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France Hirot, Aminata Ali, Philippe Azouvi, Adrien Naddaf, Caroline Huas, et al.. Five-year mortality after hospitalisation for suicide attempt with a violent method. *Journal of Psychosomatic Research*, 2022, 159, pp.110949. 10.1016/j.jpsychores.2022.110949 . hal-03775804

**HAL Id: hal-03775804**

**<https://hal.science/hal-03775804>**

Submitted on 22 Jul 2024

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## Five-year mortality after hospitalisation for suicide attempt with a violent method

France HIROT (1,2), france.hirot@fsef.net

Aminata ALI (1,2), aminata.ali@fsef.net

Philippe AZOUVI (1,3,4), philippe.azouvi@aphp.fr

Adrien NADDAF (2), adrien.naddaf@fsef.net

Caroline HUAS (1,2), caroline.huas@fsef.net

Sébastien GUILLAUME (5,6,7), s-guillaume@chu-montpellier.fr

Nathalie GODART (1,2,3), nathalie.godart@fsef.net

(1) INSERM, UMR 1018, Centre de Recherche en Épidémiologie et Santé des Populations (CESP), Université Paris-Saclay. Villejuif, France

(2) Fondation Santé des Etudiants de France (FSEF). Service hospitalo-universitaire de Santé Mentale de l'Adolescent et du Jeune Adulte (SAMAJA). Paris, France

(3) Université Versailles Saint-Quentin-en-Yvelines, UFR Simone Veil-Santé. Montigny-le-Bretonneux, France.

(4) APHP - Hôpital Raymond Poincaré. Service de Médecine Physique et de Réadaptation. Garches, France.

(5) Centre Hospitalier Universitaire De Montpellier, Service Urgence et Post-urgence psychiatrique. Montpellier, France

(6) Université Montpellier 1, 34006 Montpellier, France

(7) INSERM, U888, 34093 Montpellier, France

### Short running title

Mortality after a suicide attempt with a violent method

### Keywords

Suicide, violent means, jumping from a height, metro, train, mortality, young adults

### Data Availability Statement information

Data can be available on request and in compliance with the French law on the protection of medical data.

## Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## Conflicts of interest

The authors declare that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

## Ethics approval statement

Approval for this study was obtained from the French national ethics and scientific committee (Comité éthique et scientifique pour les recherches, les études et les évaluations dans le domaine de la santé, CESREES).

## Patient consent statement

In accordance with French legislation, information to the individuals in this study was provided on the FSEF website and in the clinic. Individuals or their legal beneficiaries in case of death had the right to object to the processing of their personal data.

## Abstract

**Objective:** This study aimed to estimate the 5-year mortality among people admitted into a transdisciplinary unit providing combined psychiatric and somatic rehabilitation treatment.

**Methods:** In this retrospective study, we analyzed the clinical records of all individuals admitted into the transdisciplinary unit from 01/01/2011 to 12/31/2017 after a suicide attempt using violent means. Vital status was ascertained for these 215 people, a standardized mortality ratio (SMR) was calculated and Log-rank tests were used to identify factors associated with mortality.

**Results:** The crude mortality rate was 5.12% (11 deaths) and the SMR was 15.45 (95% CI=[7.71-27.65];  $p<0.001$ ) 5.40 years after admission into the transdisciplinary unit. Factors associated with mortality were: older age (29.91 years *versus* 25.30 years,  $p<0.001$ ), a longer stay in acute care ( $p=0.002$ ) and a shorter stay in the transdisciplinary unit ( $p<0.001$ ).

**Conclusion:** Long-term mortality among people who have attempted suicide using violent means is 15 times higher than in the corresponding general young adult population. This study supports the hypothesis that the severity of a suicide attempt is associated with subsequent excess mortality. Therefore, there is a need to consolidate outpatient facilities that provide appropriate support for this specific population after discharge. These programmes need to ensure the continuity of coordinated psychiatric and somatic care and psychosocial rehabilitation in order to prevent the risk of suicide.

## Highlights

- The 5-year crude mortality rate was 5.12% after a suicide attempt by violent means.

- The mortality risk was 15 times higher than in the corresponding general population.
- Mortality was associated with an older age and a longer stay in acute care.

