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# Detection and management of hyperactive and hypoactive delirium in older patients during hospitalization: a retrospective cohort study evaluating daily practice

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This research was conducted at Maastricht University Medical Center+ and Maastricht University.

**Objectives:** The objectives of the study are to study daily hospital practice regarding detection and management and to study hyperactive and hypoactive delirium of older patients during their hospitalization.

**Methods:** A retrospective cohort study evaluating care as usual for older hospitalized patients with delirium at Maastricht University Medical Center+, a university hospital in the Netherlands, was performed. Inclusion criteria were older hospitalized patients (65+ years), diagnosed with delirium between 1 January and 31 December 2014. Data were retrieved from the patients' medical files. Delirium was categorized as hyperactive or hypoactive. Primary outcome measures were prevalence and management (pharmacological, reorientation, screening for delirium and delirium consultations, and physical restraints). Secondary outcomes were short-term adverse outcomes.

**Results:** Prevalence of delirium was 5% ($N = 401$), of which 77% ($n = 307$) was hyperactive and 23% ($n = 94$) was hypoactive. Significantly, more patients with a hyperactive delirium received medication to manage the delirium than patients with a hypoactive delirium (89% vs. 77%, respectively, $p = 0.004$). No other significant differences between the subtypes were found.

**Conclusion:** There was probably a strong under-recognition of delirium. Drugs were the main intervention of choice, especially for patients with hyperactive delirium. The two subtypes did not differ on non-pharmacological management. The retrospective nature of this study sheds light on the *status quo* of recognition, management, and care as usual for the different delirium subtypes in daily hospital practice, which may help in forming new guidelines and protocols for the detection and treatment of delirium for older patients in hospitals. © 2017 The Authors. *International Journal of Geriatric Psychiatry* Published by John Wiley & Sons Ltd.

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## Introduction

The number of older people admitted to hospitals has increased substantially over the past two decades. In 2010, more than half (55%) of all people admitted to hospitals in the Netherlands were aged 65 years or over, compared with 31% in 1995 (Central Agency for Statistics, 2015). Age is an important risk factor for developing delirium, and evidence suggests that between 29% and 64% of all older patients experience

 

delirium during hospitalization (Inouye *et al.*, 2014). Delirium is found to be associated with many adverse outcomes, such as increased mortality rates, prolonged hospital stay, less and slower physical recovery (Witlox *et al.*, 2010), and increased risk of developing dementia (Davis *et al.*, 2012; Krogseth *et al.*, 2016). Despite this knowledge, delirium is often missed or misdiagnosed (Siddiqi *et al.*, 2006).

Four different subtypes of delirium have been identified based on the motor symptoms exhibited by the patient: hyperactive, hypoactive, mixed, and without motor symptoms (Albrecht *et al.*, 2015). Hyperactive delirium is characterized by (motor) agitation, restlessness, and sometimes aggressiveness. Hypoactive delirium is characterized by motor retardation, apathy, slowing of speech, and patients can appear to be sedated (Lipowski, 1983; Meagher, 2009). Mixed delirium is a combination of hyperactive and hypoactive delirium. Delirium with no motor symptoms indicates that patients only experience cognitive symptoms of a delirium. The hypoactive subtype seems to be more common than the hyperactive subtype (Boettger and Breitbart, 2011; Meagher *et al.*, 2012; Albrecht *et al.*, 2015), although it is less likely to be discovered or reported (Albrecht *et al.*, 2015), as these patients exhibit fewer behavioral problems and are often perceived as cooperative (Inouye *et al.*, 2001; Rice *et al.*, 2011).

