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Family Identification of Delirium in the Emergency Department in patients with and without Dementia: Validity of the FAM-CAM

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Abstract

Objective—To examine the ability of the family-rated Family-Confusion Assessment Method (FAM-CAM) to identify delirium in the Emergency Department (ED) among patients with and without dementia, as compared to the reference-standard Confusion Assessment Method (CAM).

Design—Validation study.

Setting—Urban academic ED.

Participants—Dyads of ED patients aged 70 and older and their family caregivers (N=108 dyads).

Measurements—A trained reference standard interviewer performed a cognitive screen, delirium symptom assessment, and scored the CAM. The caregiver self-administered the FAM-CAM. Dementia was assessed using the IQCODE and the medical record. For concurrent validity, performance of the FAM-CAM was compared to the CAM. For predictive validity, clinical

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Author Contributions: JS and SKI conceived the study, designed the trial, and obtained research funding. JS, CD and SKI, trained the staff and supervised the conduct of the trial and data collection. JS, CD, YM & JE undertook recruitment of participating centers and patients and managed the data, including quality control. JS, CD, and SKI provided statistical advice on study design and analyzed the data. JS and TM drafted the manuscript, and CD, JE, YM and SKI contributed substantially to its revision. JS takes responsibility for the paper as a whole. *Drs Saczynski and Inouye contributed equally to this work.

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outcomes (ED visits, hospitalization and mortality) over 6-months were compared in FAM-CAM positive and negative patients controlling for age, sex, comorbidity and cognitive status.

Results—Among the 108 patients, 30 (28%) were CAM positive for delirium and 58 (54%) presented with dementia. The FAM-CAM had a specificity of 83% and NPV of 83%. The majority of the false negatives (n=9 out of 13, 69%) were due to caregivers not identifying the inattention criteria for delirium on the FAM-CAM. In patients with dementia, sensitivity was higher than in patients without (61% versus 43%). In adjusted models, a hospitalization in the following 6-months was more than 3 times as likely in FAM-CAM positive compared to negative patients (OR=3.4, 95% CI=1.2, 9.3).

Conclusions—Among patients with and without dementia, the FAM-CAM shows qualities that are important in the ED setting for identification of delirium. Using the FAM-CAM as part of a systematic screening strategy for the ED in which families' assessments could supplement health care professionals' assessments, is promising.

Keywords

Delirium; Dementia; FAM-CAM; family caregivers; Emergency Department

INTRODUCTION

Delirium, an acute decline in cognitive function, is common among hospitalized older patients and is associated with poor clinical and functional outcomes.[1] The Emergency Department (ED) is the point of hospital entry for the vast majority of inpatients, and up to 20% of older patients in the ED have prevalent delirium.[2] Patients with delirium in the ED are at risk for poor outcomes including longer and more complicated hospital stays, slower functional recovery and readmission.[3] More importantly, patients discharged home with delirium have a high mortality rate.[4] Despite its high prevalence, delirium often goes undiagnosed in the ED despite the inclusion of delirium in quality indicators, emergency medicine resident core competencies, and guidelines. [2,5–8] In the context of the ED, identifying delirium is a primary concern and since longer duration of delirium is associated with poorer outcomes, early identification is key. [3,4] Moreover, many older patients in the ED have dementia, which is a leading risk factor for delirium and also complicates its diagnosis.[9,10] In fact, the majority of patients presenting to the ED with dementia are previously undiagnosed, so clinicians cannot rely upon past medical history.[11] Identifying dementia in the ED is as much as challenge as identifying delirium in part because so few ED-feasible dementia screening instruments exist for Emergency Medicine.[12]

Between 26% and 40% of older patients in the ED present with cognitive impairment.[13] Recognizing delirium among patients with dementia is especially challenging because the two conditions share many symptoms such as disorientation or memory impairment.[14] However, delirium and dementia are distinct, the main difference being that delirium is characterized by an acute change in cognitive function while dementia is a slow and progressive decline in function.[1] Family members often have the critical knowledge of a patients' baseline level of cognitive function, which is the key to detecting acute changes that occur in delirium, especially in patients with dementia.[14–17] Incorporating family

caregivers' observations from a structured instrument to supplement the evaluation conducted by ED providers may help identify patients with delirium, distinguish delirium from dementia, and empower caregivers to take a more active role in monitoring changes in their family member's cognitive status.

