389) contacted by short letter for five years (a total of 24 letters for five years); control group: ( <i>n</i> = 454) received no contact	Suicide rate	5 yr (contact period) and 10 yr	Patients in the contact group had a lower suicide rate in all five years of the study Intervention group: Suicide rate: 0.77% Control group: Suicide rate: 1.32% only for the first two years ( <i>P</i> value = 0.043). Differences gradually decreased and at 15-yr no differences were observed
Hassanian- Moghaddam <i>et al</i> <sup>[27]</sup> , 2011	RCT	2300 participants	Subjects admitted to the Loghman- Hakim Poison Hospital from March to June 2006, above 12 yr of age with self- poisoning defined by exclusion of poisoning classified as recreational, habitual misuse, accidental or iatrogenic by the treating medical toxicologist	2300 patients randomized to Intervention group: ( <i>n</i> = 1150) received nine postcards sent over 12 mo. Eight postcards are mailed at 1, 2, 3, 4, 6, 8, 10 and 12 mo after discharge. A ninth postcard is sent for each participant's birthday Control group: ( <i>n</i> = 1150) received no contact	Suicidal ideation; suicide attempt; cutting or self- mutilation; deaths	12 mo	A postcard intervention reduced suicidal ideation and suicide attempts. Sustained, brief contact by mail may reduce suicidal ideation and suicide attempts in individuals who self-poison Suicidal ideation: Intervention group: 29.0%. Control group: 41.7% Relative risk reduction: 0.31 (0.22 to 0.38). Number needed to treat: 7.9 (6.0 to 11.5) Suicide attempt: Intervention group: 3.0%. Control group: 5.1% Relative risk reduction 0.42 (0.11 to 0.63). Number needed to treat 46.1 (26 to 203.7) Self-cutting: Intervention group: 4.0%. Control group: 4.7% Relative risk reduction 0.14 (-0.29 to 0.42) Number needed to treat NA
Hassanian- Moghaddam <i>et al</i> <sup>[28]</sup> , 2017						24 mo	There was a beneficial effect demonstrated for suicidal ideation and suicide attempt during the 24 mo follow-up period (after cessation of the intervention), however, there was no effect on self-cutting behavior during the same period Suicidal ideation: Intervention group: 46.6%. Control group: 58.6% ARR: 11.93% (95%CI: 7.58-16.27), OR: 0.62 (95%CI: 0.52-0.74) Suicide attempt: Intervention group: 6.2%; control group: 9.1% ARR: 2.85% (95%CI: 0.52-5.17), OR: 0.67 (95%CI: 0.48-0.93) Self-cutting: Intervention group: 1.5%; control group: 1.5% ARR: 0.00% (95%CI: -0.01-0.01), OR: 1.01 (0.49-2.07)

