



## **Suicide attempts by jumping and length of stay in general hospital: A retrospective study of 225 patients**

Louise Todorov, Hélène Vulser, Romain Pirracchio, Isabelle Thauvin, Andrei Radtchenko, Jean Vidal, Pierre Guigui, Frédéric Limosin, Cédric Lemogne

### **► To cite this version:**

Louise Todorov, Hélène Vulser, Romain Pirracchio, Isabelle Thauvin, Andrei Radtchenko, et al.. Suicide attempts by jumping and length of stay in general hospital: A retrospective study of 225 patients. *Journal of Psychosomatic Research*, 2019, 119, pp.34 - 41. <10.1016/j.jpsychores.2019.02.001>. <hal-03485695>

**HAL Id: hal-03485695**

**<https://hal.science/hal-03485695v1>**

Submitted on 20 Dec 2021

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons CC BY-NC 4.0 - Attribution - Non-commercial use - International License

## **Suicide attempts by jumping and length of stay in general hospital: a retrospective study of 225 patients**

Louise Todorov <sup>a</sup>, Hélène Vulser <sup>a,b</sup>, Romain Pirracchio <sup>b,c,f</sup>, Isabelle Thauvin <sup>a</sup>, Andrei Radtchenko <sup>a</sup>, Jean Vidal <sup>d</sup>, Pierre Guigui <sup>b,e</sup>, Frédéric Limosin <sup>a,b,g</sup>, Cédric Lemogne <sup>a,b,g</sup>

<sup>a</sup>AP-HP, Hôpitaux Universitaires Paris Ouest, Service de Psychiatrie et Addictologie de l'adulte et du sujet âgé, Paris, France

<sup>b</sup>Université Paris Descartes, Sorbonne Paris Cité, Faculté de Médecine, Paris, France

<sup>c</sup>AP-HP, Hôpitaux Universitaires Paris Ouest, Service d'Anesthésie-Réanimation, Paris, France

<sup>d</sup>AP-HP, Hôpitaux Universitaires Paris Ouest, Service de Médecine physique et Réadaptation, Issy-les-Moulineaux, France

<sup>e</sup>AP-HP, Hôpitaux Universitaires Paris Ouest, Service de Chirurgie orthopédique et Traumatologie, Paris, France

<sup>f</sup>Inserm U1153, Department of Biostatistics and Medical Informatics, Saint Louis Hospital, Paris, France

<sup>g</sup>Inserm U1266, UMR-S 1266, Institute of Psychiatry and Neuroscience, Paris, France

### **Corresponding author:**

Dr Louise Todorov

Unité fonctionnelle de Psychologie et Psychiatrie de liaison et d'urgence

Hôpital européen Georges-Pompidou

20 rue Leblanc, 75908 Paris Cedex 15, France

Tel: 00.33.1.56.09.33.71 / Fax: 00.33.1.56.09.31.46

Email: [louise.todorov@aphp.fr](mailto:louise.todorov@aphp.fr)

## **Abstract**

**Objective:** Violent suicide attempts, such as jumping from a height, frequently lead to hospitalization in general hospital with high length of stay (LOS). We investigated features associated with LOS in this context.

**Methods:** We retrospectively included all patients admitted after suicide attempts by jumping in non-psychiatric wards of a university hospital between 2008 and 2016. Several socio-demographic and clinical data were collected, including psychiatric diagnoses, coded with the International Classification of Diseases-10th Revision. We used general linear models to identify factors associated with LOS.

**Results:** Among 225 patients (125 men; mean age  $\pm$  sd: 37.5  $\pm$  15.4 years), several clinical factors were independently associated with a longer LOS: number of injuries ( $\beta=8.2$   $p<0.001$ ), external fixator ( $\beta=18.1$   $p=0.01$ ), psychotic disorder ( $\beta=14.6$   $p=0.02$ ) and delirium ( $\beta=16.6$   $p=0.005$ ). Admission in psychiatric ward at discharge tended to be associated with lower LOS ( $\beta=-15.3$   $p=0.07$ ).

**Conclusion:** In patients admitted in medical setting after suicide attempt by jumping, the presence of a psychotic disorder may increase LOS by several days, and indirectly costs of hospitalization, to a similar extent of non-psychiatric factors. The association of transfer in psychiatric ward with lower LOS suggests that the psychiatric disorder might interfere with medical care.

**Keywords:** consultation liaison psychiatry, jumping, length of stay, suicide attempt

## Introduction

Suicide kills around 800,000 people in a year, accounting for about 1.4% of all deaths worldwide [1]. In young adults, it is even the second cause of death. Suicide prevention is thus a major public health issue.

Suicide by violent means, such as hanging, firearms or jumping, represents about 74% of all completed suicides in France [2]. In Paris area, jumping from a height is particularly frequent, with 14% of suicides made by this method [2]. From a clinical point of view, violent suicide attempts have been found to be particularly associated with severe mental disorders [3,4], such as schizophrenia [5–12] sometimes even before the diagnosis [13], and to predict later completed suicide [14,15]. Taken together, these findings suggest that a particular attention should be paid after violent suicide attempts.

Moreover, lethality of such violent attempts is extremely high, reaching 50 to 95% after jumping from a height [16–18]. When non-lethal, medical non-psychiatric consequences are much more frequent in comparison with non-violent suicide attempts [15,17]. After jumping, the most frequently reported consequences are multiple traumatic injuries, especially spine, pelvis and limbs and neurological damage [19]. Such heavy damage often leads to admission in general hospital [2]. However, little is known about socio-demographic and clinical factors associated with LOS in general hospital after violent suicide attempts. Only one recent study investigated these factors among 113 patients having attempted suicide by jumping [20]. The authors reported that LOS was significantly associated with schizophrenia, height of the fall and the number of injuries. However, this study took into account few potential confounders (diagnosis status, height of the fall and the number of injuries) and examined only the global LOS, including the period of psychiatric and rehabilitation care in which LOS may be differently associated with socio-demographic and clinical variables compared with acute care wards. Indeed, a longer LOS in psychiatric ward and related costs may be justified for an adequate management of patients with severe mental disorders. Therefore, such a finding would be both self-evident and unlikely to signal unmet needs regarding the clinical management of these patients. In contrast, an association of severe mental disorders with a longer LOS in non-psychiatric ward may signal the need to devote more resources for the management of these patients. Further studies are thus required to investigate factors associated with LOS specifically in general hospital, and to examine in which extent these factors are associated with LOS.