The effects of the different subtypes on patient outcomes have been studied, but the results remain inconclusive. Some studies found that patient prognosis is worse after a delirium with hyperactive symptoms (Kobayashi *et al.*, 1992; Marcantonio *et al.*, 2002), while others found prognosis to be poorer after a delirium with hypoactive symptoms (Meagher *et al.*, 2011; Robinson *et al.*, 2011). The hyperactive and hypoactive delirium also varies in the way they are managed: Treatment with antipsychotic medication and the use of physical restraints are generally prompted by motor agitation and behavioral problems often present in patients with hyperactive delirium (O'Keeffe and Lavan, 1999; Freeman *et al.*, 2016), whereas the use of antipsychotic medication in patients with the hypoactive subtype is generally avoided (British Geriatrics Society and Royal College of Physicians, 2006; Inouye, 2006).

Almost all of the aforementioned studies used a prospective study design; that is, patients adhering to specific inclusion criteria were screened for delirium, and the required data were subsequently collected and analyzed. A retrospective study design implies that the events being studied have already occurred, allowing researchers to study the *status quo* regarding recognition and management of delirium in daily, regular practice. However, it seems that only two studies used such a retrospective design to study the management of the different types of delirium among older people in a hospital setting (Kobayashi *et al.*, 1992; Rooney *et al.*, 2014) and neither studied adverse outcomes after discharge. Moreover, new Dutch hospital guidelines on how to diagnose and manage delirium in hospitalized adults were published in 2013, a year before the start of this study. This gives the authors the opportunity to see if implementing new guidelines improves the recognition and management of delirium, as we can compare our results with previous retrospective studies. The current retrospective cohort study therefore primarily aims to (1) analyze how often delirium in older patients, and specifically the hyperactive and hypoactive subtypes, is recognized and reported in daily hospital practice and (2) identify potential differences in management and care as usual between older hospitalized patients with a hyperactive or hypoactive delirium. As a secondary aim, the short-term adverse outcomes of both patient groups are reported.

## Methods

### Design

A retrospective cohort study, analyzing care as usual in daily hospital practice, was conducted at Maastricht University Medical Center+ (MUMC+), a 715-bed university-teaching hospital in the southern part of the Netherlands.

### Inclusion criteria and identification of the relevant patient files

Patient files were included if (1) the patient was 65 years or older at the time of hospital admission; (2) patients were admitted to the hospital between 1 January and 31 December 2014; (3) patients were diagnosed with delirium by a geriatrician, geriatric nurse practitioner (GNP), or a psychiatrist, or delirium was mentioned in the patient's discharge letter; and (4) the patient consented to the use of his or her digital medical records for research.

Delirious patients were identified by going through the files of all older patients who had been looked at by a geriatrician, GNP, or a psychiatrist during the study period. If delirium was diagnosed and the patient adhered to the inclusion criteria, the patient file was included in the study. Additionally, all the discharge letters of patients 65 years or older were scanned for

 

the presence of delirium using the words "delirium," "delier," "delirant," "verward," and "verwardheid" (Dutch for delirium, delirious, confused, and confusion, respectively), and for the ICD-10 codes of delirium: F050, F051, F058, and F059. If a patient was admitted to the hospital multiple times during the study period, only the first admission where the patient experienced a delirium was included in the study.

### Delirium subtypes

At MUMC+, delirium is divided into two subtypes: hyperactive, where patients experience motor agitation, and hypoactive, where patients experience motor retardation or only the cognitive symptoms without any motor symptoms. Symptoms of motor agitation include fidgeting, picking or pulling at medical equipment, and walking or wandering around the wards. For this study, patients with mixed delirium are also considered to be hyperactive. The type of delirium is specified during the delirium consultation with the geriatrician, GNP, or psychiatrist, based on clinical judgment and the Delirium Observation Screening Score (Schuurmans *et al*., 2003) (see Table 1 for a description). In case delirium was identified through the discharge letter, and no subtype was mentioned, the classification was made by author E.v.V. based on the behavior of the patient as described in the patient's file. The subtyping criteria were discussed with the GNPs and authors F.R.J.V. (head of the Geriatric Psychiatry Department) and W.J.M. (head of the Geriatrics Department) before the classification of the subtypes took place.

