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A simple risk score list can be used to predict the occurrence of delirium in patients admitted to inpatient hospice care: A medical record study

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Abstract

Objective: This study aimed to examine whether the 10-item Risk Score List (RSL) accurately predicts delirium in patients admitted to inpatient hospice care and whether this instrument can be simplified. Determining the risk for developing delirium can help to treat these patients in a timely manner.

Methods: This was a retrospective medical record study in patients who died in 2019 or 2020 in three hospices. Predictive values were examined using Cox regression analysis, crosstabs, and C-statistic.

Results: In total, 240 patients were included. Median age at admission was 78 (IQR 70–84) years. Primary diagnosis most often was cancer ($n = 186$, 78%); 173 (72%) patients had an increased risk of delirium according to RSL, of whom 120 (69%) developed delirium. Overall, 147 (61%) patients developed delirium. The RSL significantly predicted future delirium (HR 3.25, CI 1.87–5.65, $p < 0.01$) and had a sensitivity of 85%, a specificity of 43%, positive predictive value of 62%, negative predictive value of 73%, and a C-statistic of 0.64. Simplifying the RSL to four items still significantly predicted future delirium, with similar predictive values.

Conclusion: Delirium occurs in more than half of patients admitted to hospice care. The RSL can be simplified to four items, without compromising on predictive accuracy.

KEYWORDS
delirium, end-of-life care, hospice and palliative care nursing, hospice care, retrospective studies, terminal care

1 | INTRODUCTION

Delirium is a distressing and acute neurocognitive disorder in patients, which is characterised by an impairment in awareness and attention (American Psychiatric Association, 2013). In addition, a deficit in cognitive functioning is apparent, for instance in memory, orientation, language, visuospatial functioning, or perception (American Psychiatric Association, 2013). Both hyperactive and hypoactive subtypes exist, with a mixed type being most prevalent. Previously conducted reviews and original studies show that delirium occurs in 42%–88% of

patients across a variety of palliative care settings (Watt et al., 2019). Developing delirium has several negative consequences, such as an impairment in communication, which could prevent the patient of communicating with family, thereby possibly affecting the quality of life (Bush et al., 2017; de la Cruz, Fan, et al., 2015). Moreover, delirium in the palliative phase could cause a destructive triangle in which patients, family, and caregivers become more and more stressed (Finucane et al., 2017).

Treatment of delirium usually consists of treating its underlying cause, such as infection, or optimising opioid or benzodiazepine usage (Gaudreau et al., 2005, 2007). Nonpharmacological treatments have also been suggested and revolve around reorientation, limitation of stimuli, and providing consistency in caregivers. Furthermore, pharmacological treatment of delirium usually consists of administering antipsychotics, although current evidence does not support the usage of antipsychotics in the treatment of delirium, as was recently described by two systematic reviews (Finucane et al., 2020; Nikooie et al., 2019). Treating delirium results in a decrease of symptoms in approximately half of the patients (Lawlor et al., 2000; Leonard et al., 2008). However, when patients are in the dying phase, delirium proves often to be "terminal" and irreversible, as a result of the dying process (Klankluang et al., 2021). Especially in the last months of the patient's life, occurrence of delirium disrupts the quality of life. Therefore, early recognition is of great importance to promote early treatment and to prepare and support the family. Furthermore, evidence from hospitalised, nonpalliative, older patients suggests that nonpharmacological multicomponent interventions could decrease the occurrence of delirium when started preventively (Hshieh et al., 2015), thereby indicating the importance to identify patients at higher risk.

Several predisposing and precipitating factors exist for developing delirium, such as being older than 70 years of age, having pre-existing cognitive disorders, or (withdrawal of) alcohol or opioids (American Psychiatric Association, 2013; Featherstone et al., 2022; Guo et al., 2021). A variety of screening tools to identify symptoms of delirium are available (Watt et al., 2021), such as the Delirium Observation Screening (DOS) Scale (Neefjes et al., 2019; Schuurmans et al., 2003). However, screening can be complex and time consuming (Porteous et al., 2016). For example, the DOS only proves useful when being used consistently for three times per day (Schuurmans et al., 2003). Therefore, it was suggested to identify those patients higher at risk of developing delirium for whom screening is necessary (Bannink et al., 2004). In 2004, Bannink and colleagues developed the 10-item Risk Score List (RSL) to identify patients at risk of developing delirium (Bannink et al., 2004). This instrument was studied in 104 patients admitted to a hospital palliative care unit. It identified 51 patients as having a high risk of developing delirium, of whom 12 developed delirium (Bannink et al., 2004). The RSL has not yet been studied in patients admitted to inpatient hospice care, where delirium is often diagnosed (Watt et al., 2019).