The Confusion Assessment Method (CAM) is the most widely used standardized method for the identification of delirium with high sensitivity (94–100%) and specificity (90–95%).[18] A version of the CAM for family members and informal caregivers, the Family Confusion Assessment Method (FAM-CAM), has been validated in outpatient and medical inpatient settings.[15,19] The FAM-CAM is completed by family caregivers with the goal of guiding them through describing their observations on the key symptoms of delirium. Therefore, this tool pulls from a new source of information to identify delirium in the most challenging patients – those with pre-existing cognitive dysfunction. The FAM-CAM is not meant to take the place of the clinical providers' assessment, but rather as an adjunct tool, to educate family members in the recognition of delirium. The FAM-CAM may help ED providers recognize delirium and could be used in conjunction with clinician's delirium screening because the FAM-CAM obtains standardized information from family members who are often an untapped source of information. Family members have unique knowledge of the patient's baseline cognitive status as well as longer-term changes in cognition, which is particularly important for distinguishing delirium from dementia. However, whether it is amenable to administration in the ED setting has not been examined. The aim of this study was to examine the performance of the family-rated FAM-CAM in the ED compared to the reference standard CAM rated by trained research interviewers and to determine whether the FAM-CAM performed similarly in patients with and without dementia. The secondary aim was to examine whether delirium identified by the FAM-CAM is associated with clinical outcomes over 6-months (ED readmission, hospitalization and mortality), as evidence of its predictive validity.

METHODS

Study setting

This prospective study was performed in a tertiary-care, academic ED in Central Massachusetts with an annual volume of 66,000 adult patients. We used the Standards for Reporting of Diagnostic Accuracy Studies (STARD) reporting guidelines.[20]

Selection of Participants.

The convenience sample included 108 patient and family caregiver dyads. To be eligible for enrollment patients had to be receiving care in the ED, be 70 years or older, have a family caregiver present in the ED, and speak English. Patients were excluded if they presented to the ED for head trauma because altered mental status due to head trauma confounds the typical diagnosis of delirium and has a different trajectory and treatment approach. Eligible patients were approached after treatment and stabilization to minimize the impact on ED care. On average, patients were interviewed after 2 hours in the ED. Eligible family caregivers were required to have regular interactions, in person or via phone conversations, with the patient at least once a week. Caregivers provided informed consent and patients

provided assent (due to many being unable to provide consent because of dementia or delirium). The study was approved by the institutional review board of the participating institution.

Study Procedures.

Once enrolled, patients and caregivers were interviewed separately in-person by trained study staff. The patient was interviewed by a trained rater using a brief cognitive screen and delirium symptom assessment (The Delirium Symptom Interview, detailed below). Following this, the trained reference standard interviewer rated the CAM (detailed below), which combines interviewer observations with results from the brief interview and cognitive screen to identify symptoms of delirium. The patient's interviewer was blinded to responses of the family caregiver. The family caregiver was asked to step out of the ED room while the patient was being interviewed and was interviewed by a separate trained research staff member who was blinded to the results of the patient interview. The family members were interviewed to collect demographic and psychosocial information (e.g., depression, anxiety, and cognition) which may affect their ability to reliably report on the patients' status. Subsequently, the family caregiver self-administered the FAM-CAM independently. The patient and family interviewers did not communicate with each other until the CAM and FAM-CAM ratings were completed and recorded.

Outcomes.

