

Prevalence and Risk Factors for Delirium in Elderly Patients With Severe Burns: A Retrospective Cohort Study

Daan T. van Yperen, MD,^{*,†,⊕} Jelle W. Raats, MD, PhD,[‡] Jan Dokter, MD, PhD,^{*} Gijsbertus Ziere, MD, PhD,^{||} Gert R. Roukema, MD^{*,‡} Margriet E. van Baar, MSc, PhD,^S and Cornelis H. van der Vlies, MD, PhD^{*,†,‡}

Little is known about delirium in elderly burn center patients. The aim of this study is to provide information on the prevalence of delirium and risk factors contributing to the onset of delirium. All patients aged 70 years or older admitted with burn injuries to the Burn Center, Maastad Hospital, in 2011 to 2017 were eligible for inclusion. We retrospectively collected data regarding the presence of delirium, potential risk factors contributing to the onset of delirium and outcome after delirium. We included elderly 90 patients in this study. The prevalence of delirium in our population was 13% ($N = 12$). Risk factors for delirium were advanced age, increased American Society for Anesthesiologists score, physical impairment and the use of anticholinergic drugs during admission. Patients with delirium had a poorer outcome, with prolonged hospital stay and increased mortality 6 and 12 months after discharge. Delirium is diagnosed in 13% of the elderly patients admitted to our burn center. Risk factors for delirium found in this study are advanced age, poor physical health status, physical impairment, and the use of anticholinergic drugs. Delirium is related to poor outcomes, including prolonged hospital stay and mortality after discharge.

Delirium is an acute cerebral disorder characterized by a concurrent disturbance in attention, awareness and cognition. It is a serious, costly, under-recognized and often fatal condition, mostly affecting elderly patients.¹ In a general adult population, the prevalence of delirium is low (1–2%), but among hospitalized patients this number is significantly higher (10–50%), increasing up to 82% when admitted to an intensive care unit (ICU).^{2,3} Delirium is caused by a combination of both nonmodifiable predisposing factors (e.g., age) and modifiable precipitating factors (e.g., surgery) and is associated with increased morbidity, mortality, prolonged hospital stay and institutionalization following discharge.^{4,5} With the elderly population increasing at an unprecedented rate, it is expected that the number of patients with delirium will increase in the future.

The recognition and treatment of delirium has recently been gaining more interest in the burn care community.⁶ This is needed, because approximately 10% of the admitted burn center patients in the Netherlands are 65 years or older and

we think that, because of their severe and painful injuries, often acute and prolonged hospital admission, frequent use of opioids and sedatives, and increased need for surgical treatment, the elderly burn patient is at particular risk for delirium.^{7–10} Nevertheless, only limited information is available on the prevalence of delirium.

The current literature shows a delirium prevalence of 29% and 77% in adults admitted to a burn ICU.^{11,12} At two specialized burn centers, delirium was diagnosed in 16% and 39% of the admitted adults.^{13,14} Risk factors for delirium have been widely investigated for surgical and nonsurgical populations, but not for burn center patients.

The literature shows that one-third of the cases of delirium are preventable with nonpharmacological interventions.¹⁵ Since mortality and morbidity rates in delirious patients are high, it is crucial to identify risk factors. This will help clinicians determine which patient is at risk for delirium, so intervention strategies can focus on preventing the occurrence of delirium and the related outcomes. Therefore, the primary objective of this study was to evaluate the prevalence of delirium and to identify risk factors for delirium in elderly burn center patients.

METHODS

Study Design

This is a retrospective cohort study. Potential study subjects were identified from the Dutch Burn Repository R3, a national register from 2009 onwards for patients admitted to one of the three dedicated burn centers in the Netherlands.⁸ Only patients admitted to the Burn Center, Maastad Hospital, were identified from Dutch Burn Repository R3.

The Medical Ethics Committee of the Maastad Hospital approved this study (TWOR; 2017–78).