In this retrospective study, we aimed to assess socio-demographic and clinical factors associated with LOS among patients hospitalized in a general hospital after suicide attempt by jumping. As we sought to evaluate the management of suicide attempters in non-psychiatric department, we deliberately focused on patients admitted in medical and surgical ward and not in psychiatric ward.

## **Methods**

### **Participants**

The study was conducted at a 712-bed acute metropolitan general university hospital in Paris, France (European Georges Pompidou Hospital). This general hospital has a trauma center with Orthopedic Surgery ward specialized in spinal surgery and a C-L Psychiatry unit. All in-patients admitted after suicide attempts by jumping and referred to a C-L psychiatrist from 1st January, 2008 to 31 December, 2016, were included in the study. In case of multiple suicide attempts for the same patient during this period, only the first stay was considered. For each patient, the main psychiatric diagnosis was coded according to the International Classification of Diseases, 10th revision (ICD-10) and computerized by the psychiatrist in the medical record of the patient after the consultation.

All patients with 'X80' ICD-10 code (i.e. "Intentional self-harm by jumping from a high place") in the period were selected. In order to identify cases with missing X80 codes, medical records of patients hospitalized in Orthopedic Surgery ward and seen by a C-L psychiatrist in the period were systematically reviewed. Patients were not included in this study if they were under age 16, if they had initial medical care in another hospital or if they died before the first psychiatric assessment.

The present project obtained the authorization of the local ethic committee (CERHUPO) under the allocated reference number 17-9-3.

### **Data collection**

Data were obtained from the medical records located in the main hospital computer system. We focused on the data needed to accurately describe the sample as well as to adjust the subsequent analyses on potential confounding factors (e.g. the number of injuries). The collected data included 3 types of variables:

- Variables assessed at admission: age, sex, living status, homeless status, occupational status, ability to speak French, previous psychiatric care, history of hospitalization in a

psychiatric ward, delirium state, substance use disorder, main psychiatric diagnosis, intent to die and height of the fall.

- Hospital care variables: admission date, initiation of psychotropic medication, anticoagulation, orthopedic corset and external fixator, discharge date.
- Orientation at discharge.

#### *Variables assessed at admission*

Living status was categorized into living alone or not; homeless status as having a place to live or not, occupational status as active / student / pensioner or inactive / unemployed and ability to speak French as yes or no. History of psychiatric care and history of hospitalization in a psychiatric ward were categorized as presence or absence. The main psychiatric diagnosis was first established based on the criteria of ICD-10 from 'F0' to 'F9' and then categorized in three classes: 'F2' code (Schizophrenia, schizotypal and delusional disorders), 'F3' code (Mood disorders) and 'Other diagnoses'. Delirium state and substance use disorder were assessed at the time of the first assessment and separately categorized as presence or absence. Considering these two diagnoses separately from the main diagnosis, allowed us to take into account potential comorbidity. Acknowledged intent to die at the time of suicidal attempt was categorized into 2 classes: presence or absence. Height of the fall was expressed in meters and used as a continuous variable.

#### *Hospital care variables*

Initiation of psychiatric medication (excluding symptomatic medication) was categorized as yes or no. Anticoagulation, orthopedic corset and external fixator were all categorized as presence or absence. The patterns of injury were recorded by using medical imaging (X-ray, computed tomography and magnetic resonance imaging) considering the following regions: head, face, arm, leg, spine, pelvis, vascular and visceral injuries. The number of regions with at least one lesion was further summed to define a "number of injuries" score to assess the medical non-psychiatric severity, as in the previous study on patients hospitalized after suicide attempt by jumping [18].

#### *Orientation at discharge*

Orientation at discharge was categorized into five classes: returning home, further care in rehabilitation center, further care in rehabilitation center with psychiatric care, further care in psychiatric ward and other (including death, escape from hospital or and repatriation).

#### *Length of stay*

LOS was calculated as the whole number of days from admission to the day of discharge from the hospital.

### **Statistical analyses**

Statistical analyses were performed using R software (<http://cran.r-project.org>, version 3.0.2).

Continuous variables were first assessed for normality distribution using Shapiro-Wilk test.

Preliminary analyses were performed to compare socio-demographic and clinical variables according to the main psychiatric diagnosis (F2: 'Psychotic disorders', F3: 'Mood disorders' or 'Other diagnoses') using Chi-squared tests and analyses of variance (ANOVA). When differences were observed, analyses were completed with pairwise Chi-squared and Student's t tests.

Our principal analysis examined the associations between socio-demographic and clinical variables with LOS with general linear models using the `glm()` function included in R. Reported beta values refer here to unstandardized regression coefficients.

To reduce the collinearity of the variables included in the final model, we first assessed the association between groups of *a priori* related variables and LOS in several steps, all models being adjusted for age and sex.

First, we examined variables assessed at admission in 5 independent models (named models 1):

- Model 1a included other socio-demographic variables (ability to speak French, homeless status, occupational status, living status);
- Model 1b included history of psychiatric care;
- Model 1c included the number of injuries;
- Model 1d included variables related to the suicide attempt (height of the fall, intent to die);
- Model 1e included age, sex and variables related to psychiatric assessment by the C-L psychiatrist (delirium state, substance use disorder, main psychiatric diagnosis).

Finally, when variables used in model 1a to model 1e had a p value for the association with LOS inferior to 0.20, they were included in a global model 1.

Despite the potential for multicollinearity, the variables "number of injuries" and "height of the fall" were simultaneously included for several reasons. First, height of the fall may be differently associated with medical injuries in accidents versus suicide attempts [17,21,22]. Second, it is not uncommon for the fall to be damped, by bushes for examples. In that case, the number of injury may not be related to

height of the fall. Third, previous studies on suicide/suicide attempt by jumping have generally considered these two variables in their analyses [20,22].

Second, we examined hospital care variables in model 2 that included initiation of medication, anticoagulation, orthopedic corset and external fixator as covariates.

Third, the orientation at discharge was assessed in model 3.

Finally, a global model included all variables from model 1, model 2 and model 3 for which the p value for the association with LOS was inferior to 0.20.

Previous models were performed using the crude number of days from admission to discharge as outcome in order to assess the magnitude of the association between LOS and each variable. Sensitivity analyses were also performed using the logarithm of LOS as outcome in order to take into account the non-normal distribution of this variable using the same covariates as in the global model.

## **Results**

The final study population consisted of 225 patients (125 men and 100 women) with a mean age  $\pm$  standard deviation of  $37.5 \pm 15.4$  years. All continuous variables, except LOS, were normally distributed. The mean of hospital stay was  $44.9 \pm 40.6$  days (median = 36, interquartile range = 44). We reported an average of  $3.2 \pm 1.7$  injuries per patient. The main psychiatric diagnosis was 'F2' in 95 patients (42%), 'F3' in 59 patients (26%), and 'Other diagnoses' in 71 patients (32%). Detailed diagnoses of the latter group are provided in Supplemental Data.