Our study aimed at examining the predictive accuracy of the 10-item RSL for the risk of developing delirium in patients admitted to an inpatient hospice care facility. Also, we aimed to examine whether this instrument could be simplified.

2 | METHODS

2.1 | Study design and setting

This was a retrospective medical record study in three inpatient hospice care facilities in the Netherlands. Prior to the study, semi-structured interviews were held to obtain clarity on the composition of the care team and the procedures on the prevention and treatment of delirium in each hospice. In the Netherlands, inpatient hospices are facilities in which patients with a life expectancy of less than 3 months can reside in a peaceful, friendly, caring environment until their death. The main goal in the hospice is to be as comfortable as possible, by means of a holistic approach and for instance limiting potentially unnecessary medical treatments, thereby promoting an as good as possible quality of life and quality of dying. The study protocol was approved by the institutional medical ethics board of the Leiden University Medical Center (G20.100) and by the scientific research committees of the participating hospices.

2.2 | Study population

For the semistructured interviews, per hospice, a nurse, a physician, and a care coordinator were interviewed. Further, medical records from up to 80 patients deceased in the year 2019 or 2020 per hospice were included. No patients were excluded from the analysis. Only the last 3 months of life were examined, even if the patient was admitted for more than 3 months.

2.3 | Data collection

In each hospice, semistructured interviews were conducted to obtain clarity on the composition of the care team and the procedures concerning screening, diagnosis and treatment of delirium in each hospice. For these interviews, a standardised topic list was developed (see Data S1). In each hospice, the care coordinator was contacted to obtain contact details of a nurse, physician, and care coordinator. Subsequently, the potential participants were contacted by mail and received extra information on the study. After they agreed to participate, they were contacted by phone to plan the interview. Interviews were conducted face-to-face by one of the members of the research team (R.S.) and were recorded.

Subsequently, medical records of deceased patients were retrospectively examined. A large part of the records were on paper and partly electronic. For the data collection, an extraction form was developed and tested by the research team of the Center of Expertise in Palliative Care of the leading institute (Leiden University Medical Center), which consisted of a professor of palliative medicine, a professor of epidemiology, a general practitioner, an advanced nurse practitioner and a psychologist, all specialised in palliative care. The following data were collected:

1. Demographic variables (e.g., gender, diagnosis, and comorbidities).
2. Admission data (e.g., age at admission and medication at admission).
3. Risk Score List (RSL) (Bannink et al., 2004): The RSL was retrospectively scored by two members of the research team (R.S. and I.M.M.R.) at time of admission using the information available in the medical record. The RSL is a Dutch instrument containing 10 precipitating factors for delirium (previous delirium [3 points], cognitive impairment [3 points], opioid change [3 points], age >70 years [1 point], use of alcohol [1 point], recreational use of drugs [1 point], fever [1 point], metabolic problems [1 point], hearing or vision problems [1 point], procedures requiring anaesthesia [1 point]) and has been previously studied in a hospital palliative care unit (Flaws et al., 2019). A total score is calculated by adding the scores on the separate items (range 0–16). A score of three or higher indicates an increased risk on developing delirium and recommends the start of a screening instrument.
4. Date of delirium diagnosis.
5. Treatment of delirium (e.g., pharmacological and nonpharmacological).

The extraction form was digitalized in the data management program "Castor EDC." Two researchers (R.S. and I.M.M.R.) collected the data simultaneously on location in the hospice care facilities. During data collection, ambiguities were frequently discussed to obtain clarity. For this study, patients were classified as having had a delirium if either (1) a formal diagnosis was present in the medical record or (2) medication was started typically prescribed for symptoms indicating delirium (e.g., agitation and confusion). Only medication as described in the Dutch guidelines for delirium at the end of life was considered (Bannink et al., 2010) (i.e., haloperidol, risperidone, olanzapine, lorazepam, midazolam, quetiapine, and clozapine). Further, it had to be clearly described in the medical record for what purpose the medication was prescribed. When haloperidol was for instance prescribed for nausea in the absence of any symptoms suggesting the presence of delirium, the patient was not classified as having had a delirium. Terminal delirium was separately classified, since at the end of life neurocognitive decline could be a sign of a dying brain. Terminal delirium was defined as delirium occurring in the last 3 days of life (White et al., 2007).