Carter <i>et al</i> <sup>[29]</sup> , 2005	RCT	772 participants	Participants (> 16 yr) presented to the toxicology service with deliberate self poisoning from April 1998 to December 2001	772 patients randomized To Intervention group: ( <i>n</i> = 378) received a postcard at 1, 2, 3, 4, 6, 8, 10 and 12 mo after discharge Control group: ( <i>n</i> = 394) received no contact after discharge	Proportion of patients who repeat episodes of deliberate self poisoning; the number of repeat episodes of deliberate self poisoning per person	12 mo	A postcard intervention reduced repetitions of deliberate self poisoning, although it did not significantly reduce the proportion of individual repeaters Proportion of patients who repeated episode of self poisoning: Intervention group: 15.1%; control group: 17.3% N° of repeat episodes: Intervention group: 101; control group: 192 Incidence risk ratio of repetition: Intervention group: 0.55 <i>vs</i> Control group: 1.00 [ES = 0.13 (CI: 0.35 to 0.87); <i>P</i> value = 0.010]
Carter <i>et al</i> <sup>[30]</sup> , 2007					Proportion of patients who repeat episodes of deliberate self poisoning; number of repeat admissions	24 mo	A postcard intervention maintained the halving of the rate of hospital-treated-self-poisoning events over 2-yr period, although it did not significantly reduce Proportion of patients who repeated episode of self poisoning: Intervention group: 21.2%; control group: 22.8% N° of readmissions: Intervention group: 145. Control group: 310 Incidence risk ratio of repetition: Intervention group: 0.49; control group: 1.00 [ES = 0.10 (CI: 0.33 to 0.73); <i>P</i> value = 0.010] The treatment was effective only for women: Intervention group: 0.49; control group: 1.00 [ES = 0.12 (CI: 0.30 to 0.80); <i>P</i> value = 0.004]
Carter <i>et al</i> <sup>[31]</sup> , 2013					Proportion of patients who repeat episodes of deliberate self poisoning; number of repeat admissions; proportion of patients admitted to the hospital for any psychiatric reason; number of readmissions to a psychiatric hospital; all-cause mortality; suicide deaths	5 yr	A postcard intervention halved self-poisoning events and reduced psychiatric admissions by a third after 5 yr Proportion of patients who repeat episodes of deliberate self poisoning: Intervention group: 24.9%. Control group: 27.2% Number of repeat admissions: Intervention group: 252; control group: 484 Incidence risk ratio of readmission: Intervention group: 0.54; control group: 1.00 (CI: 0.37 to 0.81; <i>P</i> value < 0.01) The treatment was effective only for women: Intervention group: 0.55; control group: 1.00 [CI: 0.34 to 0.88); <i>P</i> value = 0.01] Proportion of patients admitted to the hospital for any psychiatric reason: Intervention group: 38.1%. Control group: 35.5% Number of readmissions to a psychiatric hospital: Intervention group: 447; control group: 710 All-cause mortality: Intervention group: 5.8%; control group: 5.6% Suicide deaths: Intervention group: 1.3%. Control group: 1.5%

Beautrais <i>et al</i> <sup>[32]</sup> , 2010	RCT	327 participants	Participants (> 16 yr) admitted to psychiatric emergency services at Christchurch Hospital, New Zealand, following self-harm or attempted suicide during the period August 1, 2006 to April 6, 2007	327 participants randomized to Intervention group: ( <i>n</i> = 153) received treatment as usual + postcard intervention (six "postcards" sent by mail during the 12 mo following) Control group: ( <i>n</i> = 174) received treatment as usual	Percentage of patients re-submitted at the psychiatric emergency service and at the emergency department for self-harm; numbers of self-harm re-presentations	12 mo	There were no significant differences between the control and intervention groups in the proportion of participants re-presenting with self-harm or in the total number of re-presentations for self-harm Percentage of patients re-submitted at the psychiatric emergency service and at the emergency department for self-harm: Intervention group: 25.5%; control group: 28.2% Numbers of self-harm re-presentations: Intervention group: 56.9%; control group: 78.2% (IRR 0.73; CI: 0.5-0.95; <i>P</i> value < 0.03)
Evans <i>et al</i> <sup>[33]</sup> , 1999	RCT	827 participants	Patients admitted to hospital following deliberate self-harm between November 1994 and July 1996	827 patients randomized to Intervention group: ( <i>n</i> = 417) received the green card offering 24-h crisis telephone consultation with an on-call psychiatrist for up to 6 mo Control group: ( <i>n</i> = 410) received standard treatment	Patients who repeated self-harm	6 mo	At 6 mo, there was no effectiveness of the provision of a card offering 24-h crisis telephone consultation on repetition of self-harm but there was a possible benefit among those presenting following a first episode Patients with repeated self-harm: Intervention group: 16.8%; control group: 14.4% Median time to repetition: Intervention group: 33 d; control group: 40 d Intervention with green card seemed to have a protective effect on self-harm first timers <i>vs</i> people with history of previous self-harm. First timers: 18 (OR: 0.64; 0.34-1.22) Previous history of self-harm: 52 (OR: 1.85; CI: 1.14-3.03)
Evans <i>et al</i> <sup>[34]</sup> , 2005						12 mo	At 12 mo there was no overall benefit of the intervention. Among those with a first episode of self-harm, the possible benefit of the intervention had diminished Patients with repeated self-harm: Intervention group: 21.6%; control group: 18.8% Median time to repetition did not differ between the two groups Among those with a first episode of self-harm, the possible benefit of the intervention had diminished compared to Evans <i>et al</i> <sup>[33]</sup> 1999 (OR: 0.89, CI: 0.52-1.52)
Cotgrove <i>et al</i> <sup>[35]</sup> , 1995	RCT	105 participants	Adolescents (aged 16 yr or under), admitted to the study hospitals between January 1987 and January 1990 for a suicide attempt (all acts of deliberate self-poisoning and deliberate self-harm are also considered)	105 participants randomized to Intervention group: ( <i>n</i> = 47) received a token, a green card, which acted as a passport to re-admission into a pediatric ward in their local hospital Control group: ( <i>n</i> = 58) received standard treatment	Rate of further suicide attempts; rate of the use of the token	12 mo	There were lower rates of repeat suicide attempts in the intervention group. The differences between two groups did not reach the level of statistical significance Further suicide attempts: Intervention group: 6%; control group: 12% Rate of repetition: Intervention group: 6%; control group: 12%