From the ^{*}Burn Center, Maastad Hospital, Maastadweg 31, 3079 DZ Rotterdam, The Netherlands; [†]Trauma Research Unit Department of Surgery, Erasmus MC, University Medical Center Rotterdam, PO Box 2040, 3000 CA, The Netherlands; [‡]Department of Surgery, Maastad Hospital, Maastadweg 31, 3079 DZ Rotterdam, The Netherlands; ^{||}Geriatric Medicine, Maastad Hospital, Maastadweg 31, 3079 DZ Rotterdam, The Netherlands; ^SAssociation of Dutch Burn Centers, Burn Center, Maastad Hospital, Maastadweg 31, 3079 DZ Rotterdam, The Netherlands

Conflict of interest statement. The authors have no conflicts of interest to report. Address correspondence to Cornelis H. van der Vlies, MD, PhD, Burn Center, Maastad Hospital, Maastadweg 31, 3079 DZ Rotterdam, The Netherlands. Email: vliesc@maastadziekenhuis.nl

© The Author(s) 2019. Published by Oxford University Press on behalf of the American Burn Association. This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited. For commercial re-use, please contact journals.permissions@oup.com

doi:10.1093/jbcr/irz161

Setting

A physician (D.Y.) screened patients for eligibility and collected data by reviewing the patient's electronic medical records in April and May 2018.

Participants

All patients aged 70 years or older admitted with burn injuries to the Burn Center, Maastad Hospital, from 2011 to 2017 were eligible for inclusion. We specifically chose this period because of the implementation of the "Safety Management System" in Dutch hospitals in 2011.¹⁶ This system is designed to screen all admitted elderly patients 70 years of age or older for the risk of falling, undernourishment, physical impairment, and delirium to reduce hospital admission-induced morbidity and mortality.

Patients were excluded if 1) hospital admission was less than 48 hours or 2) the patient was only admitted to our burn ICU.

Patient and Injury Characteristics

Age, gender, and comorbidities were retrieved from patients' medical records. Comorbidities and physical status were derived from patients' medical history. Comorbidities included cardiac history (valve disorders, arrhythmias, heart failure, and ischemic heart disease), pulmonary history (chronic obstructive pulmonary disease), neurologic history (dementia, cerebrovascular accidents, epilepsy, and Parkinson's disease), psychiatric history (depression, psychosis, anxiety disorders, and cognitive disorders), and the presence of diabetes or malignancy. The presence of a cognitive disorder included dementia (e.g., Alzheimer's disease, Korsakoff's syndrome) and mild cognitive impairment. In patients undergoing surgery, the American Society for Anesthesiologists (ASA) score was determined by the attending anesthesiologist. In all other cases, the ASA score was determined by a physician (D.Y.) based on the patient's medical history.

The burn injury severity was represented by the percentage TBSA burned, determined by the treating burn physician.

Delirium

Delirium was diagnosed by the treating physician, a geriatrician, or a psychiatrist, all using the Diagnostic and Statistical Manual of Mental Disorders IV (DSM-IV) criteria and the confusion assessment method.¹⁷ The confusion assessment method is a simple and the most recommended screening device, showing high sensitivity and specificity for diagnosing delirium.^{18,19}

According to hospital protocol, the risk for delirium was scored in all patients aged 70 years or older, within 24 hours after admission. This screening tool is developed to recognize patients at risk for a delirium during admission. The screening tool consists of three items that can be rated as absent or present with a maximum of 3 points. A score of 1 or higher was defined as high risk. If patients was at increased risk on admission, or when a patient showed clinical signs of delirium during admission, a nurse collected the Delirium Observation Screening Scale (DOSS) score three times per day for 3 days, to screen for the presence of delirium.²⁰ A DOSS score of 3 or more was considered highly indicative for delirium. The diagnosis was then confirmed by either the treating physician or the consulted geriatrician or psychiatrist.

Risk Factors for Delirium

Data were collected on several parameters potentially contributing to delirium.^{21,22}

Nutritional status was measured using the Short Nutritional Assessment Questionnaire (SNAQ-RC) score.²³ Patients were classified as undernourished if the score was three or higher.

Physical impairment during activities of daily living was evaluated with the Katz scale.²⁴ A patient was considered physically impaired when the Katz score was five or lower.