### Management of delirium

The management of delirium in the MUMC+ can be either pharmacological or non-pharmacological. The main pharmacological treatment is the administration of haloperidol, although other antipsychotics or benzodiazepines are also sometimes used. Non-pharmacological management can be divided into three types: nursing interventions aimed at reorientation of the patient, psychosocial management, and physical restraint. Table 1 provides an overview and explanation of the non-pharmacological interventions.

### Data extraction

The following data were extracted from the digital patient files by author E.v.V.:

1. Demographic and baseline data: age at hospital admission, sex, living conditions prior to hospital admission (i.e., was the patient living at home or in a nursing home), reason for admission, comorbidities, presence of dementia, number and type of medications used at the time of delirium diagnosis, and ward of admission and ward where the delirium had been diagnosed.
2. Information related to the delirious episode: duration and cause of the delirium. The duration was measured from the date on which the diagnosis of delirium was first confirmed in the digital patient file, till, in order of importance, (1) a physician or a GNP noted in the patient files that the delirium was in remission or had passed; (2)

Table 1 Non-pharmacological delirium management at the Maastricht UMC+, aimed at reorientation of the patient, and monitoring and managing the delirium

| Intervention | Type | Description |
|---|---|---|
| Living room | Reorientation | A living room for the older patients, run by volunteers and an occupational therapist. The living room offers interaction with other patients, a daily routine, and activities such as music or art. |
| Orientation box | Reorientation | Contains a clock, calendar, diary, an information leaflet, and a radio with CDs. |
| Circadian rhythm | Reorientation | To maintain a healthy sleep–wake cycle, or to avoid its disruption. Physical therapists and the living room are used to activate the patient during the day, and sedatives in the morning are avoided where possible and given in the evening instead. |
| Family participation | Reorientation | Families have the opportunity to stay the night with the patient, and to bring photos, pillows, and bedsheets from home to make the patient feel more at ease in the hospital. |
| Delirium consultation | Psychosocial | A consultation performed by a nurse practitioner specialized in delirium, a geriatrician, or by a psychiatrist. If a patient is diagnosed with delirium, advice is given on the best treatment and interventions. |
| Delirium Observation Screening Score | Psychosocial | The Delirium Observation Screening Score (24) is used to screen for delirium and measuring delirium severity. It consists of 13 observations that can be scored as present (1 point) or not present (0 point). The maximum amount of points is 13, and the cut-off score is 3. It is administered three times a day: during the morning, day, and evening nursing shifts. |
| Physical restraints | Restraint | Physical restraints are used to prevent a patient from harming themselves or others. The main mode of restraining is an enclosed bed canopy system. |

 

pharmacological treatment for the delirium was ceased because of abating symptoms; (3) the Delirium Observation Screening Score remained below 3 points for three consecutive measurements; (4) the patient had died during hospital admission; or (5) the patient had been discharged from the hospital.

3. Delirium management: the pharmacological, non-pharmacological, and psychosocial management of delirium (Table 1).
4. Adverse outcomes: length of hospital stay, mortality during hospital stay, and discharge destination (back home, to a nursing home, or to a rehabilitation facility). Discharge destination was only measured for those patients who were living at their own home prior to admission, as patients living in a nursing home are always discharged back to the nursing home.

### Statistical methods

Differences between groups for baseline characteristics were calculated using a two-tailed independent samples *t*-test for age, number of medications used, and number of comorbidities. $\chi^2$ was used for sex, living conditions prior to admission, and presence of dementia. Differences in management and discharge destination between the delirium subtypes were tested using logistic regression analyses. A generalized linear mixed regression on a negative binomial distribution was performed to examine the relationship between type of delirium on the length of stay and duration of the delirium while controlling for age, sex, presence of dementia, and hospital ward where the patient was admitted when the delirium was diagnosed. Because of the skewed distribution of length of stay and duration of the delirium, the mode and range were given for these outcomes, instead of the mean and standard deviation. A conservative cut-off of $p \leq 0.01$ was chosen to minimize the chance of a type I error after multiple testing, with a confidence interval of 99%. Missing data were defined as such and were not taken into account in the analyses. Data were analyzed using SPSS version 22 (IBM Corp., Armonk, NY, USA).