## Introduction

Suicide prevention is a major public health issue worldwide. Over 800 000 people die by suicide each year, accounting for about 1.4% of all deaths (1). Suicide attempt is considered as the most predictive clinical risk factor for subsequent suicide (1). Compared to self-poisoning, violent methods of deliberate self-harm have been associated with a higher risk of subsequent suicide (2–4). The severity of suicide attempts can be classified according to two different criteria: the level of lethality of the suicide attempt (5–8) or the type of method used (2–4,9–12). Violent means mainly include jumping from a height, crashing a motor vehicle, lying in front of a moving object (trains, metros), firearms, hanging or drowning. These violent methods are significantly linked to early mortality (1,13,14) and attempted suicides of this nature have been found to predict later completed suicide (2–4,7,9–12). Studies have also shown that people who attempt suicide also have higher rates of death from other causes, including accidents and disease (15).

Some of these violent suicide attempts lead to severe traumatic injuries (8,16). Thus, people who survive a suicide attempt by jumping from a height have multiple injuries, especially to the spine, the pelvis and the limbs, alongside neurological damage (16), leading to extensive treatment and long hospitalisations in general hospital (17,18). Jumping from a height has also been linked to severe mental disorders, particularly schizophrenia (16,19). People who have attempted suicide require particular care, with multidisciplinary psychiatric and somatic management in the acute stages, and if needed, in the functional rehabilitation stage for the most severe cases. There are only a few clinical experiences of mixed psychiatric/medical inpatient units for people who have attempted suicide (20).

In France, the FSEF (French student health foundation) has developed a psychiatric ward of this sort with a transdisciplinary approach (21). This transdisciplinary unit offers psychiatric and somatic rehabilitation care designed specifically for people who have attempted suicide with a violent method leading to severe injuries, primarily jumping from a height or jumping in front of a motor vehicle (22–24). After acute care, the most severe subgroup of people who have attempted suicide in this manner need both complex functional rehabilitation care (which cannot usually be provided in a psychiatric ward) and intensive psychiatric care. This intensive psychiatric care, it enables closer follow-up than in the case of consultation-liaison psychiatry in a rehabilitation unit (17,25).

To our knowledge, only one study has compared long-term mortality among people after a serious suicide attempt with the general population (7). Beautrais found a 5-year mortality rate that was 5 times higher for people whose suicide attempt had led to extensive inpatient medical treatment (treatment in intensive care unit, hyperbaric unit or burns unit; or surgery under general anaesthesia; or extensive medical treatment including antidotes for drug overdose, telemetry or repeated tests or investigations; or suicide attempt by hanging or gunshot (7)). These kinds of suicide attempt do however differ from attempts using violent means. We found no study comparing the long-term mortality of people who have attempted suicide using violent method with the general population.

The aim of the present study was to determine the long-term mortality rate for these individuals after a suicide attempt by violent method (jumping from a height or in front of a moving object) and hospitalisation in our transdisciplinary unit, to calculate a standardized mortality ratio and to search for predictive factors associated with mortality.

## Participants and methods

### Study design

We conducted a retrospective study including a sample of people admitted into the transdisciplinary unit after a suicide attempt using a violent method. The primary objective was to calculate the crude mortality rate and the standardized mortality ratio (SMR) in this sample. The secondary objective was to determine predictive factors for mortality.

### Participants

#### Inclusion criteria

We considered all consecutive individuals admitted into the transdisciplinary unit after a suicide attempt by jumping from a height, jumping in front of a moving object or crashing a motor vehicle between 1st January, 2011 and 31 December, 2017. In case of multiple admissions for the same person during this period, only the first was considered (this concerned only one individual who was admitted twice).

#### Exclusion criteria

We excluded suicide attempts by other methods (3 exclusions: 1 hanging, 2 self-poisoning) and cases of polytrauma outside a context of suicide attempt (1 traffic accident).

### Procedures and ethics approval

Approval for this study was obtained from the French national ethics and scientific committee (CESREES), and by the French Commission on Information Technology and Liberties (CNIL).

In accordance with French legislation, information to the individuals in this study was provided on the FSEF website and in the clinic. The individuals or their legal beneficiaries in case of death had the right to object to the processing of their personal data.