In addition, data were collected on delirium in the patient's history, visual and/or hearing impairment, daily alcohol consumption (≥ 1 consumptions/d), preadmission hemoglobin level (measured within 5 days after admission), prehospital stay (living at a nursing home), ICU stay, and need for ventilation at the ICU.

The patient's drug records were reviewed and checked for polypharmacy and the use of anticholinergic drugs. Polypharmacy was defined as the use of five or more drugs from five different therapeutic groups. The use of anticholinergic drugs from groups 2 to 3 on the Anticholinergic Cognitive Burden (ACB) scale was noted, as those have moderate to severe anticholinergic effects and are clinically relevant for the risk of delirium.^{25,26}

Surgery-Related Risk Factors

When surgical treatment was needed, data were obtained regarding the preoperative hemoglobin level, anesthesia technique (general or regional), time of anesthesia (time between intubation and detubation) and estimated blood loss during surgery.

Outcome After Delirium

Total length of hospital stay was registered. Mortality during admission and after discharge was scored. Postdischarge mortality was scored after 30 days, 6 months, and 12 months by using hospital records.

Statistical Analyses

Continuous data were tested for normal distribution using the Shapiro-Wilk test. The mean and standard deviation (parametric data) and median and quartiles (nonparametric data) were reported. Descriptive analyses were used to report patient and injury characteristics. Delirious patients were compared with the nondelirious patients. To evaluate factors that were associated with delirium univariate analyses (Mann-Whitney *U* test for continuous data and Fisher's exact test for dichotomous data) were performed. These analyses were performed both in the total group and in a subgroup of patients after surgery to assess surgery-related risk factors. No imputation was performed for missing data. Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 24.0 or higher (SPSS, Chicago, IL). A $P < 0.05$ was considered statistically significant.

RESULTS

A total of 114 patients aged 70 years or older, admitted with burns to the Burn Center, Maastad Hospital, in the period

2011 to 2017, were eligible for participation. After screening, 24 patients were excluded, resulting in 90 elderly patients included in this study (Figure 1).

Patient and Injury Characteristics

The median age of the included patients was 77 years, and gender was equally distributed between participants. Of all elderly patients, 59 (66%) had an ASA score of 2 or less and the median TBSA was 5% (Table 1).

Delirium

A total of 12 out of 90 (13%) elderly patients were diagnosed with delirium (Figure 2). On admission, 36 (40%) were at risk for delirium. In 33 (37%) patients, DOSS scores were collected, and 22 (24%) had a DOSS score of three or higher. These patients were assessed by either the treating burn physician ($N = 10$) or the consulted geriatrician or psychiatrist ($N = 12$), and delirium was diagnosed in four (4%) and seven (8%) patients, respectively. In the remaining three patients, no DOSS scores were collected. Nevertheless, delirium was diagnosed in one (1%) after assessment by the geriatrician or psychiatrist.

In patients aged ≥ 80 years, the prevalence of delirium was even higher (67%).

Risk Factors for Delirium

In this subset of elderly patients, we compared delirious patients with nondelirious patients regarding potential risk factors for delirium (Table 2). Patients differed on 4 out of 15 investigated potential risk factors. The median age in delirious patients was significantly higher compared with the nondelirious patients (84 versus 76 years; $P = 0.04$). Two-thirds (67%) of the patients with delirium were 80 years or older.

A significantly greater proportion of patients from the delirium group had a poor physical health status (ASA score ≥ 3) compared with the nondelirium group: 8 (67%) patients versus 23 (30%) patients ($P = 0.02$).

Nine (82%) patients from the delirium group were physically impaired (Katz score ≤ 5), which was significantly higher

Table 1. Patient and injury characteristics

	<i>N</i> = 90 (%)
Age (years)	
Median (P_{25} - P_{75})	77 (72-84)
Gender	
Male	45 (50)
Female	45 (50)
ASA score	
1	7 (8)
2	52 (58)
3	27 (30)
4	4 (4)
Comorbidity	
Cardiac	27 (30)
Pulmonary	8 (9)
Neurologic	19 (21)
Psychiatric	14 (16)
Diabetes mellitus	18 (20)
Malignancy	6 (7)
TBSA (%)	
Median (P_{25} - P_{75})	5 (2-8)
<1	3 (3)
1-4	40 (44)
5-10	33 (37)
>10	14 (16)

Missing value(s): Comorbidity, $N = 1$.

compared with the 30 out of 78 (40%) patients who were physically impaired but did not develop delirium ($P = 0.01$).