## Results

### Delirium recognition and subtypes

No patients objected to the use of their patient files.

Between 1 January and 31 December 2014, a total of 7.907 patients aged 65 years or older were admitted to the MUMC+. Delirium was confirmed in 401 older patients (5%), 307 (77%) were of the hyperactive subtype, and 94 (23%) were of the hypoactive subtype.

### Sample characteristics

Patient files ($N = 401$) were identified through the logs of the psychiatry and geriatric wards ($n = 267$) and through scanning discharge letters ($n = 274$); 140 patients were identified through both pathways. The main reasons for hospital admission were cardiovascular problems (20%; $n = 79$), infections (19%; $n = 75$), and hip or femur fractures (15%; $n = 61$). Twenty-four people (6%) were admitted because of delirium or confusion. Table 2 presents an overview of the reasons for admission, and classification of the individual problems into the different categories can be found in Appendix A. Most patients were admitted through the surgical wards (including the cardio-thoracic surgery ward) (15%; $n = 61$), through the Emergency Department (13%; $n = 52$), and through the Department of Internal Medicine (13%; $n = 51$).

Patients who suffered from hyperactive delirium did not differ significantly from patients who suffered hypoactive delirium on any of the baseline characteristics. An overview of the baseline characteristics for the total group and per subtype is presented in Table 3.

The most commonly reported cause of delirium was an infection (urinary tract infection, pneumonia, or other infections) (38%; $n = 154$) and surgery (24%; $n = 95$). Other causes of delirium were medication use (5%; $n = 19$) and falls (3%; $n = 14$). For the remaining patients (30%; $n = 119$), no direct cause of the delirium could be established.

Table 2 Primary reasons for admission of the patient cohort

| Reasons for admission[a] | Total ($N = 401$) |
|---|---|
| Cardiovascular problems | 79 (20%) |
| Infections | 75 (19%) |
| Hip or femur fractures | 61 (15%) |
| General downturn/decay | 32 (8%) |
| Oncological causes | 29 (7%) |
| CVA/trauma capitis | 27 (7%) |
| Delirium or confusion | 24 (6%) |
| Pulmonary causes (other than infections) | 23 (6%) |
| Gastro-intestinal and intra-abdominal issues | 23 (6%) |
| Other | 28 (7%) |

[a]Reasons for admission have been classified into the categories as mentioned in the table. The individual reasons for admission in each category can be found in Appendix A.

 

Table 3 Demographic characteristics and baseline data of the total sample and of hyperactive and hypoactive subgroups

| | Total $N = 401$ | Hyperactive $N = 307$ (77%) | Hypoactive $N = 94$ (23%) | $p$-value |
|---|---|---|---|---|
| Female *n* (%) | 167 (42%) | 122 (40%) | 45 (48%) | 0.16 |
| Age M ± SD (range) | 81 ± 7 (65–99) | 81 ± 7 (65–99) | 80 ± 7 (65–93) | 0.49 |
| Living at home before admission *n* (%) | 314 (78%) | 243 (79%) | 71 (76%) | 0.46 |
| Presence of dementia *n* (%) | 96 (24%) | 71 (23%) | 25 (27%) | 0.49 |
| #Comorbidities M ± SD (range) | 4 ± 2 (1–12) | 4 ± 2 (1–12) | 4 ± 2 (1–9) | 0.75 |
| #Medications M ± SD (range) | 8 ± 4 (0–20) | 8 ± 4 (0–20) | 8 ± 4 (0–19) | 0.59 |

A $\chi^2$ was used to check for statistical differences between the subtypes for sex, living at home before admission, and presence of dementia. An independent samples *t*-test was used to check for statistical differences between the subtypes on number of comorbidities and number of medications used.
#, number of... (comorbidities or medications used).