2.4 | Data analysis

Semistructured interviews were deductively analysed using selective coding. Answers to the questions were presented in a table to allow for comparison between the hospices. For the quantitative data from the medical records, descriptive statistics were used to summarise demographic data. Mean scores and standard deviations were calculated when data were normally distributed. Medians and interquartile ranges were calculated when data were non-normally distributed. Data were presented for the population as a whole, and for patients with and without delirium separately. Data were compared using Chi-square and Kruskall–Wallis tests. Cox regression analysis and crosstabs were conducted to calculate predictive value of the total score of the RSL and the dichotomous risk score of the RSL (scores of <3 indicate no risk and scores ≥3 indicate increased risk). Subsequently, the predictive values of the separate RSL items were calculated in order to examine which items should be included in the simplified version. The sensitivity, specificity, positive predictive value, negative predictive value, and the predictive accuracy of the RSL were calculated using crosstabs and C-statistics. End-point was delirium, with the exclusion of terminal delirium. Significant items of the RSL were combined in a simplified model, after which predictive values were reanalysed.

3 | RESULTS

3.1 | Composition of the hospices and prevention and treatment of delirium

Interviews were held with a total of 10 respondents (three respondents worked in hospice 1, four in hospice 2, three in hospice 3) (Table 1). Three of them were physicians (two general practitioners and one elderly care physician), four were nurses, and three were care coordinators. The composition of the hospice care teams were similar, and the hospices conducted similar preventive measures for delirium. Often indicated preventive measures were creating a day–night routine, providing structure, placing a clearly visible clock with date and time, and creating a calm environment. All hospices were screened for delirium using the DOS. In hospice 1, the DOS was scored three times per day for the entire period the patient was admitted. In hospice 2 and 3, the DOS was scored at time of admission and afterwards only when patients showed signs of a possible delirium. Nonpharmacological measures were taken in all hospices when the patients showed signs of delirium. Most often, these measures consisted of guarding the day–night routine and reducing stimuli. All hospices indicated having a proactive medication policy for delirium, which is agreed upon at admission of the patient to the hospice. With a proactive medication policy, medication can be started when needed, even at night. Hospices named haloperidol as the medication of choice in treating symptoms of delirium, and lorazepam as second choice in case of anxiety or sleeping impairments. Further, only if patients had a life expectancy of more than a few weeks, an attempt was made to identify and treat the cause of delirium, such as infection of the urinary tract or lungs.

3.2 | Patient population

The medical records of 240 deceased patients were analysed (Table 2). Of these patients, 144 (60%) were female. Patients were admitted to hospice care at a median age of 78 years old (*IQR* 70–84) and had a median admission time of 10 (*IQR* 4–28) days until death. Thirteen patients were admitted for more than 3 months. Patients mostly lived alone prior to hospice admission ($n = 131$, 55%) and were admitted from home in 114 (48%) cases. The main diagnosis was

TABLE 1 Composition and preventive measures in the hospices

	Hospice 1	Hospice 2	Hospice 3
Composition	6 private rooms	6 private rooms	6 private rooms
	3 care coordinators	2 care coordinators	3 care coordinators
	15 nurses	15 nurses	8 nurses (+extra 'on- call')
	80 care volunteers	40 care volunteers	80 care volunteers
	2 spiritual caregivers	1 spiritual caregiver	1 spiritual caregiver
Treating physician	Own general practitioner or consulting palliative care physician (approx. 50%–50%)	Own general practitioner or elderly care physician (approx. 50%–50%)	Own general practitioner or consulting general practitioner (approx. 80%–20%)
Multidisciplinary team meeting	Yes, once a week	Yes, once a week	Yes, once a week
Screening for delirium	Standard 3 times per day (DOS)	Standard at time of admission, afterwards only on indication (DOS)	Standard at time of admission, afterwards only on indication (DOS)
Medical measures for delirium	On indication (e.g., when fragile, cognitive problems, opioid, or psychotropics use)	On indication (not further specified)	On indication (e.g., pre-existent delirium or brain tumour, fragile, and pain)
Non-medical measures taken	Day-night routine, Reduce stimuli, providing structure	Day-night routine, familiar items from home, involvement of family	Day-night routine, reduce stimuli, familiar items from home