This procedure information is registered online on the public French Health Data Hub platform: <https://www.health-data-hub.fr/projets/etude-du-devenir-apres-une-hospitalisation-dans-un-service-transdisciplinaire-somato-0>

### The transdisciplinary unit

The transdisciplinary unit is located in the FSEF Bouffémont clinic (Val-d'Oise, Paris area). It has 20 beds and admits individuals aged 15 to 35, corresponding to the population of adolescents and young adults admitted into FSEF establishments. These people were hospitalized after a violent suicide attempt that had resulted in serious injuries, primarily after jumping from a height or jumping in front of a motor vehicle (22). The transdisciplinary unit is an open psychiatric ward with premises

whose architecture is organized to facilitate communication and social activities. The facilities are adapted to functional rehabilitation. Its staff includes two psychiatrists, a physician, a psychologist, a speech therapist, an occupational therapist, a social worker, three physiotherapists and fifteen nurses (22,25).

Psychiatric care includes regular individual and family psychiatric consultations, interviews with nurses, as well as psychotropic medication if required. In addition, group activities are proposed, deploying various creative and occupational therapies, support groups, and psycho-education groups. Somatic care includes technical and nursing care, physiotherapy, balneotherapy, occupational therapy, speech therapy and neuropsychology. The staff can assess disabilities by placing people in everyday life situations (cooking, driving, etc.). Depending on the context, a social assessment, an educational assessment or employment assistance are provided (22).

### Data collection

Data was obtained from the computerized medical records of the clinic.

As we were looking for an association between mortality and socio-demographic and medical variables in accordance with the literature (12,19,26–28), we collected:

- sex, age;
- occupational status classified as: student, in employment, unemployed, disabled status;
- method of the suicide attempt;
- previous suicide attempt, previous suicide attempt by violent means, history of psychiatric hospitalisation;
- main psychiatric diagnosis: the diagnoses were coded according to the International Classification of Diseases, 10th revision (ICD-10) as recorded in the individual's medical file at the end of hospitalization by the psychiatrist in charge of the person. They were categorized into three classes: schizophrenia (ICD-10 F2 code: schizophrenia, schizotypal and delusional disorders), mood disorders (F3 code) and 'Other diagnoses'. This third group included personality disorders, anxiety disorders, behavioral disorders or substance use disorders.
- substance use (any substance use reported by individuals, whether or not they met the substance use disorder criterion);
- nature of injured body parts in the suicide attempt: head or face, chest, abdomen, spine, pelvis, arms, legs (as in Omi *et al.*(29));
- length of stay in acute care after the suicide attempt;
- length of stay in the transdisciplinary unit;
- clinical limitations in arm mobility at discharge from the transdisciplinary unit, limitations in leg mobility at discharge, sphincter disorders at discharge;
- treatments at discharge: antidepressants, neuroleptics, mood stabilizers, nociceptive pain treatments, neuropathic pain treatments.

Vital status was ascertained in 2021 by searching the French national mortality databases between 2011 and 2019. Each death occurring in France is registered in these databases by the French National Institute of Statistics and Economic Studies (*Institut National de la Statistique et des Etudes*

*Economiques*, INSEE). This register reports the death of any person residing in France whether born in France or abroad. The beginning of the follow-up was defined as the first admission to the transdisciplinary unit.

Expected mortality rates for sex and age groups were obtained from the INSEE up to 2019.

## Statistical analyses

The statistical analyses were performed using R Studio software (version: 1.2.5033).

To describe the sample, the data was expressed as frequencies and percentages for nominal variables and as means and standard deviations for continuous variables. Given the low levels of missing data per variable ( $\leq 7\%$ ), we decided not to impute missing data. Log-rank tests were used to identify factors associated with mortality. Considering the number of tests, the differences were considered significant at  $p < 0.002$  (27 tests:  $0.05/27 = 0.002$ ). A Cox regression model was then used to assess predictors of mortality in a multivariate analysis.

We first calculated the crude mortality rate. To compare the observed mortality with the expected mortality, the SMR was used. SMR is the ratio of observed deaths to expected deaths, where expected deaths are calculated for a typical area with the same age and gender mix during the period studied. The expected number of deaths was obtained by applying age, gender and 5-year specific mortalities in the general French population (obtained from INSEE) to the corresponding cumulative person-year in the study cohort. The SMR quantifies the excess number of deaths in our population compared to the general population. A SMR greater than 1 indicates an increased mortality rate in the population studied. Fisher's exact 95% confidence interval (CI) around the SMR was calculated using the Breslow and Day method (30). The SMR was initially calculated separately for men and women. The cumulative incidence of mortality was illustrated by a Kaplan-Meier survival curve.