### Delirium management

Most patients (86%; $n = 346$) received medication (mainly haloperidol) to manage their delirium. Patients with hyperactive delirium received medication significantly more often than patients with hypoactive delirium (89% vs. 77%, respectively, $p = .004$). There were no significant differences between the groups on any of the other interventions. The results of the regression models for the effect of delirium type on used interventions can be found in Table 4.

### Adverse outcomes

Table 5 describes the length of delirium, length of stay, in-hospital mortality, and discharge destination for the patients included in this study. Less than half (47%) of the patients from our sample could return back home after the hospital stay, and 15% died during hospitalization.

## Discussion

In this retrospective cohort study, we examined the differences in management and in short-term and long-term adverse outcomes between hyperactive and hypoactive subtypes of delirium among older hospitalized patients. Significantly more patients with hyperactive delirium received antipsychotic medication (haloperidol or other) compared with patients with hypoactive delirium. No significant differences were found for any of the other interventions or adverse outcomes, although a trend was found for higher in-hospital mortality among patients with a hypoactive delirium.

Table 4 Pharmacological, non-pharmacological, and psychosocial interventions that were employed for managing the delirium subtypes

| Management type | Total ($N = 401$) | Hyperactive ($N = 307$) | Hypoactive ($N = 94$) | Odds ratio | 99% confidence interval[a] | | $p$-value[a] |
|---|---|---|---|---|---|---|---|
| | | | | | Lower | Upper | |
| Medication | 346 (86%) | 274 (89%) | 72 (77%) | 2.44 | 1.09 | 5.45 | 0.004 |
| DOS | 300 (75%) | 232 (76%) | 68 (72%) | 1.23 | 0.59 | 2.56 | 0.47 |
| Delirium consultation | 267 (67%) | 210 (68%) | 57 (61%) | 1.46 | 0.74 | 2.88 | 0.15 |
| Reorientation[b] | 278 (69%) | 213 (69%) | 65 (69%) | 1.07 | 0.52 | 2.21 | 0.81 |
| Physical restraint | 121 (30%) | 101 (33%) | 20 (21%) | 1.86 | 0.87 | 3.96 | 0.03 |
| Medication and reorientation[c] | 239 (60%) | 189 (62%) | 50 (53%) | 1.47 | 0.76 | 2.85 | 0.13 |
| No interventions | 16 (4%) | 9 (3%) | 7 (7%) | 0.28 | 0.06 | 1.20 | 0.02 |

Differences in management between the subtypes were calculated using a logistic regression.
The model was corrected for age, sex, dementia, length of delirium, and ward where the delirium was diagnosed.
DOS, Delirium Observation Screening Score.
[a]Statistical significance levels are set at 0.01 to minimize the chance of a type 1 error after multiple testing, and confidence intervals at 99%.
[b]Interventions aimed at reorientation are the living room project, the orientation box, maintaining or restoring the circadian rhythm, and family participation. Keeping DOS, a delirium consultation, and physical restraints are interventions aimed at delirium management and monitoring and are therefore not considered to be reorientation interventions.
[c]The row "medication and reorientation" is an interaction term between medication and reorientation; that is, there patients received both pharmacological and non-pharmacological interventions during the delirious episode. There is an overlap between the number in this row and those in the row "medication and reorientation".