The use of anticholinergic drugs during admission was found to be significantly more frequent in the patients who developed delirium (75%) than in the patients who did not develop delirium (28%; $P < 0.01$).

Risk Factors for Delirium in Patients Undergoing Surgery

Elderly patients who underwent surgical treatment were analyzed regarding four surgery-related factors. No statistically significant difference was observed between the groups regarding preoperative hemoglobin level, type of anesthesia, duration of anesthesia, and estimated blood loss during surgery.

Outcome After Delirium

The length of hospital stay was significantly prolonged in the delirious group (median 27 days) versus the nondelirious group (median 19; $P = 0.02$; Table 3).

Mortality was significantly higher in delirious patients at 6 and 12 months after discharge, but not at 30 days post-discharge. At 6 months, mortality in the delirious group was 42% versus 8% in the nondelirious group ($P < 0.01$), and at 12 months, mortality was 42% versus 9% ($P < 0.01$).

DISCUSSION

The primary objective of this study was to evaluate the prevalence and risk factors for delirium in elderly (≥ 70 years) burn

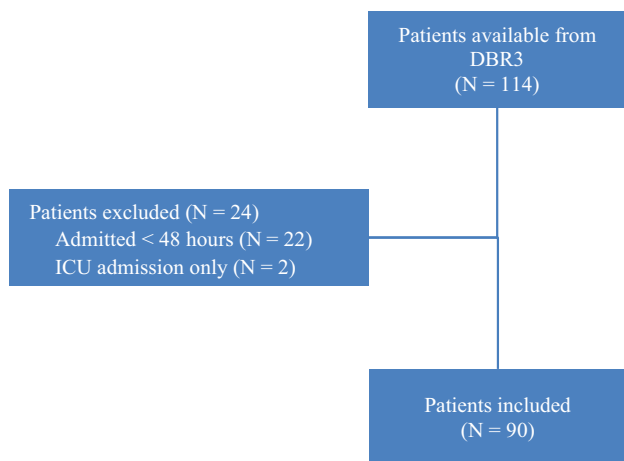


Figure 1. Patient inclusion.