Table 1 displays the comparison of socio-demographic and clinical characteristics of the patients according to the main psychiatric diagnosis. Patients with psychotic disorders were more likely to be inactive than those with other diagnoses. They had more frequently a history of psychiatric care or psychiatric hospitalization. Patients with psychotic disorders or mood disorders showed significantly longer LOS compared with patients with other diagnoses. Patients with mood disorders were older, more likely to be female and reported more frequently intent to die at the time of suicidal attempt than those with other diagnoses. Patients with other diagnoses had fewer body injuries, received less frequently psychiatric treatment and were more likely to return home at discharge than those with psychotic or mood disorders.



Regarding the factors associated with the LOS, multivariate models 1 (a to f) are displayed in Table 2 whereas multivariate models 2 and 3 as well as the global model are displayed in Table 3.

In separate models 1a to 1f, the p value for the association between the following variables and LOS was inferior to 0.20: French language ( $p=0.13$ ), occupational status ( $p=0.02$ ), height of the fall ( $p<0.001$ ), number of injuries ( $p<0.001$ ), psychiatric follow-up ( $p=0.15$ ), psychotic disorder ( $p<0.001$ ) and delirium ( $p<0.001$ ).

In global model 1, the p value remained inferior to 0.20 for the following variables: number of injuries ( $p<0.001$ ), psychotic disorder ( $p=0.04$ ) and delirium ( $p=0.003$ ). The p value for the association between the following variables and LOS was also inferior to 0.20: background psychiatric treatment ( $p=0.03$ ), anticoagulation ( $p=0.001$ ) and external fixator ( $p<0.001$ ) (model 2); orientation at discharge ( $p<0.001$ ) (model 3).

Due to the high risk of multicollinearity in model 1, another model 1 was performed again without the variable "height of the fall". We observed that the results were similar in terms of significance and did not change the results of the global model.

In the global model, several variables were independently associated with a longer LOS: number of injuries ( $\beta = 8.2$ ;  $p<0.001$ ), psychotic disorder ( $\beta = 14.6$ ;  $p=0.02$ ), delirium ( $\beta = 16.6$ ;  $p=0.005$ ) and external fixator ( $\beta = 18.1$ ;  $p=0.01$ ) (Table 3). We found a trend for a lower LOS in patients admitted in psychiatric ward at discharge ( $\beta = -15.3$ ;  $p = 0.07$ ).

In sensitivity analyses, using the logarithm of LOS as outcome, number of injuries ( $\beta = 0.2$ ;  $p < 0.001$ ), psychotic disorder ( $\beta = 0.5$ ;  $p = 0.003$ ), delirium ( $\beta = 0.4$ ;  $p = 0.002$ ), external fixator ( $\beta = 0.4$ ;  $p = 0.02$ ), anticoagulation ( $\beta = 0.6$ ;  $p < 0.001$ ) and admission in rehabilitation center at discharge ( $\beta = 0.4$ ;  $p = 0.046$ ) were positively associated with log (LOS). Admission in psychiatric ward at discharge was associated with a lower length of stay ( $\beta = -0.8$ ;  $p < 0.001$ ).

## Discussion

This retrospective study aimed to examine socio-demographic and clinical factors associated with LOS in patients admitted in general hospital after a suicide attempt by jumping. To our knowledge, this study is the largest to address this question and the first one to investigate these associations specifically in non-psychiatric wards. We found that psychotic disorders and delirium were associated with an increase in the duration of hospital stay by several days (15 and 17, respectively). These

associations were of a magnitude nearly similar of those of medical non-psychiatric factors, such as the presence of an external fixator (18 days). In contrast, we observed a trend for a lower LOS (-15 days) in patients admitted in psychiatric ward at discharge.

Our findings confirm and extend results from previous studies reporting higher LOS in general hospital in patients with mental illness [23–25], notably psychotic disorders [26–28]. This result was also reported in the previous retrospective cohort of patients hospitalized after suicide attempt by jumping [20]. However, in this previous study, the increased LOS may have been explained by a longer stay in psychiatric ward, as this period was included in the LOS. Several hypotheses may explain a higher LOS in non-psychiatric wards within patients with psychotic disorders. First, psychotic symptoms by themselves may interfere with optimal medical cares. For example, delusional states may lead to agitation that may then make the patient pull out his or her urinary or blood catheter, and cognitive dysfunctions may make difficult understanding medical care prescriptions, such as immobilization. Overall, schizophrenia has been associated with increased rates of postoperative adverse events during surgical hospitalizations [29] as well as increased rates of preexisting medical comorbidities [30]. Second, stigma associated with psychotic disorders may lead to suboptimal treatment or decrease in nursing cares provided to those patients [31]. Then, side effects of antipsychotic treatments, frequently used in patients with psychotic disorders, may increase the risk of complications due to immobilization [32] such as functional intestinal occlusion [33] or venous thrombosis [34]. Finally, longer LOS in patients with psychotic disorders might be due to difficulties in finding an available medical-psychiatric bed, notably rehabilitation bed with psychiatric care.

Our finding of an association between delirium and longer LOS is also in line with previous studies [35–38], including studies investigating delirium after orthopedic surgery [39,40] or in patients with multiple traumatic injuries [41]. This finding could be explained by several factors. For instance, delirium is often associated with increased post-operative complications [40], notably urinary tract infections, pneumonias or surgical site infections [35,42]. Furthermore, early delirium could delay adequate treatment, for example physical therapy after surgery or differed first psychiatric interview [43] thus leading to delayed psychiatric treatment of a potential underlying psychiatric disorder. Together with the association of a higher LOS in patients with an external fixator, which is also in line with the literature [44,45], this predictable result provided external validity for our analyses.

In the present study, admission in psychiatric ward at discharge tended towards an association with a lower LOS. Although it certainly warrants replication, this result suggests that some psychiatric symptoms, such as persistent suicide intents or important agitation due to delusional symptoms, may lead to an earlier transfer in psychiatric ward while medical non-psychiatric cares could be still needed. This suggests reinforcing psychiatric care in patients admitted in general hospital after violent suicidal attempt so that they can receive appropriate both psychiatric and non-psychiatric care. One may argue that the association between admission in psychiatric ward at discharge and lower LOS is not inconsistent with our result of higher LOS in patients with psychotic disorders. Indeed, patients with psychotic disorders were more likely to be transferred in psychiatric ward at discharge (25% versus 13% in patients with mood disorders or other diagnoses in our study). However, although no data are available in this study to test this hypothesis, it may be suggested that, among patients with psychotic disorders, those with more warning psychiatric symptoms, such as delusional and agitation state, are more likely to be transferred earlier in psychiatric ward, than patients with chronic cognitive impairment or disorganized symptoms. Shorter LOS in patients admitted in psychiatric ward at discharge might also be due to the organization of the mental health services in France, where psychiatric beds are readily available for patients with severe mental disorders.