Letters and telephone contacts							
Mouaffak <i>et al.</i> <sup>[36]</sup> , 2015	RCT	320 participants	Adult subjects (men and women > 18 older) surviving a suicide attempt, discharged from the Emergency Department from January 2009 until December 2011	320 participants randomized to Intervention group: ( <i>n</i> = 160) destined to OSTA program (provided a card with a telephone number of a psychiatrist available 24 h a day and telephone calls at 2 wk post discharge, at months 1 and 3) Control group: ( <i>n</i> = 160) received no contact	Proportion of patients who reattempted suicide; proportion of patients who started a medical follow-up	12 mo	There were no significant differences, between the two groups, in the number of patients who reattempted suicide and in suicide attempts Proportion of patients who reattempted suicide: Intervention group: 14.5%; control group: 14% Number of suicide attempts: Intervention group: $0.2 \pm 0.58$ . Control group: $0.23 \pm 0.84$ Patients who started a medical follow-up: Intervention group: 24.2%; control group: 31%
Kapur <i>et al.</i> <sup>[37]</sup> , 2013	RCT	66 participants	Participants (> 18 yr), resident in Manchester, who presented to 2 of the 3 Emergency Department in the city with self-harm during November 2010 to May 2011	66 participants randomized to Intervention group: an information leaflet listing local and national sources of help mailed as soon as possible after consent, two telephone calls within the first 2 wk, and then a series of letters over a 12-mo period (at 1, 2, 4, 6, 8 and 12 mo). Control group: Received treatment as usual	Proportion of patients with at least one repeat episode of self-harm resulting in hospital attendance within 12 mo; number of repeat episodes during the same time period	12 mo	The rate of repetition of self-harm behavior was higher in the intervention group than control group. Repeat rate of self-harm over 12 mo: Intervention group: 34.4%. Control group: 12.5% (OR: 3.67, 95% CI: 1.0-13.1; <i>P</i> = 0.046) Total number of episodes of repeat self-harm over 12 mo: Intervention group: 41; control group: 7. [IRR = 5.86, 95% CI: 1.4-24.7; <i>P</i> value = 0.016] Adjusting for baseline clinical factors (centre, method of harm (self-poisoning <i>vs</i> other), previous self-harm, previous psychiatric treatment): repetition: (adjusted OR: 4.35, 95% CI: 0.9-19.8; <i>P</i> value = 0.057) repeat episodes: (adjusted IRR = 7.16, 95% CI: 1.6-32.8, <i>P</i> value = 0.011)
Telephone contact							
De Leo <i>et al.</i> <sup>[38]</sup> , 1995	Ecological study	12135 participants	Participants (> 65 years old) who were living in the Veneto region of Italy connected to the Tele Help/Tele-Check service from January 1, 1998 and December 31, 1998	Authors compared the rate of suicide between Tele-Help/Tele-Check users and the general population	Rate of suicide	4 yr	Only one suicide death occurred among elderly service users than expected. Ratio: 1:7.44 between observed and expected suicides. Standardized mortality ratio: $(1/7.44 \times 100\%)$ : 13.44% ( $\chi^2 = 2.54$ , <i>df</i> = 1, 95% CI: 0.3%-74.8%; <i>P</i> value < 0.05)
De Leo <i>et al.</i> <sup>[39]</sup> , 2002	Ecological study	18641 participants		Comparison between observed and expected suicide rates among older Tele-Help/Tele-Check users		10 yr	Significantly fewer suicide deaths occurred among elderly service users than expected. Suicide deaths: Observed <i>n</i> = 6; expected <i>n</i> = 20.86, $\chi^2 = 10.58$ , <i>df</i> = 1; <i>P</i> value < 0.001 with an SMR for users of 28.8% (95% CI: 11.5-62.5)
Cedereke <i>et al.</i> <sup>[40]</sup> , 2002	RCT	216 participants	Patients treated after a suicide attempt at the Medical Emergency Inpatient Unit of the University	216 participants randomized to Intervention group: ( <i>n</i> = 107) received telephone call at 4 and 8 mo	Attendance to treatment; repetition of suicide attempts; GAF, CSI, SSI score	12 mo	At follow-up, attendance and repetition of suicide attempts did not differ between the two groups Attendance to treatment repetition of suicide attempts: At baseline: Intervention group:



		Hospital of Lund between February 1995 and April 1997	Control group: (n = 109) destined to no such interventions			76%, Control group: 72% At follow-up: Intervention group: 72%. Control group: 65% Repetition of suicide attempts: Intervention group: 17% made 26 suicide attempts. Control group: 17% made 27 suicide attempts GAF: Intervention group: 1 <sup>st</sup> month = 50.5 ± 19.9. 12 <sup>th</sup> month = 61.4 ± 20.4 (P value < 0.001) Control group: 1 <sup>st</sup> month = 50.3 ± 21.1. 12 <sup>th</sup> month = 58.6 ± 20.2 (P value < 0.01) SSI score Intervention group: 1 <sup>st</sup> month = 7.9 ± 8.4 (P < 0.10). 12 <sup>th</sup> month = 5.8 ± 7.8 (P value < 0.05) Control group: 1 <sup>st</sup> month = 5.0 ± 6.8 (P < 0.10). 12 <sup>th</sup> month = 4.0 ± 6.2 (P value < 0.05) SCL90-GSI Intervention group: 1 <sup>st</sup> month = 1.05 ± 0.74. 12 <sup>th</sup> month = 0.82 ± 0.78 (P value < 0.05) Control group: 1 <sup>st</sup> month = 1.02 ± 0.77. 12 <sup>th</sup> month = 0.88 ± 0.72
Vaiva <i>et al</i> <sup>[41]</sup> , RCT 2006	605 participants	People (18-65 yr) discharged from an emergency department after attempted suicide by deliberate self poisoning	605 participants randomized to Intervention group: (n = 147) received telephone contact at one month after a suicide attempt Intervention group: (n = 146) received telephone contact at three months Control group: (n = 312) without telephone intervention	Proportion of participants who reattempted number of deaths by suicide and losses to follow up at 13 mo	13 mo	For participants contacted at one month, the number of who reattempted suicide is significantly lower than that of controls. For participants contacted at three months, the number who attempted suicide was not significantly lower than that of control Proportion of participants who reattempted suicide: At 1 mo: Intervention groups: 16%. Control group: 19% At 3 mo: Intervention group: 14%. Control group: 19% Number of deaths by suicide: At 1 mo: Intervention group: 0 %. Control group: 1% At 3 mo: Intervention group: 1%. Control group: 1% Lost to follow up: At 1 mo: Intervention group: 7%. Control group: 10% At 3 mo Intervention group: 10%. Control group: 10% Significantly fewer suicide deaths occurred in the intervention group than in the control group. Suicide deaths: Intervention group: 0.2%. Control group: 2.2% (P value < 0.001)
Fleischmann <i>et al</i> <sup>[42]</sup> , 2008 RCT	1867 participants	Suicide attempters identified by medical staff in the emergency units of eight collaborating hospitals in five different countries	1867 participants randomized Intervention group: (n = 922) received treatment as usual plus brief intervention and contact (which provided a standard 1-h individual information session combined with periodic follow-up phone calls or visit) Control group: (n = 945) received treatment as usual	Deaths from suicide	18 mo	