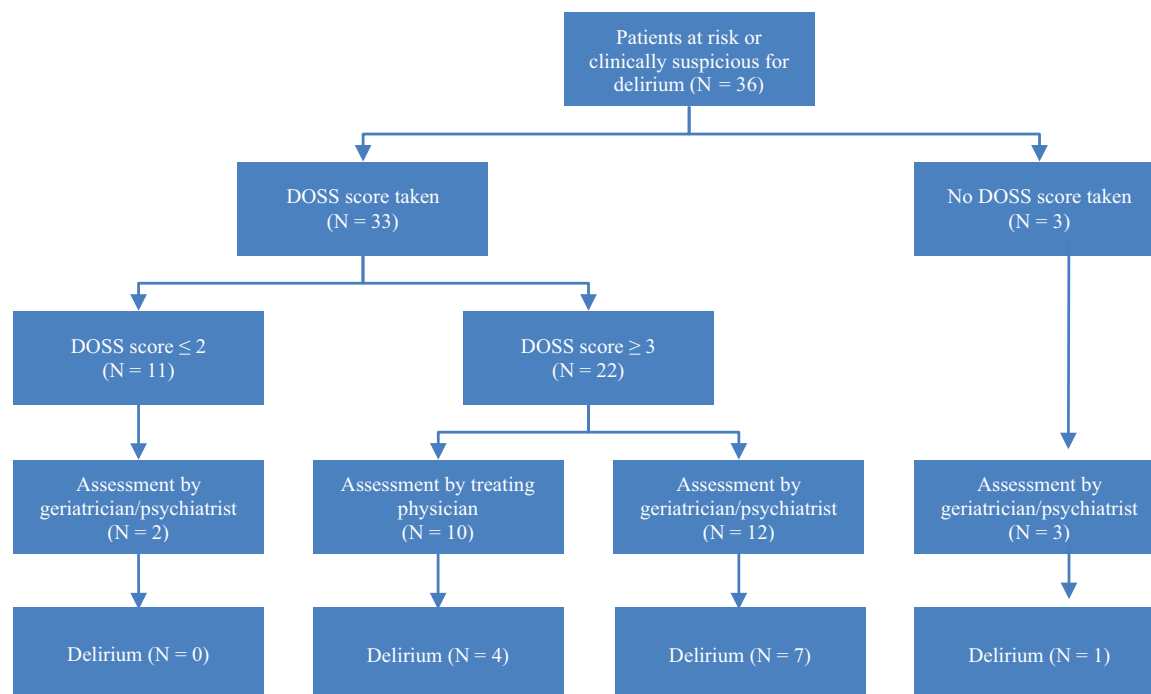


Figure 2. Delirium diagnostic process.

center patients. Between 2011 and 2017, 13% of the elderly burn patients admitted to our burn center were diagnosed with delirium. Advanced age, poor physical health status, physical impairment, and the use of anticholinergic drugs contributed to the onset of delirium. Delirium resulted in a prolonged hospital stay and increased mortality after 6 and 12 months.

The prevalence of 13% found in this study is comparable with Palmu et al¹³ found in a general burn population and with what other studies found in elderly patients from both general and surgical medical populations.^{27–30} However, it is considerably lower compared with the 39% Holmes et al showed in elderly admitted burn patients (154 out of 392 patients).¹⁴ A possible explanation could be that Holmes et al defined patients as delirious when only a change in mental status was observed and antipsychotic medication was prescribed, without any evaluation by a physician, geriatrician, or psychiatrist.

In this study, we used advanced age (≥ 70 years) as a proxy for frailty. However, as stated by Santos-Eggimann et al, we want to emphasize the difference between chronological and biological age, and that frailty tends to increase with advanced age but is not confounded with it.³¹

We are the first to investigate the risk factors for delirium in elderly burn center patients. We found that advanced age, poor physical health status, physical impairment, and the use of anticholinergic drugs are related to the onset of delirium. These risk factors have also been identified in other medical populations.^{32,33} Interestingly, not polypharmacy but the contribution of anticholinergic drugs was confirmed as a risk factor for delirium. This has been showed by other studies as well.^{33,34} Promethazine and morphine are frequently used in our patients for itch and pain management. Promethazine has severe anticholinergic effects (ACB scale 3) and can increase

the risk for delirium. Therefore, physicians should be cautious when prescribing promethazine in elderly patients. Although morphine has mild anticholinergic effects (ACB scale 1), Agarwal et al reported that it might reduce the risk of delirium in ventilated burn patients, possibly through pain reduction, because inadequate pain management can also be a risk factor for delirium.¹²

Our study reported a high delirium prevalence of 67% in octogenarians. In addition, delirium was related to extensively prolonged hospital and significantly increased mortality after discharge. A meta-analysis by Witlox et al showed that delirium is associated with poor outcome, regardless of any important confounders.⁵ In elderly patients undergoing elective major surgery, delirium resulted in prolonged hospital stay and higher 30-day mortality.³⁰ In elderly burn center patients, Holmes et al showed that delirium was associated with prolonged hospital and ICU stay, but not with increased risk of death.¹⁴ These issues show the major importance of preventing the onset of delirium in elderly patients, as population projections indicate that the number of persons aged >80 years will double during the next 30 years. Identified risk factors can be treated or optimized by consultation of a multidisciplinary coordinated team of healthcare professionals. Proactive geriatric consultation with early pre- and postoperative interventions and optimization of polypharmacy have been proven to reduce both the prevalence and severity of surgery-related delirium.^{35,36} Early screening and treatment of undernutrition and physical impairment can be started with the help of dietitians and physiotherapists. However, burn patients are most often admitted in an acute setting, so preventive strategies for delirium are more challenging to organize compared with the elective setting.