Regarding the characteristics of our population, the proportion of patients with psychotic disorders, mood disorders and other disorders (Supplemental Table) were in line with the literature about suicide attempts by jumping from a height [10–12,20,46,47]. Regarding the patients with psychotic disorders (42% in our sample), psychotic symptoms, such as disorganization or cognitive impairment, can interfere with the preparations that other violent suicide means may require. This high proportion of patients with psychotic disorders may thus be explained by the immediate and widespread availability of this method of suicide.

Taken together, these results suggest that, as previously reported [48–52], there are disparities in non-psychiatric healthcare among patients with severe mental disorders. In addition to the systematic psychiatric assessment of patients who attempted suicide by jumping, C-L psychiatrists should pay particular attention to the quality of care provided to patients with psychotic disorders. As suggested

by Freudenreich [53], various interventions may be helpful to this end, e.g. providing education about schizophrenia and its symptoms, reducing stigmatization, supporting the non-psychiatric staff, managing situations of aggressive behaviors or ensuring adequate care. When orientation to psychiatric ward at discharge is decided, C-L psychiatrists have a key role in organizing the transfer (appropriate transport, sedative treatment if needed) and in ensuring the continuity of non-psychiatric care. Regarding the detrimental correlates of delirium, C-L psychiatrists may also contribute to prevent this complication to occur. For instance, they can check that there was no previous psychotropic treatment in order to reduce risk of withdrawal effects, or advise non-psychiatric staff on anticholinergic effects of some drugs. Once delirium state is present and in case of behavioral disorders, C-L psychiatrists may support physicians with non-pharmacological interventions and symptomatic treatment. Further studies should test the impact of a C-L service on length of stay among suicide attempters.

### **Strengths and limitations**

Strengths of this study are the relatively large sample and the wide set of covariates considered, compared to previous reports. Furthermore several expected associations, such as the proportion of the diagnosis groups [20] or the sex ratio within these groups, were in line with the literature, thus supporting the external validity of our study. Some limitations should be acknowledged. First, data collection was not designed for the study and psychiatric diagnoses were not obtained with standardized interviews. Second, we cannot ascertain that all patients admitted after a suicidal attempt by jumping were correctly identified. Third, the "Other diagnoses" group was heterogeneous, due to the various psychiatric diagnoses it contains. Fourth, we collected data from suicide attempters admitted to a single general hospital in a restricted geographical region, which may limit the generalizability of our results. Finally, regarding the correlates of suicide attempts by jumping from a height, there is a recruitment bias related to the selection of surviving patients.

### **Conclusion**

This study aimed to highlight the factors associated with LOS in general hospital among suicide attempters by jumping. We found that the presence of a psychotic disorder at the time of the first C-L

psychiatry consultation was associated with a clinically and statistically significant increase of the duration of hospital stay, whereas admission in psychiatric ward at discharge tended to be associated with lower LOS. These findings confirm that severe mental disorders are associated with higher general hospital costs, thus advocating for better funding for hospitals that provide care to these particularly vulnerable patients. They also suggest disparities in non-psychiatric healthcare in patients with severe mental disorders. C-L psychiatrists should thus pay attention to such clinical factors to help improving general medical care in those patients.

**Acknowledgements**

L.T reports speaker fees from Otsuka Pharmaceutical. I.T reports investigator fees from Janssen. F.L reports consulting, investigator or speaker fees from AstraZeneca, Janssen, Lundbeck, Roche and Servier, and non-financial support from Lundbeck and Otsuka Pharmaceutical, outside the submitted work. C.L reports consulting or speaker fees from Daiichi-Sankyo, Janssen, Lundbeck and Servier, and non-financial support from Lundbeck and Otsuka Pharmaceutical, outside the submitted work. A.R reports speaker fees from Lundbeck. H.V has no conflict of interest to disclose. The authors report no proprietary or commercial interest in any product mentioned or concept discussed in this article.

**Formatting of funding sources**

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

## References

- [1] World Health Organization, Preventing suicide: A global imperative. Available: [http://www.who.int/mental\\_health/suicide-prevention/world\\_report\\_2014/en/](http://www.who.int/mental_health/suicide-prevention/world_report_2014/en/) (accessed January 11, 2018).
- [2] [2ème rapport de l'Observatoire National du Suicide. Suicide, connaître pour prévenir : dimensions locales, nationales et associatives.] Available: [http://solidarites-sante.gouv.fr/IMG/pdf/2e\\_rapport\\_de\\_l\\_observatoire\\_national\\_du\\_suicide.pdf](http://solidarites-sante.gouv.fr/IMG/pdf/2e_rapport_de_l_observatoire_national_du_suicide.pdf) (accessed August 17, 2018).
- [3] Copeland AR. Suicide by jumping from buildings. *Am J Forensic Med Pathol* 1989;10:295–8.
- [4] Lindqvist P, Jonsson A, Eriksson A, Hedelin A, Björnstig U. Are suicides by jumping off bridges preventable? *Accid Anal Prev* 2004;36:691–4. doi:10.1016/S0001-4575(03)00089-7.
- [5] Nieto E, Vieta E, Gastó C, Vallejo J, Cirera E. Suicide attempts of high medical seriousness in schizophrenic patients. *Compr Psychiatry* 1992;33:384–7. doi:10.1016/0010-440X(92)90060-4.
- [6] Reisch T, Schuster U, Michel K. Suicide by jumping from bridges and other heights: social and diagnostic factors. *Psychiatry Res* 2008;161:97–104. doi:10.1016/j.psychres.2007.06.028.
- [7] Chen Y-Y, Lee M-B, Chang C-M, Liao S-C. Methods of suicide in different psychiatric diagnostic groups. *J Affect Disord* 2009;118:196–200. doi:10.1016/j.jad.2009.05.020.
- [8] Huisman A, van Houwelingen CAJ, Kerkhof AJFM. Psychopathology and suicide method in mental health care. *J Affect Disord* 2010;121:94–9. doi:10.1016/j.jad.2009.05.024.
- [9] Park S, Ahn MH, Na R, Kim S-O, Yoon JS, Park J-H, et al. Factors associated with suicide method among psychiatric patients in a general hospital in Korea. *Psychiatry Res* 2013;210:945–50. doi:10.1016/j.psychres.2013.08.037.
- [10] de Moore GM, Robertson AR. Suicide Attempts by Firearms and by Leaping From Heights: A Comparative Study of Survivors. *Am J Psychiatry* 1999;156:1425–31. doi:10.1176/ajp.156.9.1425.
- [11] Nakagawa M, Kawanishi C, Yamada T, Sugiura K, Iwamoto Y, Sato R, et al. Comparison of characteristics of suicide attempters with schizophrenia spectrum disorders and those with mood disorders in Japan. *Psychiatry Res* 2011;188:78–82. doi:10.1016/j.psychres.2010.09.008.
- [12] Kimura R, Ikeda S, Kumazaki H, Yanagida M, Matsunaga H. Comparison of the clinical features of suicide attempters by jumping from a height and those by self-stabbing in Japan. *J Affect Disord* 2013;150:695–8. doi:10.1016/j.jad.2013.04.048.