Assessment of delirium by trained interviewer—The CAM, the most widely used delirium assessment, was used as the reference standard rating of delirium in this study. The CAM has been previously used in multiple studies in the ED.[21] The CAM consists of a four-item algorithm, which included (1) acute change in mental status, (2) inattention, (3) disorganized thinking, or (4) altered level of consciousness.[18] The presence of acute change and inattention plus the presence of either disorganized thinking or altered level of consciousness results in a positive delirium diagnosis on the CAM. The interviewer completed the CAM based on observations of the patient during a brief cognitive screen and symptoms reported by the patients on the Delirium Symptom Interview (DSI).[22] Prior to study start, all interviewers underwent at least 4 hours of CAM training by a Research Coordinator with over a decade of experience administering and scoring the CAM and completed 5 practice interviews that were observed and double scored by the trainer before being certified to administer the CAM. After certification, quality control checks were performed on all interviewer's twice a year and additional training was provided as necessary. Any unclear cases were adjudicated by JS and CD.

Assessment of delirium by the family caregiver—The FAM-CAM is an 11-item instrument that was adapted from the CAM to provide an informant-rated instrument for signaling the presence of delirium symptoms and can be administered to a caregiver by a trained interviewer or self-administered.[23] In this study, caregivers self-administered the FAM-CAM and were blinded to any other delirium assessments. The FAM-CAM allows for delirium assessment in a wide range of settings, as compared with traditional delirium assessments, including the CAM, which rely on in-person, potentially time-intensive bedside assessments by clinically trained staff. The FAM-CAM takes approximately 5 minutes to

complete and includes the core features of the CAM for delirium diagnosis (acute onset, inattention, disorganized thinking, and altered level of consciousness).[23] In the present study the FAM-CAM is not intended to enable the caregiver to diagnose delirium, rather it has the potential to engage family caregivers in the process of helping to identify symptoms of delirium which could then be incorporated into the ED provider's process of identifying delirium. The families who completed the FAM-CAM received no formal training on delirium because we aimed to test the validity of the FAM-CAM under conditions that would increase the applicability of the results to real-world ED settings. The FAM-CAM is freely available online for clinical practice, nonprofit, and educational uses (https://www.hospitalelderlifeprogram.org/delirium-instruments). A positive FAM-CAM is defined by the presence of either acute change, fluctuation or acute onset matched with the presence of inattention and the presence of either disorganized speech, excess drowsiness, disorientation or perceptual disturbance.[23]

Assessment of the dementia status—The Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE) was used for caregiver assessment of the patient's level of cognitive functioning. The IQCODE is a 26-item questionnaire used for an informant-based interview to evaluate chronic changes in cognitive function.[24] Each item is scored on a Likert scale ranging from 1 (has become much better) to 5 (has become much worse). The total score ranges from 26 to 130 and is averaged by the total number of items for a final score between 1 and 5. Higher scores indicate greater decline. A score of 3.5 or higher reflected dementia. We chose the IQCODE because it taps into the caregiver's knowledge of changes in the participant's cognitive status and can capture changes not reflected in the medical record. We also obtained dementia diagnoses using standard medical record review – both ICD-9 and ICD-10 diagnoses.

Sociodemographic variables for patients included age, sex, race and marital status. In family caregivers, data was recorded on age, sex, race, relationship and frequency of contact with the patient, whether they lived with the patient, and employment status.

Other clinical variables for patients were collected from the ED physician and nursing charts and included information on chief complaint, emergency severity at triage[25], the Charlson comorbidity index[26], medical history of stroke, depression, anxiety, coronary heart disease, diabetes, hypercholesterolemia and/or hyperlipidemia, hypertension, myocardial infarction, peripheral vascular disease, chronic lung, liver or renal disease, history of past episode of confusion or delirium and whether the patient received a formal diagnosis of delirium during their inpatient stay.

Clinical Outcomes—To address the secondary aim of this study, the association between delirium identified by the FAM-CAM and clinical outcomes, we collected data on outcomes over a 6-month period from electronic medical records and state death records. Repeat ED visits were defined as an ED visit in the 6 months after enrollment in patients who were not hospitalized during the index ED visit (the visit in which they were enrolled into the study) or in the 6 months after discharge in patients who were hospitalized during the index ED visit. Hospital admission was defined as admission within 6 months of study enrollment for patients who were not admitted during the index ED visit and admission 6 months after

discharge for those who were admitted during the index ED visit. That is, a hospitalization resulting from the ED visit in which the patient was enrolled was not considered a hospital admission for the purposes of our long-term outcome analyses. For mortality, in patients who were discharged from the ED, we defined the follow-up period for mortality as 6-months after the date of study enrollment, and in patients who were hospitalized during the index visit, we defined the follow-up period as 6-months after hospital discharge. Information on mortality was collected from electronic medical records and state death records. We did not collect information on cause of death.