## Results

### Participant characteristics

The study sample comprised 215 people. The characteristics of these individuals are presented in Table 1. There were 50.23% men. The mean age was 25.54 years ( $\pm 6.27$ ) at admission. Occupational status was working for 31.11% of the individuals considered, student for 37.74%, unemployed for 25.47% and disabled status for 5.66%. The method of suicide attempt was primarily jumping from a height (91.63%) with a mean height of the fall of 9.59 m ( $\pm 4.12$ ) which corresponds to a fall from about three and a half floors of a building. Other attempts amounted to 7.44% for jumping in front a train or a metro and 0.93% for crashing a motor vehicle. The mean length of stay in general hospital was 2.08 months ( $\pm 1.51$ ; 63.3 days,  $\pm 45.9$ ) before admission to our unit.

A proportion of 45.12% of the individuals presented schizophrenia, 34.42% presented mood disorders and 20.46% other diagnoses. This third group primarily comprised personality disorders (10.70%, half of which were borderline personality disorders). Anxiety disorders, behavioral disorders and substance use disorders each accounted for less than 3.26% of the participants. In our sample, 40.76% had substance use, mainly cannabis (27.96%) and/or alcohol (12.32%). In 70.56% of the cases

there was a previous psychiatric episode (reported by the person or his/her relatives), 61.50% had a history of psychiatric care, 50.48% a history of psychiatric hospitalisation and 35.64% a history of previous suicide attempt (before the index attempt), 14.36% using violent means.

*Table 1: Socio-demographic and medical data for the 215 people hospitalised in the transdisciplinary unit after a suicide attempt using violent means*

	Total	Alive	Dead		
	N = 215	N = 204	N = 11		
	Number (percentage) or mean (standard deviation)	Number (percentage) or mean (standard deviation)	Number (percentage) or mean (standard deviation)	Chi-2 (degree of freedom)	p
Socio-demographic data					
Men	108 (50.23%)	104 (50.98%)	4 (36.36%)	0.6 (1)	0.45
Age at admission (years)	25.54 ( $\pm$ 6.27)	25.30 ( $\pm$ 6.29)	29.91 ( $\pm$ 4.16)	560 (211)	<b>&lt;0.001</b>
Occupational status:				4.1 (3)	0.26
- Student	80 (37.74%)	79 (39.30%)	1 (9.09%)		
- Working	66 (31.11%)	61 (30.35%)	5 (45.45%)		
- Unemployed	54 (25.47%)	50 (24.88%)	4 (36.36%)		
- Disabled status	12 (5.66%)	11 (5.47%)	1 (9.09%)		
Medical history					
Substance use	86 (40.76%)	83 (41.50%)	3 (27.27%)	0.8 (1)	0.38
History of psychiatric hospitalisation	106 (50.48%)	99 (49.50%)	7 (70.00%)	1.7 (1)	0.20
History of suicide attempt	72 (35.64%)	67 (34.72%)	5 (55.56%)	1.3 (1)	0.25
History of suicide attempt using violent means	29 (14.36%)	26 (13.47%)	3 (33.33%)	3.3 (1)	0.07
Data at admission					
Method of the suicide attempt :				0 (1)	0.92
- Jumping in front of a moving object or crashing a motor vehicle	18 (8.37%)	17 (8.33%)	1 (9.09%)		
- Jumping from a height	197 (91.63%)	187 (91.67%)	10 (90.91%)		
Height of the fall (meters)	9.59 ( $\pm$ 4.12)	9.46 (4.15)	11.90 (2.90)		0.89
Length of stay in acute care (months)	2.08 ( $\pm$ 1.51)	2.03 ( $\pm$ 1.43)	3.00 ( $\pm$ 2.47)	133 (89)	<b>0.002</b>
Injuries					
Head or face	80 (37.74%)	76 (37.81%)	4 (36.36%)	0.1 (1)	0.78
Chest	82 (38.14%)	76 (37.26%)	6 (54.55%)	0.6 (1)	0.39
Abdomen	57 (26.51%)	54 (26.47%)	3 (27.27%)	0 (1)	0.86
Spine	168 (78.14%)	160 (78.43%)	8 (72.73%)	0.4 (1)	0.54
Pelvis	103 (47.91%)	101 (49.51%)	2 (18.18%)	4.2 (1)	0.04
Arms	94 (43.72%)	90 (44.12%)	4 (36.36%)	0.6 (1)	0.42
Legs	153 (71.16%)	144 (70.59%)	9 (81.82%)	1.2 (1)	0.28
Data at discharge					
Length of stay in the transdisciplinary unit (months)	6.05 ( $\pm$ 5.98)	6.07 ( $\pm$ 6.07)	5.77 ( $\pm$ 3.95)	225 (140)	<b>&lt;0.001</b>