- [13] Nielssen OB, Large MM. Untreated psychotic illness in the survivors of violent suicide attempts. *Early Interv Psychiatry* 2009;3:116–22. doi:10.1111/j.1751-7893.2009.00117.x.
- [14] Runeson B, Tidemalm D, Dahlin M, Lichtenstein P, Langstrom N. Method of attempted suicide as predictor of subsequent successful suicide: national long term cohort study. *BMJ* 2010;341:c3222–c3222. doi:10.1136/bmj.c3222.
- [15] Giner L, Jaussent I, Olié E, Béziat S, Guillaume S, Baca-Garcia E, et al. Violent and serious suicide attempters: one step closer to suicide? *J Clin Psychiatry* 2014;75:e191-197. doi:10.4088/JCP.13m08524.
- [16] Wyatt JP, Beale JP, Graham CA, Beard D, Busuttill A. Suicidal high falls. *J Clin Forensic Med* 2000;7:1–5. doi:10.1054/jcfm.2000.0357.
- [17] Richter D, Hahn MP, Ostermann PA, Ekkernkamp A, Muhr G. Vertical deceleration injuries: a comparative study of the injury patterns of 101 patients after accidental and intentional high falls. *Injury* 1996;27:655–9.
- [18] Warner KG, Demling RH. The pathophysiology of free-fall injury. *Ann Emerg Med* 1986;15:1088–93. doi:10.1016/S0196-0644(86)80134-2.
- [19] Rocos B, Chesser TJ. Injuries in jumpers - are there any patterns? *World J Orthop* 2016;7:182–7. doi:10.5312/wjo.v7.i3.182.
- [20] Omi T, Ito H, Riku K, Kanai K, Takada H, Fujimi S, et al. Possible factors influencing the duration of hospital stay in patients with psychiatric disorders attempting suicide by jumping. *BMC Psychiatry* 2017;17:99. doi:10.1186/s12888-017-1267-5.
- [21] Dickinson A, Roberts M, Kumar A, Weaver A, Lockey DJ. Falls from height: injury and mortality. *J R Army Med Corps* 2012;158:123–7.
- [22] Teh J, Firth M, Sharma A, Wilson A, Reznek R, Chan O. Jumpers and fallers: a comparison of the distribution of skeletal injury. *Clin Radiol* 2003;58:482–6.
- [23] Bourgeois JA, Kremen WS, Servis ME, Wegelin JA, Hales RE. The impact of psychiatric diagnosis on length of stay in a university medical center in the managed care era. *Psychosomatics* 2005;46:431–9. doi:10.1176/appi.psy.46.5.431.
- [24] Fulop G, Strain JJ, Fahs MC, Schmeidler J, Snyder S. A prospective study of the impact of psychiatric comorbidity on length of hospital stays of elderly medical-surgical inpatients. *Psychosomatics* 1998;39:273–80. doi:10.1016/S0033-3182(98)71344-1.



- [25] Siddiqui N, Dwyer M, Stankovich J, Peterson G, Greenfield D, Si L, et al. Hospital length of stay variation and comorbidity of mental illness: a retrospective study of five common chronic medical conditions. *BMC Health Serv Res* 2018;18. doi:10.1186/s12913-018-3316-2.
- [26] Schoepf D, Uppal H, Potluri R, Heun R. Physical comorbidity and its relevance on mortality in schizophrenia: a naturalistic 12-year follow-up in general hospital admissions. *Eur Arch Psychiatry Clin Neurosci* 2014;264:3–28. doi:10.1007/s00406-013-0436-x.
- [27] Bressi SK, Marcus SC, Solomon PL. The Impact of Psychiatric Comorbidity on General Hospital Length of Stay. *Psychiatr Q* 2006;77:203–9. doi:10.1007/s11126-006-9007-x.
- [28] Gur S, Weizman S, Stubbs B, Matalon A, Meyerovitch J, Hermesh H, et al. Mortality, morbidity and medical resources utilization of patients with schizophrenia: A case-control community-based study. *Psychiatry Res* 2018;260:177–81. doi:10.1016/j.psychres.2017.11.042.
- [29] Daumit GL, Pronovost PJ, Anthony CB, Guallar E, Steinwachs DM, Ford DE. Adverse Events During Medical and Surgical Hospitalizations for Persons With Schizophrenia. *Arch Gen Psychiatry* 2006;63:267. doi:10.1001/archpsyc.63.3.267.
- [30] Rekhi G, Khyne TT, Lee J. Estimating 10-year cardiovascular disease risk in Asian patients with schizophrenia. *Gen Hosp Psychiatry* 2016;43:46–50. doi:10.1016/j.genhosppsych.2016.09.005.
- [31] Angermeyer MC, Matschinger H. Causal beliefs and attitudes to people with schizophrenia. *Br J Psychiatry* 2005;186:331–4. doi:10.1192/bjp.186.4.331.
- [32] Muench J, Hamer AM. Adverse Effects of Antipsychotic Medications. *Am Fam Physician* 2010;81:617–22.
- [33] Bulot V, Lemogne C, Nebot N, Blondon H, Roux P. Systematic prevention of severe constipation induced by antipsychotic agents: A quasi-experimental study. *Eur Neuropsychopharmacol* 2016;26:1690–1. doi:10.1016/j.euroneuro.2016.08.004.
- [34] Lieberman JA. Managing Anticholinergic Side Effects. *Prim Care Companion J Clin Psychiatry* 2004;6:20–3.
- [35] Bhattacharya B, Maung A, Barre K, Maerz L, Rodriguez-Davalos MI, Schilsky M, et al. Postoperative delirium is associated with increased intensive care unit and hospital length of stays after liver transplantation. *J Surg Res* 2017;207:223–8. doi:10.1016/j.jss.2016.08.084.
- [36] Ely EW, Gautam S, Margolin R, Francis J, May L, Speroff T, et al. The impact of delirium in the intensive care unit on hospital length of stay. *Intensive Care Med* 2001;27:1892–900.

doi:10.1007/s00134-001-1132-2.