Analysis

Sociodemographic and clinical variables are presented using descriptive statistics and compared by delirium status according to the reference standard CAM rating. We assessed the sensitivity, specificity, positive and NPV and positive and LR- of the FAM-CAM compared to the reference standard CAM rating, and examined the results stratified by dementia status. Classification of FAM-CAM assessments corresponded to the following: *true positives* (TP) were defined as scoring positive on the FAM-CAM and the reference standard CAM; *false positives* (FP) were defined as scoring positive on the FAM-CAM and negative on the CAM; *true negatives* (TN) were defined as scoring negative on the FAM-CAM and the reference standard CAM; *false negatives* (FN) were defined as scoring negative on the FAM-CAM and positive on the CAM.

To examine the association between the FAM-CAM and long-term clinical outcomes, we modeled repeat ED visits, hospital admissions and mortality over 6-months using logistic regression and adjusting for age, sex, IQCODE score and Charlson score. The covariates were chosen a priori.

RESULTS

Characteristics of patients

A total of 108 patient-family member dyads were enrolled in this study. Twenty eight percent of the patients (n=30) had delirium based on the CAM. Patients were an average of 80 years old, half were male, and the majority were Caucasian (non-white n=2, 2% [Table 1]). Sociodemographic characteristics and comorbidities of patients were similar in patients with and without delirium (ps ≥ 0.06), except for past episode of confusion or delirium, which was more common among patients with delirium than those without (47% vs 6%, p<.001).

Family caregivers were an average of 80 years old, one third were male (28%) and the majority were Caucasian (94%; Table 2). The majority of family caregivers were spouses (40%) or daughters (34%) of patients who had daily contacts with the patient (75%), lived with the patient (52%) and were retired or unemployed (52%). These proportions were similar among family caregivers of patients with delirium versus those without delirium.

Validation of the FAM-CAM

FAM-CAM data in relation to CAM data is presented in Supplementary Table S1 for the overall sample and Supplementary Table S2 and S3 respectively for patients with and without dementia. The FAM-CAM had moderate sensitivity (57%; 95% confidence interval [CI]: 39% - 74%), but higher specificity (83%; 95% CI: 75% - 92%), when compared to the reference standard CAM, and acceptable NPV (83%) (Table 3). The likelihood ratio positive was 3.4 (95% CI: 1.4, 5.4). The majority of the false negatives (n=9 out of 13, 69%) were due to caregivers not identifying inattention on the FAM-CAM.

Among patients with dementia, the FAM-CAM showed higher sensitivity (with dementia, 61%; 95% CI: 41 % - 81% versus without dementia, 43%; 95% CI: 6% - 80%) and lower specificity (with dementia, 74%; 95% CI: 60% - 89% versus without dementia, 91%; 95% CI: 82% - 99%; Table 3) and lower LR+ (with dementia 2.2; 95% CI: 0.7 – 3.6 versus without dementia 5.6 95% CI: −1.1, - 12.3). Again, the majority of false negatives in patients with dementia (n=6 out of 9, 67%) were due to the caregiver not identifying inattention on the FAM-CAM. Negative predictive value was lower in patients with dementia (74%, 95%CI: 60%, 89%) compared to patients without dementia (91%, 95%CI: 82%, 99%).

Clinical Outcomes.

We compared clinical outcomes in the 6-months after enrollment by FAM-CAM status. ED visits and mortality rates within 6 months were significantly higher among patients who screened positive on the FAM-CAM than in those who screened negative (hospital admission: 40% vs. 18%; mortality: 13% vs. 3%; ps<0.05, Table 4). Repeat ED visit in the following 6 months were more common in delirious compared to non-delirious patients, but the results did not reach statistical significance (Table 4). In adjusted models controlling for age, sex, IQCODE, Emergency Severity Index at triage, and Charlson score, patients who had a hospitalization over the next 6 months were more than three times as likely to have had a positive FAM-CAM score than those who did not have a hospitalization (OR = 3.24, 95% CI = 1.2, 8.9) (Table 4). Patients who returned to the ED at 6 months were also more likely to have had a positive FAM-CAM score than those who did not (OR= 1.11, 95% CI = 0.4, 2.8).