Bertolote <i>et al</i> <sup>[43]</sup> , 2010					Repeated suicide attempts		At follow up, repeated suicide attempts did not differ between the two groups. Repeated suicide attempts: Intervention group: 7.6%. Control group: 7.5%
Cebrià <i>et al</i> <sup>[44]</sup> , 2013	Case-control study	991 participants	Patients without age limit treated for attempted suicide during the years 2007-2008. They were identified following a systematic review of electronic medical records of the emergency departments of psychiatry, medicine, traumatology, surgery and pediatrics in the area of Sabadell	991 participants randomized to Intervention group: (n = 604) received telephone call for 1-yr after discharge from Emergency Department for suicide attempt Control group: (n = 387) received treatment as usual	Days to first reattempt; rate of patients who reattempted suicide	12 mo	The rate of patients who reattempted suicide was lower in the intervention group compared to the previous year Mean time in days to first reattempt Intervention group: Baseline: 316.64; Intervention year: 346.47 (Baseline <i>vs</i> intervention years log rank <i>P</i> value < 0.0005) Control group: Baseline: 273.05; Intervention year: 300.36 Intervention group <i>vs</i> control group during the intervention year (respectively 346.47 <i>vs</i> 300.36; log rank <i>P</i> value < 0.0005) Rate of patients who reattempted suicide Intervention group: Baseline: 14%; Intervention year: 6% (Baseline <i>vs</i> intervention years log rank <i>P</i> value < 0.0005) Control group: Baseline: 21%; Intervention year: 14% Intervention group <i>vs</i> control group during the intervention year (respectively 6% <i>vs</i> 14%; log rank <i>P</i> value = 0.005)
Cebrià <i>et al</i> <sup>[45]</sup> , 2015	Nonrandomized, controlled, parallel study	514 participants		All participants (Cebrià <i>et al</i> <sup>[45]</sup> 2013) were called after 5 yr	Rate of reattempts; time to recurrence	5 yr	There was a reduction of the rate of reattempts in the first year. The effects of the intervention was not be maintained at 5 yr Rate of reattempts Intervention group: 0.864. Control group: 0.839 Time to recurrence Intervention group: 1429 d. Control group: 1332 d
Amadéo <i>et al</i> <sup>[46]</sup> , 2015	RCT	200 participants	Participants admitted to the Emergency Department of the Centre Hospitalier de Polynésie Française for intentional self harm over the period 2008-2010. All patients included in this study had a short psychiatric hospitalization (minimum 24 h)	200 patients Randomized to Intervention group: (n = 100) received treatment as usual plus brief intervention and contact (which provided nine follow-up phone calls Control group: (n = 100) received treatment as usual	Number of suicides and repeated non-fatal suicidal behavior	18 mo	There were a reduction in the number of suicides and episodes of non-fatal suicide behaviour in the intervention group Episodes of non-fatal suicide behaviour: Intervention group: 26.7% <i>vs</i> Control group: 21% Suicide: Intervention group: 0% <i>vs</i> Control group: 2.0%
Telephone, e-mail, text message, letters							
Hvid <i>et al</i> <sup>[47]</sup> , 2009	Cohort study	151 participants	Participants arrived at the hospital's emergency rooms and clinical departments of	151 participants are randomized to Intervention group: Cohort of 2004 (n = 93) received a primary	Participation by acceptance and adherence;	1 yr	There were a significant lower repetition rate and fewer suicidal acts in the intervention group. The programme had a high acceptability Acceptability:

			Copenhagen University Hospital Amager for attempted suicide and self-harm actions through spring 2002 and spring 2004	contact while the patient was in hospital and followed-up visits (8) after hospital discharge, by personal contact, telephone calls, letters, text messaging and emails. The intervention period was limited to 6 mo	repetition of suicide attempt and suicide; number of repetitive acts in 1 yr after the attempted suicide episode		65 of 94 patients of the Cohort of 2004 remained in the programme (70% participation) Repetitions during 1 yr: Cohort of 2002: 18 repetitive patients and 1 suicide (32.8%) 37 repetitive acts Cohort of 2004: 12 repetitive patients and 1 suicide (13.9%), 22 repetitive acts RR = 0.427 (95% CI: 0.228-0.797)
Hvid <i>et al.</i> <sup>[48]</sup> , 2011	RCT	133 participants	Subjects admitted to the emergency room and clinical departments and screened for attempted suicide and self-harm actions during a period from 2005-2007	133 participants randomized to Intervention group: (n = 69) received home visit and additional contact (telephone calls and text messages) Control group (n = 64) received no contact	Proportion of patients who repeated suicide attempt; number of suicidal acts	12 mo	There were a significant lower proportion who repeated a suicide attempt the intervention group and the number of repetitive acts was also significant lower Proportion of patients who repeated suicide attempt: Intervention group: 8.7%; Control group: 21.9% (Fewer events for intervention group vs control group; log rank <i>P</i> = 0.0414) Number of suicidal acts: Intervention group: 8; Control group: 22 (log rank <i>P</i> = 0.0037)