 

Table 5 Short-term adverse outcomes for all patients with delirium, and according to subtype

| Adverse outcomes | Total $N = 401$ | Hyperactive $N = 307$ | Hypoactive $N = 94$ | $B$ or OR[a] | 99% confidence interval | | $p$-value[b] |
|---|---|---|---|---|---|---|---|
| | | | | | Lower | Upper | |
| Length of stay in days: *m* (range) | 8 (1–160) | 7 (1–126) | 8 (2–160) | $B = 3.44$ | 1.85 | 5.04 | 0.58 |
| Length of delirium in days: *m* (range) | 3 (1–99) | 3 (1–91) | 6(1–99) | $B = 0.02$ | −0.35 | 0.31 | 0.88 |
| Discharged back home[c], *n* (%) | 124 (47%) | 97 (46%) | 27 (51%) | OR = 0.80 | 0.33 | 1.92 | 0.51 |
| Died in hospital, *n* (%) | 59 (15%) | 38 (12%) | 21 (22%) | OR = 0.45 | 0.20 | 1.02 | 0.012 |

A generalized linear mixed negative binomial regression was used to check the differences on length of stay and length of delirium between the subtypes, and a logistic regression was used for "discharged back home" and "died in hospital."
Mode is used instead of the mean because of the skewed distribution of the data.
The model was corrected for age, sex, dementia, length of delirium, and ward where the delirium was diagnosed.
OR = odds ratio; *m* = mode.
[a]*B* is the coefficient provided for generalized linear mixed negative binomial regressions, and OR is provided for logistic regression.
[b]Statistical significance levels are set at 0.01, and confidence intervals at 99% to minimize the chance of a type I error after multiple testing.
[c]$N = 265$ because only people who were living in their own home before admission and did not die during hospital stay were taken into account for this outcome.

Previous retrospective studies found a prevalence rate of delirium of 2% in an Irish hospital (Rooney *et al.*, 2014), and 2.8% in a US hospital setting (McCoy *et al.*, 2016). However, prospective studies showed that the prevalence of delirium in older hospitalized patients varies from 29% to 64%, depending on the hospital ward (Inouye *et al.*, 2014). Our results indicate that there is probably a substantial under-recognition and/or underreporting of delirium in the MUMC+, despite new Dutch guidelines for the recognition and treatment of delirium in older hospitalized patients being published in 2013 (Nederlandse Vereniging voor Klinische Geriatrie, 2013). Moreover, only 25% of the identified patients with delirium in our study were classified as being of the hypoactive subtype, even though various studies have found that the hypoactive subtype is the most prevalent one with prevalence rates up to 56% (Boettger and Breitbart, 2011; Meagher *et al.*, 2012; Albrecht *et al.*, 2015). The retrospective nature of this study reflecting regular, daily practice is probably the reason for this under-recognition. Medical staff may often overlook patients with hypoactive delirium because they are mostly passive and quiet and are perceived as cooperative (Inouye *et al.*, 2001; Rice *et al.*, 2011). Furthermore, delirium is considered by many physicians to be a harmless side effect of hospitalization (Leslie and Inouye, 2011). This could mean that for some patients, the delirium, and especially the hypoactive subtype, may have been recognized by a nurse or physician, but not reported in the patient file or discharge letter and, subsequently, not included in this study.

Medication, mostly haloperidol, was preferred over non-pharmacological interventions for the management of both delirium subtypes, despite the guidelines advocating the use of non-pharmacological interventions before resorting to medication (NICE, 2010; Nederlandse Vereniging voor Klinische Geriatrie, 2013). Almost 90% of the patients with hyperactive delirium, and 77% of the patients with hypoactive delirium, received antipsychotic medication to treat the delirium. In particular, the high percentage of patients with hypoactive delirium receiving medication is noticeable, as the NICE and Dutch guidelines advise physicians to be sparing in the prescription of antipsychotics for the treatment of these patients (NICE, 2010; Nederlandse Vereniging voor Klinische Geriatrie, 2013). Moreover, two recent systematic reviews have concluded that there is little evidence for the efficacy of antipsychotics in the treatment of delirium and that the available evidence is generally weak or circumstantial (Neufeld *et al.*, 2016; Schrijver *et al.*, 2016). In addition, the use of antipsychotics in older patients, in particular those with dementia, is a cause for concern, as they can increase the risk of mortality (Schneider *et al.*, 2005; Jeste *et al.*, 2008). Non-pharmacological interventions, aimed at reorientation, however, have been proven to be (cost)effective in many different international studies (Inouye *et al.*, 2015) and should—in accordance with international guidelines (NICE, 2010; Nederlandse Vereniging voor Klinische Geriatrie, 2013)—be considered first, followed by medication only if non-pharmacological management seems insufficient. Also, just two thirds of the delirious patients were referred to a geriatric consultation liaison, even though their expertise can provide nurses and physicians with the necessary information and tools to adequately detect and manage delirium.