This study has several limitations. First, we retrospectively extracted data from patients' medical records. With the

Table 2. Risk factors for delirium

	Delirium, N = 12 (%)	No delirium, N = 78 (%)	P
Age (y)			
Median (P ₂₅ -P ₇₅)	84 (78-86)	76 (72-83)	.04
70-74	1 (8)	36 (46)	
75-80	3 (25)	13 (17)	
>80	8 (67)	29 (37)	
ASA ≥ 3	8 (67)	23 (30)	.02
Cognitive impairment	1 (8)	8 (10)	1.00
TBSA (%)			
Median (P ₂₅ -P ₇₅)	6.5 (1.5-8.0)	4.5 (2.0-8.0)	.40
<1	0 (0)	3 (4)	
1-4	4 (33)	36 (46)	
5-10	6 (50)	27 (35)	
>10	2 (17)	12 (15)	
Nutritional status			
SNAQ-RC score ≥ 3	1 (9)	12 (16)	1.00
Physical impairment			
Katz score ≤ 5	9 (82)	30 (40)	.01
Delirium in history	2 (18)	8 (11)	.61
Visual impairment	4 (36)	44 (62)	.19
Hearing impairment	1 (10)	17 (24)	.44
Daily use of alcohol	2 (18)	8 (12)	.62
Preadmission Hb level (mmol/L)			
Median (P ₂₅ -P ₇₅)	8.8 (8.3-9.2)	8.1 (7.3-9.1)	.12
Prehospital stay			
Living at a nursing home	2 (18)	8 (11)	.61
Admission to ICU	4 (33)	9 (12)	.07
Ventilated needed	1 (25)	0 (0)	.03
Surgery performed	10 (83)	54 (69)	.50
Polypharmacy	10 (83)	58 (74)	.72
Use of anticholinergic drug	9 (75)	22 (28)	<.01

Missing values: Katz score (delirium, N = 1; no delirium, N = 2), SNAQ-RC score (delirium, N = 1; no delirium, N = 4), delirium in history (delirium, N = 1; no delirium, N = 5), visual impairment (delirium, N = 1; no delirium, N = 7), hearing impairment (delirium, N = 2; no delirium, N = 7), daily use of alcohol (delirium, N = 1; no delirium, N = 9), prehospital stay (delirium, N = 1; no delirium, N = 2), cognitive impairment (no delirium, N = 1). ASA, American Society for Anesthesiologists; SNAQ, Short Nutritional Assessment Questionnaire; Hb, hemoglobin; ICU, intensive care unit.

introduction of electronic medical record, the registration of patient characteristics, possible risk factors and outcome have improved. Nevertheless, not all parameters were (accurately) reported throughout the entire study period, resulting in missing or inaccurate data.

We used the DOSS score to screen patients for possible delirium. This is a properly validated instrument, but delirium subtypes, such as a hypoactive delirium, can be missed. According to the hospital protocol, a geriatrician or psychiatrist should be consulted in all patients suspected to have delirium or with DOSS scores of three or more. This has not been done in all cases (Figure 2). Not all cases were assessed by a geriatrician or psychiatrist, possibly resulting in misdiagnosed (under- or over-) cases of delirium.

Due to the relatively low number of patients, a multivariate analysis of the risk factors for delirium was not possible. In the univariate analyses, several risk factors were found, and

Table 3. Outcome after delirium

	Delirium, N = 12 (%)	No delirium, N = 78 (%)	P
Length of hospital stay (d)			
Median (P ₂₅ -P ₇₅)	27 (17-54)	19 (9-26)	.02
Mortality			
30 d	3 (25)	6 (8)	.10
6 mo	5 (42)	6 (8)	<.01
12 mo	5 (42)	7 (9)	<.01

to identify whether these factors contribute independently to the occurrence of delirium, multivariate analyses are necessary.