[37] van der Sluis FJ, Buisman PL, Meerdink M, Aan de Stegge WB, van Etten B, de Bock GH, et al. Risk factors for postoperative delirium after colorectal operation. *Surgery* 2017;161:704–11.

doi:10.1016/j.surg.2016.09.010.

[38] Jansen L, van Schijndel M, van Waarde J, van Busschbach J. Health-economic outcomes in hospital patients with medical-psychiatric comorbidity: A systematic review and meta-analysis. *PLOS ONE* 2018;13:e0194029. doi:10.1371/journal.pone.0194029.

[39] Brown CH, LaFlam A, Max L, Wyrobek J, Neufeld KJ, Kebaish KM, et al. Delirium After Spine Surgery in Older Adults: Incidence, Risk Factors, and Outcomes. *J Am Geriatr Soc* 2016;64:2101–8. doi:10.1111/jgs.14434.

[40] Rogers MP, Liang MH, Daltroy LH, Eaton H, Peteet J, Wright E, et al. Delirium after elective orthopedic surgery: risk factors and natural history. *Int J Psychiatry Med* 1989;19:109–21.

[41] Von Rueden KT, Wallizer B, Thurman P, McQuillan K, Andrews T, Merenda J, et al. Delirium in Trauma Patients: Prevalence and Predictors. *Crit Care Nurse* 2017;37:40–8.

doi:10.4037/ccn2017373.

[42] Elsamadicy AA, Wang TY, Back AG, Lydon E, Reddy GB, Karikari IO, et al. Post-operative delirium is an independent predictor of 30-day hospital readmission after spine surgery in the elderly (≥65years old): A study of 453 consecutive elderly spine surgery patients. *J Clin Neurosci* 2017.

doi:10.1016/j.jocn.2017.02.040.

[43] Kishi Y, Meller WH, Kathol RG, Swigart SE. Factors affecting the relationship between the timing of psychiatric consultation and general hospital length of stay. *Psychosomatics* 2004;45:470–6.

doi:10.1176/appi.psy.45.6.470.

[44] Scalea TM, Boswell SA, Scott JD, Mitchell KA, Kramer ME, Pollak AN. External fixation as a bridge to intramedullary nailing for patients with multiple injuries and with femur fractures: damage control orthopedics. *J Trauma* 2000;48:613–21; discussion 621-623.

[45] Murray AM, McDonald SE, Archbold P, Crealey GE. Cost description of inpatient treatment for ankle fracture. *Injury* 2011;42:1226–9. doi:10.1016/j.injury.2010.08.023.

[46] Kontaxakis V, Markidis M, Vaslamatzis G, Ioannidis H, Stefanis C. Attempted suicide by jumping: clinical and social features. *Acta Psychiatr Scand* 1988;77:435–7.

[47] Gore-Jones V, O'Callaghan J. Suicide attempts by jumping from a height: a consultation

liaison experience. *Australas Psychiatry* 2012;20:309–12. doi:10.1177/1039856212449672.

[48] Laursen TM, Munk-Olsen T, Nordentoft M, Mortensen PB. Increased mortality among patients admitted with major psychiatric disorders: a register-based study comparing mortality in unipolar depressive disorder, bipolar affective disorder, schizoaffective disorder, and schizophrenia. *J Clin Psychiatry* 2007;68:899–907.

[49] Robertson R, Campbell NC, Smith S, Donnan PT, Sullivan F, Duffy R, et al. Factors influencing time from presentation to treatment of colorectal and breast cancer in urban and rural areas. *Br J Cancer* 2004;90:1479–85. doi:10.1038/sj.bjc.6601753.

[50] Ishikawa H, Yasunaga H, Matsui H, Fushimi K, Kawakami N. Differences in cancer stage, treatment and in-hospital mortality between patients with and without schizophrenia: retrospective matched-pair cohort study. *Br J Psychiatry* 2016;208:239–44. doi:10.1192/bjp.bp.114.156265.

[51] Druss BG, Bradford WD, Rosenheck RA, Radford MJ, Krumholz HM. Quality of medical care and excess mortality in older patients with mental disorders. *Arch Gen Psychiatry* 2001;58:565–72.

[52] Frayne SM, Halanych JH, Miller DR, Wang F, Lin H, Pogach L, et al. Disparities in diabetes care: impact of mental illness. *Arch Intern Med* 2005;165:2631–8. doi:10.1001/archinte.165.22.2631.

[53] Freudenreich O, Stern TA. Clinical experience with the management of schizophrenia in the general hospital. *Psychosomatics* 2003;44:12–23. doi:10.1176/appi.psy.44.1.12.

### **Figure legends:**

Figure 1: Flow-chart of the study population

X80: "Intentional self-harm by jumping from a high place" code from the International Classification of Diseases, 10th revision

**Table 1: Comparison of socio-demographic and psychiatric data of the suicide attempters according to psychiatric diagnoses**

	F2		F3		Other diagnoses		Test	p value
	N=95		N=59		N=71			
	mean	sd	mean	sd	mean	sd	F	p
<b>Age (years)</b>	34.2	10.8	46.9	18.4	34.0	14.6	17.4	<b>&lt;0.001<sup>b,c</sup></b>
<b>Height of the fall (meters)</b>	11.1	5.6	8.9	4.3	8.7	4.8	5.7	<b>0.004<sup>a,c</sup></b>
<b>Number of injuries</b>	3.5	1.7	3.5	1.7	2.8	1.6	4.5	<b>0.01<sup>a,b</sup></b>
<b>LOS (days)</b>	55.6	46.4	43.8	30.9	31.6	35.3	7.6	<b>&lt;0.001<sup>a,b</sup></b>
	<b>N</b>	<b>%</b>	<b>N</b>	<b>%</b>	<b>N</b>	<b>%</b>	<b>χ<sup>2</sup></b>	<b>p</b>
<b>Sex</b>							7.3	<b>0.03<sup>b,c</sup></b>
Female	36	37.9	35	59.3	29	40.9		
Male	59	62.1	24	40.7	42	59.1		
<b>Occupational status</b>							30.0	<b>&lt;0.001<sup>a,c</sup></b>
Active / Student / Pensioner	31	32.6	39	66.1	51	71.8		
Inactive / Unemployed	64	67.4	20	33.9	20	28.2		
<b>Homeless status</b>	11	11.6	4	6.8	5	7.0	1.5	0.48
<b>Living alone</b>	43	45.3	24	40.7	25	35.2	1.7	0.43
<b>No French language</b>	8	8.4	3	5.1	5	7.0	0.6	0.74
<b>Acknowledge intent to die</b>	48	50.5	44	74.6	27	38.0	17.6	<b>&lt;0.001<sup>b,c</sup></b>
<b>History of psychiatric care</b>	76	80.0	34	57.6	28	39.4	28.7	<b>&lt;0.001<sup>a,c</sup></b>