Psychiatric diagnosis				1.4 (1)	0.49
- Schizophrenia	97 (45.12%)	94 (46.08%)	3 (27.27%)		
- Mood disorder	74 (34.42%)	69 (33.82%)	5 (45.46%)		
- Other	44 (20.46%)	41 (20.10%)	3 (27.27%)		
Sequelae at discharge:					
- Arm mobility limitation	59 (28.36%)	57 (28.93%)	2 (18.18%)	0.7 (1)	0.39
- Leg mobility limitation	163 (79.90%)	154 (79.79%)	9 (81.82%)	0 (1)	0.90
- Sphincter disorders	55 (26.19%)	51 (25.50%)	4 (40.00%)	0.7 (1)	0.41
Treatment at discharge					
- Antidepressant treatment	85 (41.67%)	81 (41.75%)	4 (40.00%)	0 (1)	0.91
- Neuroleptics	129 (63.24%)	124 (63.92%)	5 (50.00%)	1.2 (1)	0.27
- Mood stabilizers	33 (16.18%)	31 (15.98%)	2 (20.00%)	0.2 (1)	0.66
- Nociceptive pain treatments	122 (61.00%)	116 (60.73%)	6 (66.67%)	0.8 (1)	0.38
- Neuropathic pain treatments	89 (43.84%)	83 (42.78%)	6 (66.67%)	2.1 (1)	0.14

At admission, all the individuals had severe injuries resulting from the suicide attempt. They had a mean of 3.43 injured body parts ( $\pm 1.5$ ). The injured body regions were: 37.74% head or face, 38.14% chest, 26.51% abdomen, 78.14% spine, 47.91% pelvis, 43.72% arms and 71.16% legs.

The mean length of stay in the transdisciplinary unit was 2.08 months ( $\pm 1.51$ ; 184 days,  $\pm 182$ ). At discharge, 28.36% of the individuals had arm mobility limitations, 79.90% leg mobility limitations and 26.19% sphincter disorders. They mostly received psychotropic treatment: 41.67% antidepressants, 63.24% neuroleptics, 16.18% mood stabilizers. They were also frequently taking painkillers: 91.00% nociceptive pain treatments, 43.84% neuropathic pain treatments.

## Mortality

The follow-up period was 5.40 years ( $\pm 2.02$ ; min: 0.29; max: 8.99). During this period, 11 individuals died. The crude mortality rate was 5.12%. The deaths occurred throughout the follow-up period, with a mean of 3.31 years ( $\pm 2.52$ ) after admission to the transdisciplinary unit (see figure 1). One woman committed suicide by drowning while hospitalised in the clinic. This last suicide attempt was the third in 18 months in a context of psychiatric disorders that had been on-going for 20 years.

Mortality was 15 times higher than would be expected in the general population, with a SMR of 15.45 (95% CI=[7.71-27.65];  $p < 0.001$ ). SMR for men was 10.12 (95% CI=[2.76-25.92];  $p = 0.002$ ). SMR for women was 22.85 (95% CI=[9.19-47.09];  $p < 0.001$ ).

The characteristics of the individuals who died are presented in table 1. The deceased group was older ( $p < 0.001$ ) and had a longer stay in acute care ( $p = 0.002$ ). They also had a shorter length of stay in the transdisciplinary unit ( $p < 0.001$ ). The multivariate analysis is presented in table 2.