Note: DOS: Delirium Observation Screening Scale.

cancer ($n = 186$, 78%), and 219 (91%) patients had one or more additional medical diagnoses. A minority of the patients were smokers or used alcohol at a daily basis (respectively $n = 39$, 16%, and $n = 46$, 19%). Patients were admitted to hospice with a median of 2 (*IQR* 1–2) medications. Opioids were most often prescribed ($n = 157$, 65%), followed by benzodiazepines ($n = 66$, 28%), corticosteroids ($n = 53$, 22%), antiemetics ($n = 49$, 20%), and antipsychotics ($n = 35$, 15%).

3.3 | Prevalence and treatment of delirium

Based on the hospice medical records, 147 (61%) patients were considered having had a delirium in the last 3 months of life; 42 (29%) patients had a formal diagnosis in the medical record, and the remaining 105 (71%) patients were administered medication for symptoms indicating delirium. In 48 (20%) patients, the delirium occurred in the last 3 days of life, thereby being considered a terminal delirium. Patients had their delirium diagnosed a median of 4 (*IQR* 0–14) days after being admitted to hospice care. They died a median of 6 (*IQR* 2–13) days after delirium was diagnosed.

Of the 147 patients who had delirium, 146 (99%) patients were pharmacologically treated. Only one patient with a formal delirium diagnosis in the medical record did not start on medication. Mostly, patients were treated with haloperidol ($n = 134$, 92%). Fifteen patients (10%) were treated with a combination of haloperidol and midazolam and one patient was treated with a combination of lorazepam and midazolam. For 59 (40%) patients with delirium, specific non-pharmacological interventions were described in the medical record. Most often, the exposure to stimuli was reduced ($n = 24$, 41%). Also, drastic measures such as rooming-in of family and the use of a camera or movement sensor to monitor delirium were quite often reported (respectively $n = 17$, 29% and $n = 9$, 15%). Seven (5%) patients diagnosed with delirium received antibiotics to treat urinary tract infection or lung infection.

3.4 | Risk score list

For all patients, the researcher scores the RSL at time of admission (Table 3). A total of 90 (38%) patients had had a previous delirium prior to admission, 77 (32%) patients had a cognitive disturbance (e.g., brain tumour, CVA or dementia) at admission. Furthermore, in 97 (40%) patients, opioid medication was switched at time of admission, and 180 (75%) patients were older than 70 years of age. The median score on the RSL at time of admission was 5 (*IQR* 2–7) (Table 3). A total of 173 (72%) patients had a score of 3 or higher, thereby being classified as having a higher risk of delirium. Of these 173 patients, 120 (69%) developed delirium during their admission. Patients who developed delirium had a higher median score on the RSL at time of admission (6, *IQR* 4–8) compared to patients who did not develop delirium (4, *IQR* 1–6, $p < 0.01$).

The predictive value of the RSL was analysed in Cox regression analyses. Table 4 lists the hazard ratios (HR) for all separate item scores, the total score and the dichotomous risk score of the RSL. Both the total score and the dichotomous risk score were significant predictors of future delirium (respectively HR 1.22, 95% CI 1.14–1.31 and HR 3.25, 95% CI 1.87–5.65, both $p < 0.01$). The RSL (as dichotomous score) had a sensitivity of 85%, a specificity of 43%, a positive predictive value of 62%, and a negative predictive value of 73%. The C-statistic was 0.64 (95% CI 0.56–0.72, $p < 0.01$).

TABLE 2 Study population at time of admission, divided by end-point developing delirium after admission yes or no