<b>Past psychiatric hospitalization</b>	68	71.6	24	40.7	18	25.4	36.9	<b>&lt;0.001<sup>a,c</sup></b>
<b>Substance use disorder</b>	22	23.2	11	18.6	49	69.0	47.8	<b>&lt;0.001<sup>a,b</sup></b>
<b>Delirium state</b>	14	14.7	21	35.6	14	19.7	9.6	<b>0.008<sup>c</sup></b>
<b>Initiation of psychiatric treatment</b>	70	73.7	42	71.2	18	25.4	44.8	<b>&lt;0.001<sup>a,b</sup></b>
<b>Anticoagulation</b>	85	89.5	54	91.5	53	74.7	9.5	<b>0.008<sup>a,b</sup></b>
<b>External fixator</b>	12	12.6	8	13.6	5	7.0	1.8	0.41
<b>Orthopedic corset</b>	40	42.1	28	47.5	25	35.2	2.0	0.36
<b>Orientation at discharge</b>							43.4	<b>&lt;0.001<sup>a,b</sup></b>
Returning home	5	5.3	2	3.4	24	33.8		
Rehabilitation center	8	8.4	7	11.9	7	9.9		
Rehabilitation center with psychiatric care	52	54.7	39	66.1	24	33.8		
Psychiatric ward	24	25.3	8	13.6	9	12.7		
Other	6	6.3	3	5.1	7	9.9		

'F2' = Schizophrenia, schizotypal and delusional disorders; 'F3' = mood disorders; m = mean; sd = standard deviation; F = ANOVA's F- value;  $\chi^2$  = chi-square value

<sup>a</sup>: 'F2' group differ from 'Other diagnoses' group; <sup>b</sup>: 'F3' group differ from 'Other diagnoses' group; <sup>c</sup>: 'F2' group differ from 'F3' group; bold figures indicate significant results at p<0.05.



Yes	-	-	-	9.7	5.6	<b>0.08</b>	-	-	-	-	-	-	-	-	-
<b>Number of injuries</b>	-	-	-	-	-	-	12.7	1.4	<b>&lt;0.001</b>	-	-	-	-	-	-
<b>Height of the fall</b>	-	-	-	-	-	-	-	-	-	2.6	0.5	<b>&lt;0.001</b>	-	-	-
<b>Acknowledge intent to die</b>															
No	-	-	-	-	-	-	-	-	-	<b>Ref</b>			-	-	-
Yes	-	-	-	-	-	-	-	-	-	4.0	5.2	0.45	-	-	-
<b>Psychotic disorder</b>															
No	-	-	-	-	-	-	-	-	-	-	-	-	<b>Ref</b>		
Yes	-	-	-	-	-	-	-	-	-	-	-	-	28.0	6.7	<b>&lt;0.001</b>
<b>Mood disorder</b>															
No	-	-	-	-	-	-	-	-	-	-	-	-	<b>Ref</b>		
Yes	-	-	-	-	-	-	-	-	-	-	-	-	6.9	7.6	0.36
<b>Substance use disorder</b>															
No	-	-	-	-	-	-	-	-	-	-	-	-	<b>Ref</b>		
Yes	-	-	-	-	-	-	-	-	-	-	-	-	5.4	7.0	0.44
<b>Delirium</b>															
No	-	-	-	-	-	-	-	-	-	-	-	-	<b>Ref</b>		
Yes	-	-	-	-	-	-	-	-	-	-	-	-	31.1	6.3	<b>&lt;0.001</b>

β: Estimated parameter; SE = standard error; Ref = Reference; bold figures indicate significant results at p<0.05

**Table 3: Associations between each variable and length of stay**

	Model 1			Model 2			Model 3			Global model		
	$\beta$	SE	p	$\beta$	SE	p	$\beta$	SE	p	$\beta$	SE	p
<b>Age (for 10 years)</b>	2.4	1.6	0.13	1.4	1.7	0.40	0.9	1.7	0.61	1.3	1.6	0.39
<b>Sex</b>												
Male	<b>Ref</b>			<b>Ref</b>			<b>Ref</b>			<b>Ref</b>		
Female	-2.1	4.6	0.65	-5.5	5.0	0.28	-5.9	5.3	0.27	-5.0	4.6	0.27
<b>French language</b>												
Yes	<b>Ref</b>			-	-	-	-	-	-	<b>Ref</b>		
No	16.5	8.6	0.06	-	-	-	-	-	-	10.8	8.7	0.21
<b>Occupational status</b>												
Inactive	<b>Ref</b>			-	-	-	-	-	-	<b>Ref</b>		
Active	-10.1	4.8	<b>0.04</b>	-	-	-	-	-	-	-7.7	4.8	0.11
<b>Height of the fall</b>	0.6	0.5	0.24	-	-	-	-	-	-	-	-	-
<b>Number of injuries</b>	10.1	1.6	<b>&lt;0.001</b>		-	-	-	-	-	8.2	1.6	<b>&lt;0.001</b>
<b>Psychiatric follow-up</b>												
No	<b>Ref</b>			-	-	-	-	-	-	-	-	-
Yes	-1.6	5.1	0.75	-	-	-	-	-	-	-	-	-
<b>Psychotic disorder</b>												
No	<b>Ref</b>			-	-	-	-	-	-	<b>Ref</b>		
Yes	12.0	5.7	<b>0.04</b>	-	-	-	-	-	-	14.6	6.3	<b>0.02</b>