CONCLUSION

Delirium is diagnosed in 13% of the elderly burn center patients admitted to our burn center. Risk factors for delirium found in this study are increased age, poor physical health status, physical impairment, and the use of anticholinergic drugs. Delirium is related to poor outcomes, including extensively prolonged hospital stay and increased mortality 6 and 12 months after discharge.

Burn care physicians should be aware of the possible risk for delirium in elderly patients. The information from this study is a first step in gaining more insights into delirium in elderly burn center patients, but a prospective multifaceted intervention study is desired to investigate whether the prevalence of delirium can be reduced in elderly burn center patients.

ACKNOWLEDGMENTS

D.T.V.Y., J.W.R., J.D., G.Z., G.E.R., M.E.V.B., and C.H.V.D.V. developed this study. D.T.V.Y. and J.W.R. collected the study data. D.T.V.Y. and M.E.V.B. performed statistical analysis of the data. D.T.V.Y., J.W.R., M.E.V.B., and C.H.V.D.V. drafted the current manuscript. J.D., G.Z., and G.E.R. critically revised the manuscript. All authors have read and approved this final manuscript to be submitted. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. We thank the Dutch Burn Repository Group (Red Cross Hospital Beverwijk, Martini Hospital Groningen, and Maasstad Hospital Rotterdam) for their contribution to the Dutch Burn Repository and the Dutch Burns Foundation Beverwijk.

REFERENCES

- Oh ES, Fong TG, Hsieh TT, Inouye SK. Delirium in older persons: advances in diagnosis and treatment. *JAMA* 2017;318:1161-74.
- Folstein MF, Bassett SS, Romanoski AJ, Nestadt G. The epidemiology of delirium in the community: the Eastern Baltimore Mental Health Survey. *Int Psychogeriatr* 1991;3:169-76.
- Inouye SK, Westendorp RG, Saczynski JS. Delirium in elderly people. *Lancet* 2014;383:911-22.
- Dani M, Owen LH, Jackson TA, Rockwood K, Sampson EL, Davis D. Delirium, frailty and mortality: interactions in a prospective study of hospitalized older people. *J Gerontol A Biol Sci Med Sci* 2018;73:415-8.
- Witlox J, Eurelings LS, de Jonghe JF, Kalisvaart KJ, Eikelenboom P, van Gool WA. Delirium in elderly patients and the risk of postdischarge