DISCUSSION

Family members of older patients in the ED were able to systematically complete a delirium screening tool, the FAM-CAM, independently, without an education session or support from research staff, and correctly rule out delirium in the majority of patients (NPV= 83%). Inattention, which is easily measured at the bedside, was identified as a symptom of delirium that family members have difficulty identifying and was responsible for 66% of family members' missed cases of delirium.[27] In addition, the sensitivity of the FAM-CAM was higher in patients with dementia compared to those without dementia, highlighting the ability of family members to detect delirium manifestations (e.g., acute change) in a population that is challenging to assess in the ED.

Although never in an ED setting, the validity of the FAM-CAM has been previously assessed in three studies with varying results. Among older persons with pre-existing cognitive impairment, Steis et al reported high sensitivity (88%, 95% CI: 47–99) and specificity (98%, 95% CI: 86–100) of the FAM-CAM against the CAM.[15] Similarly, among hospitalised older patients, Martins et al used the Portuguese version of the FAM-CAM and also observed high sensitivity (91%, 95% CI:74–97) and specificity (91%, 95% CI:74–97) against the CAM and against the DSM-IV-TR criteria (sensitivity: 75%, 95% CI:35–95; specificity: 86%, 95% CI:42–99).[19] Finally, in a study conducted by Bull et al among post-knee or hip surgery patients, a Kappa of 0.47 was observed between the FAM-CAM and the CAM.[28] The current study differs from these previous studies in several ways, in particular with regards to the training of family caregivers who completed the FAM-CAM and the blinding of assessors. In the current study, we did not provide any training to family caregivers, since we aimed to test the validity of the FAM-CAM under conditions that would increase the applicability of the results to real-world ED settings. In contrast, both the Steis and Martins teams offered intensive training for family caregivers that would not be practical in an ED setting.[15,19] In the Bull study, family caregivers were trained in the three weeks before their family member's elective surgery, to increase their knowledge of delirium and the use of the FAM-CAM.[28] Another important distinction between our study and the previous validations of the FAM-CAM was our double blinding of ratings of caregivers and research staff. In our study, family caregivers were unaware of the results obtained by the trained interviewer on the CAM and vice-versa. In previous studies, some of the trained interviewers using the CAM were not blinded to the FAM-CAM results and used the results of the FAM-CAM to score specific CAM items, such as acute change. These approaches likely increased agreement between the FAM-CAM and CAM ratings.[15]

There are three existing tools that can be independently completed by family caregivers – the FAM-CAM, the informant Assessment of Geriatric Delirium (I-AGeD) and the Sour Seven.[29–31] A strength of the FAM-CAM is that it allows families to systematically report their observations of features of delirium, as well as to detail when the changes (i.e., whether or not the changes were acute or progressive) began and if they have been getting better or worse (items 8 to 11). These elements are key in differentiating delirium from dementia which is a longstanding conundrum in the emergency setting. The I-AGeD and the Sour Seven tools only include yes/no questions, thereby limiting the information that can be shared between families and the health care team to help differentiate delirium from dementia. As for informant-based tools such as the Single Question in Delirium (SQiD) which asks '*Is this patient more confused than before*', the FAM-CAM has the benefit of including information on additional features of delirium while not adding burden to the clinicians in the ED.[32] The FAM-CAM may be especially helpful in cases when patients present with 'confusion' or altered mental status' as the chief complain associated with the ED visit, common in our cohort, and in patients with dementia where confusion may be part of the patient's baseline. By using the FAM-CAM rather than the SQiD, clinicians may choose to use only information on acute change or more detailed information in the setting of dementia or altered mental status.