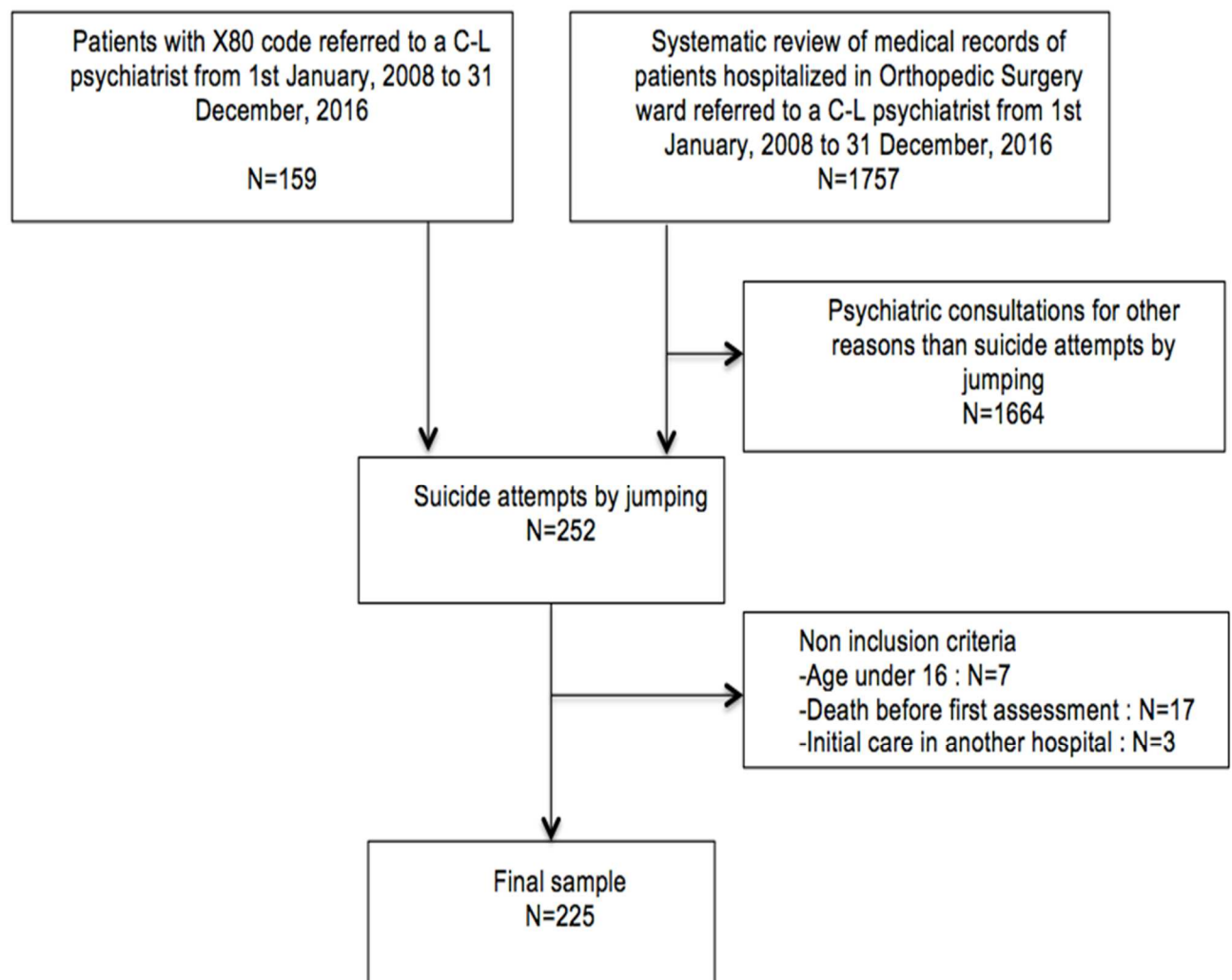


<b>Mood disorder</b>												
No	<b>Ref</b>			-	-	-	-	-	-	<b>Ref</b>		
Yes	-0.7	6.3	0.92	-	-	-	-	-	-	-0.6	6.7	0.93
<b>Delirium</b>												
No	<b>Ref</b>			-	-	-	-	-	-	<b>Ref</b>		
Yes	17.1	5.8	<b>0.003</b>	-	-	-	-	-	-	16.6	5.9	<b>0.005</b>
<b>Background psychiatric treatment</b>												
No	-	-	-	<b>Ref</b>			-	-	-	<b>Ref</b>		
Yes	-	-	-	11.3	5.2	<b>0.03</b>	-	-	-	1.9	5.2	0.72
<b>Anticoagulation</b>												
No	-	-	-	<b>Ref</b>			-	-	-	<b>Ref</b>		
Yes	-	-	-	24.4	7.4	<b>0.001</b>	-	-	-	9.4	6.9	0.17
<b>External fixator</b>												
No	-	-	-	<b>Ref</b>			-	-	-	<b>Ref</b>		
Yes	-	-	-	34.6	8.0	<b>&lt;0.001</b>	-	-	-	18.1	7.2	<b>0.01</b>
<b>Orthopedic corset</b>												
No	-	-	-	<b>Ref</b>			-	-	-	-	-	-
Yes	-	-	-	4.5	5.2	0.34	-	-	-	-	-	-
<b>Orientation at discharge</b>												
Returning home	-	-	-	-	-	-	<b>Ref</b>			<b>Ref</b>		
Rehabilitation center	-	-	-	-	-	-	30.2	10.9	0.06	8.5	10.0	0.40
Psychiatric ward	-	-	-	-	-	-	-8.0	9.2	0.39	-15.3	8.6	0.07

Rehabilitation center with psychiatric care	-	-	-	-	-	-	26.4	7.8	<b>&lt;0.001</b>	0.4	7.9	0.96
Other	-	-	-	-	-	-	29.4	11.9	<b>0.01</b>	5.8	10.8	0.59

β: Estimated parameter; SE = standard error; Ref = Reference; bold figures indicate significant results at p<0.05

Figure 1:



**Supplemental Table: Psychiatric diagnoses according to International Classification of Diseases, 10th revision (ICD-10)-code**

ICD-code	Psychiatric Diagnoses	N	%
<b>F0</b>	Organic, including symptomatic, mental disorders	2	0.9
<b>F1</b>	Mental and behavioral disorders due to psychoactive substance use	29	12.9
<b>F2</b>	Schizophrenia, schizotypal and delusional disorders	95	42.2
<b>F3</b>	Mood disorders	59	26.2
<b>F4</b>	Neurotic, stress-related and somatoform disorders	20	8.9
<b>F5</b>	Behavioral syndromes associated with physiological disturbances and physical factors	0	0
<b>F6</b>	Disorders of adult personality and behavior	17	7.7
<b>F7</b>	Mental retardation	0	0
<b>F8</b>	Disorders of psychological development	0	0
<b>F9</b>	Behavioral and emotional disorders with onset usually occurring in childhood and adolescence	3	1.3