	Total ($N = 240$)	Patients with delirium ($n = 147$)	Patients without delirium ($n = 93$)	*p* value
Gender (female)	144 (60%)	78 (53%)	66 (71%)	<0.01
Age at admission (median, *IQR*)	78 (70–84)	79 (71–84)	74 (68–83)	0.03
Days from admission to death (median, *IQR*)	10 (4–28)	12 (5–29)	7 (3–20)	<0.01
Living situation prior to admission to hospice care				0.64
Alone/independent	131 (55%)	75 (51%)	56 (60%)	
With partner, no children	84 (35%)	57 (39%)	27 (29%)	
With partner and children	7 (3%)	4 (3%)	3 (3%)	
Nursing home	6 (3%)	4 (3%)	2 (2%)	
Other	11 (5%)	6 (4%)	5 (5%)	
Unknown	1 (1%)	1 (1%)	0	
Admissions to hospice care from				0.38
Home	114 (48%)	76 (52%)	38 (41%)	
Hospital	101 (42%)	55 (37%)	46 (50%)	
Nursing home	5 (2%)	4 (3%)	1 (1%)	
Other	8 (3%)	5 (3%)	3 (3%)	
Unknown	12 (5%)	7 (5%)	5 (5%)	
Primary diagnosis				0.43
Cancer	186 (78%)	116 (79%)	70 (75%)	
Cardiovascular	17 (7%)	11 (8%)	6 (7%)	
Cerebrovascular	7 (3%)	2 (1%)	5 (5%)	
Neurodegenerative	8 (3%)	5 (3%)	3 (3%)	
Lung disease	1 (1%)	0	1 (1%)	
Other	21 (9%)	13 (9%)	8 (9%)	
Comorbidities				
CVA/TIA	19 (8%)	13 (9%)	6 (7%)	0.50
Epilepsy	4 (2%)	2 (1%)	2 (2%)	0.64
Dementia	8 (3%)	7 (5%)	1 (1%)	0.12
Heart failure (NYHA III/IV)	21 (9%)	13 (9%)	8 (9%)	0.95
COPD (GOLD III/IV)	16 (7%)	12 (8%)	4 (4%)	0.24
Diabetes type I	4 (2%)	3 (2%)	1 (1%)	0.57
Diabetes type II	43 (18%)	32 (22%)	11 (12%)	0.05
Kidney failure	42 (18%)	23 (16%)	19 (20%)	0.34
Liver failure	4 (2%)	2 (1%)	2 (2%)	0.64
Psychiatric[a]	18 (8%)	10 (7%)	8 (9%)	0.61
Other	31 (13%)	19 (13%)	12 (13%)	0.99
Non/unknown	22 (9%)	13 (9%)	9 (10%)	0.83
Nicotine usage	39 (16%)	25 (17%)	14 (15%)	0.69
Alcohol usage	46 (19%)	32 (22%)	14 (15%)	0.20
Medication at time of admission				
Opioids	157 (65%)	102 (69%)	55 (39%)	0.10
Benzodiazepines	66 (28%)	43 (29%)	23 (25%)	0.45
Corticosteroids	53 (22%)	30 (20%)	23 (25%)	0.43
Antiemetic	49 (20%)	31 (21%)	18 (19%)	0.75
Antipsychotics	35 (15%)	29 (20%)	6 (7%)	<0.01
TCA	9 (4%)	6 (4%)	3 (3%)	0.73

(Continues)

TABLE 2 (Continued)

	Total ($N = 240$)	Patients with delirium ($n = 147$)	Patients without delirium ($n = 93$)	*p* value
SSRI	8 (3%)	5 (3%)	3 (3%)	0.94
Anticholinergic	4 (2%)	4 (3%)	0	0.11
Tetracyclic antidepressant	3 (1%)	2 (1%)	1 (1%)	0.85

Abbreviations: COPD, chronic obstructive pulmonary disease; CVA, cerebrovascular accident; GOLD, global initiative for obstructive lung disease; IQR, interquartile range; NYHA, New York Heart Association; SD, standard deviation; SSRI, selective serotine reuptake inhibitor; TCA, tricyclic antidepressant; TIA, transient ischemic attack.
[a]Depressive disorder ($n = 7$), anxiety ($n = 2$), bipolar disorder ($n = 2$), delirium (2), schizophrenic ($n = 2$), panic disorder ($n = 1$), psychological problems ($n = 1$), psychotic ($n = 1$).