 

The two patient groups in our cohort did not differ significantly on any of the adverse outcomes, although in-hospital mortality had a tendency to be higher among patients with hypoactive delirium compared with patients with hyperactive delirium. Previous studies found that patients with hypoactive delirium had a longer length of hospital stay and higher mortality rates compared with patients with hyperactive delirium (O'Keeffe and Lavan, 1999; Meagher *et al.*, 2011; Robinson *et al.*, 2011). One study reported higher mortality rates for patients with hyperactive delirium and also found that these patients were more likely to be admitted to a nursing home after discharge (Marcantonio *et al.*, 2002). However, in light of the low overall prevalence of delirium, and the high relative prevalence of the hyperactive subtype, results on adverse outcomes should be interpreted with caution.

## Strengths and limitations

The retrospective, descriptive nature of this study has both strengths and limitations. It let us examine how often delirium is reported, and what the care as usual is in a regular hospital setting. In addition, prospective studies can be difficult to perform as the temporary or permanent decrease of mental competence resulting from the delirious episode makes it more difficult to receive informed consent from the patients. However, there is a bias in the retrospective design, as especially patients with more severe or hyperactive delirium may have been recognized or reported, thus excluding patients with less severe or hypoactive delirium. Also, in this study, we were not able to differentiate between the hyperactive and mixed subtype, as in the MUMC+, a delirium is classified as being either with motor agitation (hyperactive) or without motor agitation (hypoactive). As such, all patients experiencing delirium with motor agitation were classified as being hyperactive, and all patients experiencing delirium with motor retardation or without any motor symptoms were classified as being hypoactive. This may have affected our results, as the contrast between the two subtypes may have become less. Lastly, the low prevalence of delirium in this study, and the relatively high prevalence of the hyperactive subtype, may have affected the adverse outcome results. Therefore, no final conclusions can be made from the adverse outcome results, and these should be interpreted with caution. Retrospective designs, however, also have a considerable strength: They enable us to study the situation as it is in reality, without the inherent focus on delirium of a prospective design. This study, therefore, has shed light on the current recognition rates and practices regarding delirium management, which is vital information for the development of guidelines and plans for improving delirium care.

## Conclusions

Our findings indicate that delirium in older hospitalized patients is probably substantially under-recognized and/or under-reported, particularly the hypoactive subtype, despite the introduction of new guidelines on delirium in hospitalized adults. Furthermore, almost 90% of all delirious patients received medication. Considering the weak or circumstantial evidence for pharmacological treatment of delirium, and the wealth of evidence in favor of non-pharmacological interventions aimed at reorientation, the latter needs to be used more often and should be promoted among nursing staff. Also, physicians and nurses should not only be taught on how to recognize and manage a delirium but should also be made aware of the different subtypes and their corresponding treatments, the severe adverse effects of delirium, and the (unnecessary) high costs involved with this disorder. Considering the wealth of evidence on the negative effects of delirium and the availability of hospital guidelines on the detection and management of delirium, it is difficult to understand that delirium in older hospital patients is still so strongly under-recognized. Future research should focus on the differences between the delirium subtypes, the underlying causes, etiology, and strategies to improve detection, prevention, and treatment of delirium by the medical staff.

## Conflict of interest

The authors report no conflicts of interest. The study sponsor was in no way involved in the study design, collection, analysis, and interpretation of data, in the writing of the report, or in the decision to submit the report for publication.