RCT: Randomized controlled trial.

significantly reduce the repetition of self-poisoning<sup>[29-31]</sup>, self-harm<sup>[32-35]</sup> and suicide<sup>[35]</sup>. However, although Beautrais did not find a statistically significant reduction in repetition of self-harm, she noted a reduction in the total number of new admissions to the ED for self-harm.

Regarding the two studies included in this review which examined both letters and telephone contacts, one<sup>[36]</sup> showed no significant differences in the number of new suicide attempts in the two groups of intervention and control with the proportion of patients who reattempted suicide not differing significantly at 12 mo. The other study<sup>[37]</sup> demonstrated a higher rate of self-harm in the experimental group compared to the control group after 12 mo of follow up.

Nine studies that used only telephone contacts as a means of prevention of suicide in the post discharge period were included in our review. Of these, four studies showed a benefit in terms of suicide risk reduction<sup>[38,39]</sup> with a significant decrease in the number of suicide reattempts<sup>[41]</sup> at one month follow-up and a decrease in the number of deaths by suicide at 18 mo<sup>[42]</sup>. One study demonstrated a statistically significant decrease in the rate of patients who reattempted suicide at 1 year<sup>[44]</sup>, but not at 5 years<sup>[45]</sup>. Three other studies, however, found no significant differences<sup>[40,43,46]</sup> in terms of suicide risk reduction through the use of telephone contact, therefore, they cannot be considered a useful means of suicide prevention. Some authors have also assessed the simultaneous use of multiple media such as telephone calls, emails, text messages and letters<sup>[47,48]</sup>, and have

found promising results regarding the reduction in the risk of reattempting suicide. Thus, we can conclude that approximately half of the studies considered in our review (11 of 23) have shown that new technologies can be used with some benefit to decrease the risk of new attempts of suicide or self-harm in the post discharge period. It was also observed that telephone contacts, postcard, text message, *etc.*, are easily used by patients in the period of post discharge and allow a contact that is thought to be beneficial. Future researchers should continue to improve and test new technologies in the prevention of suicide. For example, an online, unguided, self-help intervention for reducing suicidal ideation was recently found to be useful, usable, and cost effective<sup>[50]</sup>. Also Berrouguet *et al.*<sup>[51]</sup> designed a 2-year multi-center randomized controlled trial which will assess the efficacy of a text message intervention on reducing the risk of suicide attempt repetition among adults after self-harm. This intervention is called SIAM (suicide intervention assisted by messages) and it represents an easily reproducible intervention that aims to reduce suicide risk in adults after self-harm. Also Vaiva *et al.*<sup>[52]</sup> have developed and examined the effectiveness of "ALGOS algorithm", an intervention based on systematic telephone contacts and a crisis card, which aims to reduce the incidence of repeated suicide attempt during the 6 mo following discharge. The authors suggest that this intervention will be easily reproducible and will supply guidelines for assessment and management of this high-risk population.

## LIMITATIONS

This paper does not present a systematic review or a meta-analysis. It is also possible that studies were missed or excluded. Our review focused on a range of interventions (telephone, postcards, letters, green/crisis cards, text messages, email) that may have a different effect. We examined the role of these interventions on suicide and on self-harm, acknowledging that these are two very different and distinct behaviors. Our focus was on English language literature and more important source of data may be available in other languages.

## CONCLUSION

Through our review of the literature concerning the new technologies and the prevention of suicide, we have concluded that it is necessary to reach out and initiate contact with the patient who has attempted suicide following hospital discharge. Moreover, we observed that new technologies and brief contact interventions (e.g., letters, green cards, telephone calls, postcards) are valuable in the prevention of suicide and should be employed in conjunction with standard treatments. Patients who are utilizing these methods consider them usable, effective, efficient, and secure. We have determined that new technologies have the potential to be important suicide prevention resources; however, it is necessary to further examine the possible benefits of these efforts through well-designed clinical trials.

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