TABLE 3 Risk score list at time of admission in 240 patients admitted to hospice care

		Total ($N = 240$)	Patients with delirium ($n = 147$)	Patients without delirium ($n = 93$)	*p* value
RSL separate items	Score				
Previous delirium	3 points	90 (38%)	72 (49%)	18 (20%)	<0.01
Cognitive impairment	3 points	77 (32%)	52 (35%)	25 (27%)	0.17
Opioid change	3 points	97 (40%)	68 (46%)	29 (31%)	0.02
Age > 70 years	1 point	180 (75%)	117 (80%)	63 (68%)	0.04
Use of alcohol >4 units per day	1 point	9 (4%)	7 (5%)	2 (2%)	0.3
Recreational drug use	1 point	0	0	0	-
Fever >38.5°C	1 point	16 (7%)	8 (5%)	8 (9%)	0.3
Metabolic problems	1 point	96 (40%)	57 (39%)	39 (42%)	0.6
Hearing problems, vision problems	1 point	69 (29%)	44 (30%)	25 (27%)	0.6
Procedures requiring anaesthesia	1 point	3 (1%)	1 (1%)	2 (2%)	0.3
RSL total score (median, *IQR*)[a]		5 (2–7)	6 (4–8)	4 (1–6)	<0.01
RSL ≥ 3[b]		173 (72%)	120 (82%)	53 (57%)	<0.01

Abbreviations: RSL, Risk Score List; SD, standard deviation.
[a]RSL as continuous score (possible range 0–16).
[b]RSL as dichotomous score (score of 3 or higher indicates higher risk on delirium).

TABLE 4 Predictors of delirium

		HR	95% CI	*p* value
RSL total score[a]		1.22	1.14–1.31	<0.01
RSL ≥ 3[b]		3.25	1.87–5.65	<0.01
RSL separate items	Score			
Previous delirium	3 points	1.32	1.16–1.51	<0.01
Cognitive impairment	3 points	1.21	1.06–1.39	<0.01
Opioid change	3 points	1.27	1.11–1.45	<0.01
Age >70 years	1 point	1.67	1.03–2.70	<0.05
Use of alcohol >4 units per day	1 point	1.87	0.76–4.64	0.175
Recreational drug use[c]	1 point	-	-	-
Fever >38.5°C	1 point	0.95	0.42–3.19	0.912
Metabolic problems	1 point	0.79	0.52–1.19	0.260
Hearing problems, vision problems	1 point	1.43	0.94–2.17	0.091
Procedures requiring anaesthesia	1 point	0.05	0.00–0.83	0.546

Note: Analyses with Cox regression. RSL: Risk Score List.
[a]RSL as continuous score (possible range 0–16).
[b]RSL as dichotomous score (score of 3 or higher indicates higher risk on delirium).
[c]No patients used drugs.

To simplify the RSL, we combined the four significant items of the RSL (previous delirium, cognitive impairment, opioid change, age >70 years) in a simplified model ("RSL-4") with a total score of 0–10. Three risk categories were specified: low-risk, score <3; moderate-risk, score 3–6; and high-risk, score >6. The RSL-4 remained a significant predictor of future delirium. When compared with the low-risk group, the moderate-risk group had a HR of 2.8 (95% CI 1.6–5.0, $p < 0.01$) and the high-risk group had a HR of 5.2 (95% CI 2.9–9.4). The C-statistic was 0.7 (95% CI 0.6–0.8, $p < 0.01$). With this instrument, 58 patients were classified as low-risk, 82 as moderate-risk, and 52 as high-risk. In the low-risk group, 16 of the 58 patients (28%) developed delirium, which was significantly less than the patients that did not develop delirium ($n = 42$, $p < 0.01$). In the moderate-risk group, 44 of the 82 patients (54%) developed delirium, which was not significantly different from the patients that did not develop delirium ($n = 38$). In the high-risk group, 40 of the 52 patients (77%) developed delirium, which was significantly more than the patients that did not develop delirium ($n = 12$, $p < 0.01$).

4 | DISCUSSION

In this retrospective study of medical records, we found that 61% of patients who died within the studied hospices developed delirium during their stay. In 20% of the total population, delirium occurred in the last 3 days of life, thereby being considered a terminal delirium. We found that the 10-item RSL significantly predicted future development of delirium, both when used as a continuous score, and when a cut-off score of 3 was considered, and seems to be applicable in inpatient hospice care settings. To stimulate its use in daily practice, the RLS was simplified to a 4 items Risk Score List (RSL-4). In our study, the RSL-4 seemed to more strongly predict future delirium, with a HR of 5.2 for patients being classified by the instrument as having a high risk. This suggests that the RSL-4 can be used as an easy-to-use instrument to identify patients at risk for delirium.