Figure 1: Survival curve for the people hospitalised in the transdisciplinary unit after a suicide attempt using violent means

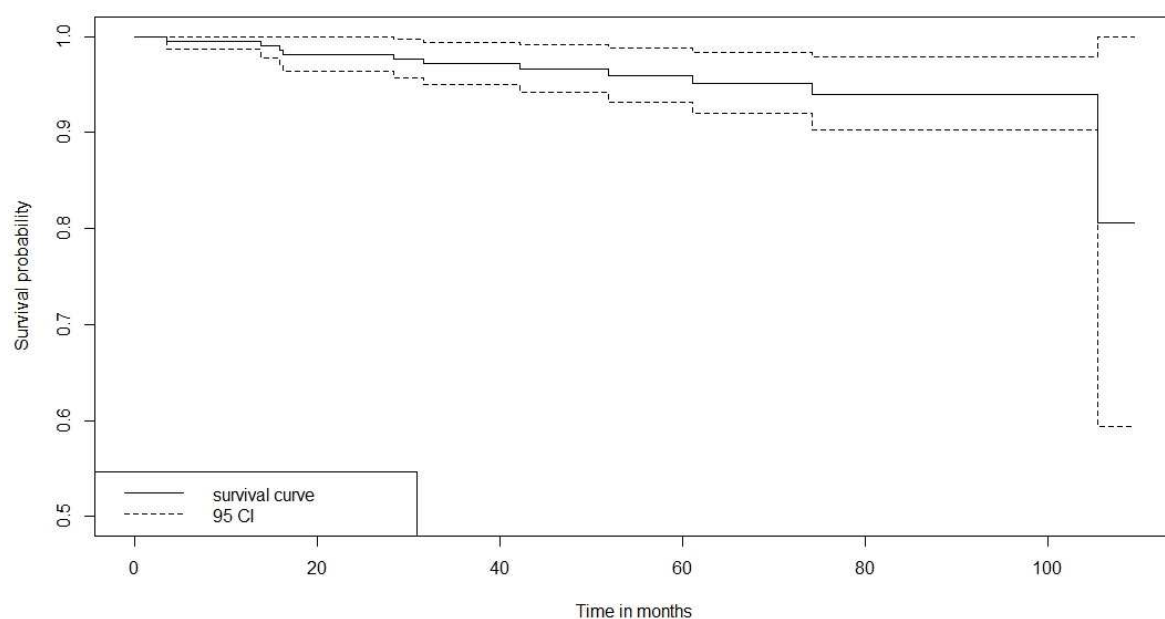


Table 2: Cox regression model for predictors of mortality.

Factors	Adjusted hazard ratio [95 CI]	P
Sex (reference=male)	0.46 [0.12; 1.70]	0.24
Age at admission (years)	1.12 [1.01; 1.25]	<b>0.04</b>
Length of stay in acute care (months)	1.27 [0.95; 1.68]	0.10
Length of stay in the transdisciplinary unit (months)	0.97 [0.86; 1.09]	0.58

## Discussion

This study aimed to determine the five-year standardized mortality ratio for individuals who attempted suicide by a violent method and were subsequently admitted to an inpatient unit providing mixed psychiatric and functional rehabilitation treatment. It also set out to search for factors associated with mortality.

After a mean follow-up of 5.4 years, the mortality was high with the SMR reaching 15.45. The individuals who died during follow-up were older and had a longer stay in acute care. They also had a shorter stay in our psychiatric and functional rehabilitation care unit.

Among people hospitalised in our transdisciplinary unit, the most frequent method of suicide attempt was jumping from a height. Other violent attempts involved jumping in front a train or a metro for 7.44% and crashing a motor vehicle for 0.93%. Half of the individuals hospitalised were men. The literature provides contrasted results on a possible male predominance in suicide attempts by jumping from a height (16,31–34). There is a predominance of males in suicide deaths on the rail network, but the predominance diminishes or even disappears when all the suicide attempts by jumping in front of a moving object are taken into account (35). The average age of 26 years at admission into the transdisciplinary unit is in line with the age of individuals who attempted suicide

in available studies on jumping from a height or in front of a moving object, which mainly concern young adults (16,35). Most of the population hospitalised in our unit had severe psychiatric disorders (schizophrenia or mood disorders: 80%). A high frequency of this kind of disorder has also been found in cohorts of survivors of deliberate jumps from a height in the literature(16,19). In addition, a French study has shown that in suicide attempts by jumping from a height, people with this type of disorders have more physical injuries and are less likely to be discharged to their homes after acute care (17).The people in our sample often had substance use as already described in relation to this kind of deliberate self-harm (16,18). Regarding the physical consequences of the suicide attempt, they had multiple severe injuries following their attempt, mainly affecting the spine, the legs and the pelvis. Most of them still had leg mobility limitations at discharge.