- mortality, institutionalization, and dementia: a meta-analysis. *JAMA* 2010;304:443–51.
6. Depetris N, Raineri S, Pantet O, Lavrentieva A. Management of pain, anxiety, agitation and delirium in burn patients: a survey of clinical practice and a review of the current literature. *Ann Burns Fire Disasters* 2018;31:97–108.
 7. Bloemsa GC, Dokter J, Boxma H, Oen IM. Mortality and causes of death in a burn centre. *Burns* 2008;34:1103–7.
 8. Dokter J, Vloemans AF, Beerthuisen GI, et al. Epidemiology and trends in severe burns in the Netherlands. *Burns* 2014;40:1406–14.
 9. Clegg A, Young JB. Which medications to avoid in people at risk of delirium: a systematic review. *Age Ageing* 2011;40:23–9.
 10. Inouye SK. Delirium in older persons. *N Engl J Med* 2006;354:1157–65.
 11. Yabanoglu H, Yagmurdu MC, Taskintuna N, Karakayali H. Early period psychiatric disorders following burn trauma and the importance of surgical factors in the etiology. *Ulus Travma Acil Cerrahi Derg* 2012;18:436–40.
 12. Agarwal V, O'Neill PJ, Cotton BA, et al. Prevalence and risk factors for development of delirium in burn intensive care unit patients. *J Burn Care Res* 2010;31:706–15.
 13. Palmu R, Suominen K, Vuola J, Isometsa E. Mental disorders after burn injury: a prospective study. *Burns* 2011;37:601–9.
 14. Holmes EG, Jones SW, Laughon SL. A retrospective analysis of neurocognitive impairment in older patients with burn injuries. *Psychosomatics* 2017;58:386–94.
 15. Hshieh TT, Yue J, Oh E, et al. Effectiveness of multicomponent nonpharmacological delirium interventions: a meta-analysis. *JAMA Intern Med* 2015;175:512–20.
 16. de Rooij SEJA, Emmelot-Vonk MH, Evers A, et al. Kwetsbare ouderen. Den Haag, The Netherlands: VMS Veiligheidsprogramma; 2009.
 17. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. 5th ed. Arlington, VA, American Psychiatric Association; 2013.
 18. Inouye SK, van Dyck CH, Alessi CA, et al. Clarifying confusion: the confusion assessment method. a new method for detection of delirium. *Ann Intern Med* 1990;113:941–8.
 19. Wei LA, Fearing MA, Sternberg EJ, Inouye SK. The confusion assessment method: a systematic review of current usage. *J Am Geriatr Soc* 2008;56:823–30.
 20. Scheffer AC, van Munster BC, Schuurmans MJ, de Rooij SE. Assessing severity of delirium by the delirium observation screening scale. *Int J Geriatr Psychiatry* 2011;26:284–91.
 21. Raats JW, Steunenberg SL, de Lange DC, van der Laan L. Risk factors of post-operative delirium after elective vascular surgery in the elderly: a systematic review. *Int J Surg* 2016;35:1–6.
 22. Verloof H, Goulet C, Morin D, von Gunten A. Association between frailty and delirium in older adult patients discharged from hospital. *Clin Interv Aging* 2016;11:55–63.
 23. Kruijenga HM, Seidell JC, de Vet HC, et al. Development and validation of a hospital screening tool for malnutrition: the short nutritional assessment questionnaire (SNAQ). *Clin Nutr* 2005;24:75–82.
 24. Wallace M, Shelkey M, Hartford institute for geriatric N. Katz index of independence in activities of daily living (ADL). *Urol Nurs* 2007;27:93–4.
 25. Boustani M, Campbell N, Munger S, Maidment I, Fox C. Impact of anticholinergics on the aging brain: a review and practical application. *Ageing Health* 2008;4:311–20.
 26. Campbell N, Boustani M, Limbil T, et al. The cognitive impact of anticholinergics: a clinical review. *Clin Interv Aging* 2009;4:225–33.
 27. de Castro SM, Unlu C, Tuynman JB, et al. Incidence and risk factors of delirium in the elderly general surgical patient. *Am J Surg* 2014;208:26–32.
 28. Ellard L, Katznelson R, Wasowicz M, et al. Type of anesthesia and post-operative delirium after vascular surgery. *J Cardiothorac Vasc Anesth* 2014;28:458–61.
 29. Franco JG, Valencia C, Bernal C, et al. Relationship between cognitive status at admission and incident delirium in older medical inpatients. *J Neuropsychiatry Clin Neurosci* 2010;22:329–37.
 30. Raats JW, van Eijdsden WA, Crolla RM, et al. Risk factors and outcomes for postoperative delirium after major surgery in elderly patients. *PLoS One* 2015;10:e0136071.
 31. Santos-Eggimann B, Sirven N. Screening for frailty: older populations and older individuals. *Public Health Rev* 2016;37:7.
 32. Krogseth M, Wyller TB, Engedal K, Juliebo V. Delirium is a risk factor for institutionalization and functional decline in older hip fracture patients. *J Psychosom Res* 2014;76:68–74.
 33. Naja M, Zmudka J, Hannat S, et al. In geriatric patients, delirium symptoms are related to the anticholinergic burden. *Geriatr Gerontol Int* 2016;16:424–31.
 34. Landi F, Dell'Aquila G, Collamati A, et al. Anticholinergic drug use and negative outcomes among the frail elderly population living in a nursing home. *J Am Med Dir Assoc* 2014;15:825–9.
 35. Hshieh TT, Yang T, Gartaganis SL, Yue J, Inouye SK. Hospital elder life program: systematic review and meta-analysis of effectiveness. *Am J Geriatr Psychiatry* 2018;26:1015–33.
 36. Inouye SK, Bogardus ST Jr, Charpentier PA, et al. A multicomponent intervention to prevent delirium in hospitalized older patients. *N Engl J Med* 1999;340:669–76.