Although the prevalence of delirium in our study (61%) is comparable to that in previous studies (Watt et al., 2019), the percentage of terminal delirium (20%) is significantly lower. For instance, a study by Klankluang et al. (2021) in both outpatient and inpatient palliative care wards of a university hospital showed a prevalence of 89% in the last few days of life. In the study of Klankluang et al., delirium was diagnosed by a psychiatrist. A study of Seiler et al. (2020) in patients admitted to a palliative ward of a university hospital showed a prevalence of 93%. In the study of Seiler et al., delirium was determined based on the DOS and the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric Association, 2013). Our low numbers might be due to the way we determined delirium in our study. A large proportion of patients had their own GP as treating physician while being admitted in hospice care facility. Most GPs do not report in the medical record of the hospice facility. Therefore, besides formal written diagnosis in the medical record, we considered patients having a delirium when they were prescribed medication for symptoms of delirium such as agitation or confusion. We therefore might have missed patients that could have been diagnosed with a delirium by the GP. Besides, while previous studies on terminal delirium focused on palliative wards in hospitals (Klankluang et al., 2021; Seiler et al., 2020), we focused on an inpatient hospice care facility. This difference is important due to the nature of the population. While patients on palliative hospital wards could still receive systemic treatments to treat their disease and to increase life expectancy, patients in inpatient hospice care facilities no longer receive such treatments and have a life expectancy of less than 3 months (Roth & Canedo, 2019).

Although all hospices in the study screened for symptoms of delirium using the DOS, no hospice made a risk calculation at time of admission. Using the DOS indeed proves useful in identifying symptoms of delirium, with satisfactory validity and reliability (Schuurmans et al., 2003). However, since two of the three hospices only used the DOS 'on indication', when symptoms of delirium already were apparent, one might argue that the use of the DOS comes too late. Mapping risk factors at time of admission is important, since it has been shown that up to 76% of delirium diagnoses are missed (de la Cruz, Fan, et al., 2015; Klankluang et al., 2021). Besides, a large part of palliative patients who develop delirium are likely to die without recovering from delirium (de la Cruz, Ransing, et al., 2015; Leonard et al., 2008). Screening for risk factors could promote the early implementation of measures to prevent or postpone delirium. Since all three hospices structurally collected a large number of patient factors at admission to hospice, all RSL items were available in the medical records. We therefore were able to completely score the RSL for all (100%) patients. We found that the original 10-item RSL was a significant predictor of future delirium. When using a cut-off score of 3, we found a HR for future delirium of 3.25. The predictive values in our study were slightly different from the originally published article from Bannink et al. (2004), with a sensitivity in Bannink's study of 92% versus 85% in our study, a specificity of 57% versus 43%, a positive predictive value of 24% versus 62%, and a negative predictive value of 98% versus 73%. This might be due the different settings: Bannink et al. conducted their research on a palliative care unit in a university hospital, while we conducted our research in an inpatient hospice care facility. Also, the population sizes differ, with 104 patients in the study of Bannink et al. versus 240 in our study. Whether our population differed from Bannink et al. is not known, since Bannink did not disclose any information on demographic characteristics (Bannink et al., 2004). It should be noted that the specificity of the RSL is rather low in our study (43%), meaning the instrument is less accurate in determining the absence of delirium. Therefore, it is recommended to always remain attentive on symptoms (prodromes) possibly indicating delirium. Perhaps the most important finding was that only four items on the RSL were significant predictors, namely "previous delirium," "cognitive impairment," "opioid changes," and "age older than 70 years." It was decided to discriminate in three different risk groups: low-risk (score <3), moderate-risk (score 3–6), and high-risk (score >6). This was decided from a clinical point of view to be more accurate in using preventive measures and further screening instruments. The four

TABLE 5 Risk groups and recommendations of the RSL-4

Risk group	Score	Recommendation
Low risk	<3	Care as usual Start DOS *on indication* (e.g., early symptoms and prodromes)
Moderate risk	3–6	Start using DOS Inform patient and family on increased risk
High risk	>6	Start using DOS Inform patient and family on high risk Consider preventive measures (e.g., limiting number of visitors and fixed day routine)

Note: RSL-4: Risk Score List – 4 items; DOS: Delirium Observation Screening Scale.

items on the RSL-4 have previously been identified as most predisposing factors for developing delirium (Guo et al., 2021; Zipser et al., 2021). Scoring the RSL-4 could decrease the time spend on further screening for delirium, since we suggest to not use the DOS for patients identified as low risk. This means that, in our study, the DOS should not be scored in 30% of patients (those identified at low risk), which could increase the time spend on other care activities.