The individuals included in this research formed a severe clinical population hospitalised in a specific unit with mixed psychiatric and somatic rehabilitation approaches. This sample gave us the opportunity to study a relatively large cohort of people who had attempted suicide by violent means, which are fairly rare methods of deliberate self-harm (13). Previous studies on this kind of population evaluated the completed suicide rate (7,10,12,36,37) or the crude all-cause mortality rate (7,36) without calculating a SMR. The high SMR (15.45) that we found after a mean follow-up of five years underlines the severity of the outcomes in this population. Recently, two studies assessed all-cause mortality SMR one year after deliberate self-harm among young adults (38,39). The American study by Olfson *et al.* found a SMR of 10 for adults aged 18 to 24 catered for in all care settings for deliberate self-harm (39). The French study by Vuagnat *et al.* found a SMR of over 20 among adults under 35 admitted to hospital after deliberate self-harm (38). Both these studies described an increased risk of subsequent mortality when violent means were used in the index episode of self-harm (38,39). However, short follow-up periods can overestimate the risk because mortality is higher in the years immediately following a suicide attempt or deliberate self-harm, especially suicide deaths (2,10–12,15,36,40,41).

To our knowledge, only Beautrais has compared mortality after a severe suicide attempt with mortality in the general population. As in our study, she followed her sample for five years and found a mortality rate that was 5 times higher for those people who had attempted suicide (without formally calculating a SMR) (7). This study used a broad definition of serious suicide attempt which included treatment in specialized unit (intensive care unit; hyperbaric unit; burns unit), or surgery under general anaesthesia, or extensive medical treatment including antidotes for drug overdose, telemetry or repeated tests or investigations, or suicide attempt by hanging or gunshot (7). The higher five-year SMR that we observed is consistent with the higher mortality observed after a suicide attempt using violent means than after self-poisoning (up to 4.8 times higher after a suicide attempt by jumping from a height) (10,11).

Numerous factors could be involved in this higher mortality. The people admitted to the transdisciplinary unit had severe physical trauma, which is a risk factor for delayed long-term mortality (42,43). Besides the index suicide attempt, they had numerous risk factors for death by suicide. Indeed, they were young adults (19), many had severe psychiatric disorders (28) and there was a frequent co-occurrence with substance use (19,28). They had already attempted suicide before

the present suicide attempt using violent methods (repeat suicide attempts (11)), they had been hospitalised in psychiatry (11). In addition, they still had activity limitations (27), persistent pain (44) or neurological deficits (45) at discharge.

In our population, mortality was associated with older age (29.91 years in the group of individuals who died *versus* 25.30 years on average in the group of survivors). This is consistent with higher suicide rates with increasing age in adulthood (46–48). Savic *et al.* (45) found a similar association between age and overall mortality after a traumatic spinal cord injury (frequent in our population). In their study, mortality and suicide were more frequent among people injured in suicide attempts than among other people with spinal cord injuries. The annual risk of mortality was also higher in the years following the injury and decreased steadily each year after the injury (45). A higher suicide risk was also found by Pan *et al.* in the 30-39 year age group among people with schizophrenia compared to other age groups (19).

The individuals who died had been hospitalised longer in acute care after their suicide attempt. The international literature describes a link between the severity of injuries and the length of stay in hospital (49,50). Our results probably reflect an association between the severity of the suicide attempt and subsequent death. Unfortunately, we were unable to obtain the causes of death in our population because only the first four of the eleven deaths were accessible via the French epidemiological centre collecting data on death certificates (Centre for Epidemiology on Medical Causes of Death, CépiDc). Nevertheless, two studies have shown that the medical severity of a suicide attempt predicts the lethality of a subsequent suicide attempt (51,52), confirming an association previously described by Trakhtenbrot *et al.* (53). Another explanation of this association between severity of the suicide attempt and all-cause mortality is poorer physical health as a result of severe trauma (42,43). Thus, Savic *et al.* found an association between the severity of traumatic spinal cord injuries and overall mortality (45).