Key points

- Delirium, and especially the hypoactive type, is probably substantially under-recognized in daily hospital practice.
- Drugs were the main intervention to manage delirium, especially the hyperactive subtype.

 

- Retrospective studies are important for describing the daily hospital practice regarding the recognition and management of delirium, without the possible bias of a prospective design.

## Ethics statement

The study was approved by the Medical Ethics Committee of Maastricht University and MUMC+ (project number 144169) and by the board of directors of MUMC+.

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## Author contributions

Concept and design, data collection, statistical computations, and drafting of the manuscript were performed by Eveline L. van Velthuijsen. Concept and design, provision of clinical content, and critical revision of the manuscript were performed by Sandra M. G. Zwakhalen. Concept and design, provision of clinical content, and critical revision of the manuscript were performed by Wubbo J. Mulder. Concept and design, provision of clinical content, and critical revision of the manuscript were performed by Frans R. J. Verhey. Concept and design, provision of clinical content, and critical revision of the manuscript were performed by Gertrudis I. J. M. Kempen. All authors gave final approval of the version of the article to be published.

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# Appendix

## Appendix A. Classification of reasons for admission[a]

| Categories | Ailment |
|---|---|
| Cardiovascular problems | Aneurysms of the thoracic and/or abdominal aorta, hemorrhage after bypass surgery, volume depletion, arterial occlusion, bypass, cardiovascular problems, dissection of the aorta, hypertensive heart disease, occlusion and stenosis of the arteria carotis, and angina pectoris |
| Infections | Pancreatitis, bacteremia, cholangitis, colitis, diverticulitis, empyema, endophthalmitis, erysipelas, gastro-enteritis, osteomyelitis, incision and draining of abscesses, infection, infection DBS leads, intestinal virus infection, fever, necrotizing fasciitis, pneumonia, sepsis, and urinary tract infection |
| Hip or femur fractures | Hip fractures, femur fractures, and coxarthrosis |
| General downturn | General deterioration; general malaise; blistering on both legs; "vomiting, weight loss, and self-neglect"; collapse; behavioral changes; pain; social admission; drowsiness; somnolence; "inertia and slurred speech"; falling; and altered consciousness |
| Oncological causes | Stem cell transplant for recurring non-Hodgkin lymphoma, bladder carcinoma, colon carcinoma, hypopharynx carcinoma, lymphomas, malign neoplasma, liver metastases, mouth carcinoma, neurological symptoms of cancer, squamous cell carcinoma, tumor upper right lobe, and tumor |
| CVA/trauma capitis | CVA, cerebral hemorrhage, cerebral infarction, sub-arachnid aneurysm, sub-arachnid hemorrhage, subdural hematoma, transient ischemic attack, and head trauma |
| Delirium or confusion | Delirium and confusion |
| Pulmonary causes (other than infections) | Dyspnea, hypoxemia, lobectomy, lung problems, lung collapse, other respiratory problems, pleural effusion, pneumothorax, respiratory acidosis, respiratory insufficiency, and rib fracture |
| Gastro-intestinal and intra-abdominal problems | Pelvic exenteration, complete exenteration, vomiting, diarrhea, gallstones, hemicolectomy, hemihepatectomy, ileus, liver cirrhosis, abdominal pain and melena, rectal hemorrhage, segmentectomy and vena porta ligation, icterus, and stoma |
| Other | Bell's palsy, hematuria, epistaxis, hernia, immune system, accident, elective surgery, Parkinson's, painful swelling in the right groin, retention bladder, ulcus cornea, medical complications, hernia cicatricalis, cleaning and care of wounds, persisting sternum wound after heart surgery, dehydration, diabetes mellitus type II, hypoglycemia, hyponatremia, kidney failure, arthritis, polymyalgia rheumatica, rheumatoid arthritis, osteoporosis, collapsed vertebra, and backache |

[a]Classification made by author E.v.V. and an independent physician.

CVA, CerebroVascular Accident (a stroke); DBS, Deep Brain Stimulation

 