Although research has been done on the development of delirium, little research has been done on what strategies could be implemented to prevent delirium in patients with life threatening illnesses. Some research has been done on nonpalliative patients in the hospital setting, suggesting that preventive measures are effective in preventing the development of delirium (Hshieh et al., 2015; Inouye et al., 2014). A systematic review from 2019 conducted by Hosie et al. (2019) only identified one study explicitly focusing on preventive measures for delirium at the end of life (Gagnon et al., 2012) and four studies in patient populations that might be in need of palliative care, only to conclude they were not able to give a definite answer to the question whether preventive measures can prevent patients from developing delirium. This highlights the need for more extensive research on how both pharmacological and nonpharmacological measures might prevent patients from developing delirium.

Although we have to further validate the RSL-4, some preliminary clinical recommendations based on expert opinion can be considered. We recommend to use the RSL-4 at time of admission in inpatient hospice care settings to predict the occurrence of delirium during the patient's stay. The RSL-4 has three categories, in which different preventive measures can be taken to timely identify and treat delirium (Table 5). In the low-risk group (score <3), we suggest regular care, with no addition of specific measures. We advise to only start using a screening instrument, such as the DOS, on indication, for instance, when early symptoms of delirium (prodromes) are present or when opioid medication is started or switched. In the moderate-risk group (score 3–6), we advise to start scoring the DOS three times a day directly from admission in order to timely recognise changes in the patients cognition or behaviour. Further, it is recommended to inform patient and family about the increased risk. In the high-risk group (score >6), we advise to score the DOS three times a day directly from admission and to already take preventive measures, such as limiting the number of visitors and health care professionals, keeping a fixed day routine, and ensuring the patient (if applicable) has clean glasses on and a functioning hearing aid (Bannink et al., 2010).

4.1 | Strengths and limitations

This study is the first in the Netherlands focusing on predicting delirium by using risk factors identified at time of admission in patients admitted to inpatient hospice care facilities. Therefore, this study provides an important step in trying to prevent patients at the end of life developing delirium. A strength of our study is that we did not exclude patients based on demographic characteristics, providing us with a varied patient group, thereby promoting generalizability to other hospices. Despite its strengths, some limitations have to be considered. This study was a retrospective study, which relied on the completeness of the medical records. Since GPs did not always report in the medical records of the hospice care facility, it is possible that we missed delirium diagnoses. In our study, we both considered a formal delirium diagnosis and a suspected diagnosis (based on symptoms and medication usage indicating delirium) as delirium in our study. One hundred and six patients were considered having had a delirium based on the medication started. It is possible that some of these patients started such medication for other reasons than delirium and were incorrectly classified by our study, meaning the percentage in fact could have been lower. On the other hand, while diagnosing based on symptoms and medication was considered sufficient for patients with hyperactive delirium, it could be that we missed cases of hypoactive delirium. We noticed inconsistencies between the hospices with regard to screening with the DOS for delirium. Due to all these reasons, it is possible we overestimated or underestimated the prevalence of delirium. Although the RSL-4 seems to be a useful instrument to predict delirium, its use has to be validated preferably in a different dataset. The RSL-4 should also be studied in a prospective study, to examine whether the development of delirium can be prevented. This prospective study should use screening and diagnostic tools consistently across settings. Further, since the prevalence of delirium in palliative care patients is considerable, it should be examined whether using preventive measures in this population as a whole could decrease its actual occurrence.

5 | CONCLUSION

A delirium is a frequently occurring disorder in patients admitted to inpatient hospice care facilities. We developed a simplified instrument (RSL-4) to be used in inpatient hospice care facilities based on a previously designed instrument, thereby providing inpatient hospice care facilities with an easy-to-use, time-saving, and accurate instrument. The RSL-4 is a 4-item instrument to be scored at time of admission to predict future development of delirium and classifies a patient as having a low, moderate, or high risk on developing delirium. Since this

instrument has good predictive values, its use helps to identify patients at risk and thereby promotes the use of preventive measures and further screening.

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CONFLICT OF INTEREST

All authors declare that there is no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author upon reasonable request. The data are not publicly available due to privacy or ethical restrictions.

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