More surprisingly, we also found a shorter length of stay in our transdisciplinary unit for the group of individuals who died. It may be that the need for intensive rehabilitation care was less marked in this group, or that these people were discharged earlier because of significant difficulties in adhering to treatment. Future studies should investigate this question, because discharge may have been less well planned when the stay was shorter. Indeed, at discharge the outpatient care of these individuals who have attempted suicide is crucial. Somatic follow-up is important to avoid possible complications related to physical injuries following the suicide attempt and to screen for somatic pathologies that can affect people with severe mental illness (54). This type of care is particularly important as it can have an impact on the risk of suicide. Physical pain is known to be associated with higher death rates from suicide (55) and more than half of our sample were receiving painkillers at discharge. Appropriate outpatient physiotherapy and rehabilitation should also be pursued if necessary, as a recent study has shown that suicide risk is mainly related to limitations in daily activities, more than to any particular type of disability or somatic difficulty, especially among those under 35 (27).

Regarding the psychiatric follow-up, the care team in the transdisciplinary unit always organises follow-up at discharge, and they are currently implementing collaboration with the French Vigilans program for all these people who have attempted suicide (56,57). Vigilans is a brief contact program following discharge from hospital after a suicide attempt. Each individual is given a crisis card with an emergency number to contact in case of distress, and they are systematically re-contacted at 10 days and at 6 months. Postcards are also sent to them every month to remind them of the possibility of contacting the team and letters are sent to the person's general practitioner and psychiatrist after each telephone interview. The Vigilans intervention has been shown to be effective in reducing suicide reattempts (57). A professional suicide helpline has also recently opened in France (58). Many other organisational factors could improve suicide prevention in this population: outreach teams, early follow-up at discharge, or 24-hour crisis teams (59). Lastly, substance use was frequent in our sample and people with comorbid psychiatric disorder and substance use can present additional complexities and barriers to help-seeking (59,60). Treating substance abuse can contribute to reducing the suicide risk, but particular attention should also be paid to support networks with family, friends and professionals working together (59,60).

### Limitations

First, this study is based on a small sample. However, this sample was an opportunity to study a relatively large cohort of people who had attempted suicide by violent means, a fairly rare method of deliberate self-harm. It was a clinical population hospitalised after a suicide attempt in a specific psychiatric ward with mixed psychiatric and physical rehabilitation approaches. Most had very severe injuries and could not be representative of all people who attempt suicide by violent means. In addition, the stays in acute care and in the transdisciplinary unit were long and this could influence mortality or suicide risk in ways we cannot predict. Data collection was retrospective, from clinical records, without standardized interviews for psychiatric diagnoses. We were not able to collect certain data that could have influenced suicide and all-cause mortality, such as social factors (family environment or social integration). Furthermore, as mentioned above, we were unable to obtain the causes of death because only the first four of the eleven deaths were accessible via the French epidemiological centre collecting data on death certificates (*CépiDc*). However, there are only a few studies on people who have attempted suicide by violent methods and this clinical sample enabled us to calculate a SMR, a result that we did not find elsewhere in literature.

### Conclusion

Long-term mortality after a suicide attempt by jumping from a height or in front of a vehicle in this study was 15 times higher than in the corresponding young adult general population. The SMR is high for all-cause mortality with a long-term follow-up of five years. This study supports the hypothesis that the severity of a suicide attempt is associated with a subsequent excess risk of mortality. A transdisciplinary approach in a specific unit for individuals with both severe psychiatric disorders and significant somatic sequelae from their suicide attempt is an important part of this care trajectory. It provides physical rehabilitation and psychiatric care, avoiding delays, in order to limit the sequelae

and the risk of a repeat of suicide attempt. It can also improve the transition to outpatient care at discharge. The results underline the need to be very careful at the time of this transition for people who have longer stays in acute care and for the older age group. Beyond the wider development of this type of transdisciplinary unit, there is a need to consolidate outpatient facilities that provide appropriate support after hospitalisation. These programmes need to ensure continuity in coordinated psychiatric and somatic care and psychosocial rehabilitation in order to prevent the risk of suicide in this particular population.

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