Implication for practice and future research

The sensitivity of delirium detection by ED providers may be as low as 20%, and other tools that have been examined, such as the modified Richmond Agitation Sedation Scale, have also demonstrated moderate to low sensitivity in the ED setting (70%; 95% CI: 48%; 85%), especially among patients with dementia (55%; 95% CI: 28%; 79%) and there is no family-member equivalent to augment clinician assessments.[3,33] Although the sensitivity and likelihood ratios of the FAM-CAM were modest, it shows promise in increasing delirium detection if supplemented to current systematic screening strategies suggested in best practice guidelines. Based on the LR+ of 3.4, adding the FAM-CAM as a screening tool would increase detection of delirium by 28% overall.[34] In patients with dementia (LR+2.2), it would increase detection by 20%, and in patients without dementia (LR+5.6) it would increase detection by 35%. Although FAM-CAM screening would require approximately an hour of staff training and additional per-patient time to distribute the FAM-CAM to families and interpret the results, it is a relatively simple tool and interpretation is quick and straightforward since the FAM-CAM is designed for use by non-medically trained caregivers. Minimal explanation of the instrument is required as the FAM-CAM measure includes instructions and examples to guide the caregiver. Our results represent the performance of the FAM-CAM without any additional instructions provided to the family when completing the instrument. In the ED we do not envision the FAM-CAM serving as a stand-alone test to screen for delirium. However, in at risk patients in the ED where delirium status was unclear it would be feasible for a nurse or physician to provide a copy of the FAM-CAM to caregivers to complete. Results from the FAM-CAM could then be used by clinicians to inform their own assessments for delirium and subsequent medical decision making. An additional benefit of the FAM-CAM is that it may empower caregivers to assess for delirium in family members outside the hospital and seeking medical care in a timely fashion. Resources for families and caregivers, along with detailed information on delirium, are available on the Hospital Elder Life website (https://www.hospitalelderlifeprogram.org/delirium-instruments) and families requesting additional information could be directed to this resource, minimizing the time required by ED staff.

Limitations

The strengths of this study include the “real world” setting in which the FAM-CAM was tested, maximizing translation of our findings into clinical settings. We over-enrolled patients with a history of dementia allowing us to compare the validity of the FAM-CAM in this group that is clinically challenging and where family assessments may be particularly useful. This study also had several limitations. We excluded non-English speakers, therefore our results cannot be generalized to these groups. In addition, our study was performed in only one ED. Although we used the IQCODE to supplement the medical record, some cases of dementia may have been missed. The majority of patients with dementia presenting to the ED are undiagnosed and there is still no standardized method for cognitive assessment in the ED.[12] We had limited power to detect differences in clinical events (mortality, hospitalization and ED revisit) therefore these results should be interpreted with caution and confirmed in a larger sample. It is also important to note that some re-hospitalizations might have been missed if patient went to a different center. In addition, although we controlled for comorbidity burden and emergency severity at triage, we were limited in controlling for the

severity of patient's clinical state in the ED. Unmeasured confounders such as lower health literacy could have skewed the results by lowering the threshold for both dementia and delirium.[35,36] In addition, we had limited power for analyses of long-term clinical outcomes (hospitalizations, repeat ED visits and death), thus these results should be interpreted with caution. With 30 patients with delirium, the 95%CIs were wide, especially in the stratified analyses. For sensitivity, the confidence intervals for demented and non-demented patients overlap so differences in the sensitivity between these two patient groups should be interpreted with caution. With so few hospital admissions and deaths, these results should also be interpreted with caution and need replication.[37] Finally, a diagnostic bias might have skewed estimated sensitivity/specificity. We used the CAM as the reference standard, which is widely recognized in delirium research, but has not been specifically validated in the ED setting. However, the gold standard for delirium diagnosis remains a medical diagnosis by an expert, thus our results are limited by the possibility of an imperfect gold standard bias.[38]

Conclusions

In an ED sample that included patients with and without dementia, the FAM-CAM was found to have the potential to aid in the identification of patients with delirium. This tool may be useful to implement as part of the screening of mental status in older patients in the emergency department to supplement other screening tools used by clinicians. In addition it may help to educate and motivate caregivers to assess for delirium onset outside the hospital setting. Systematically involving family members in delirium screening would allow clinicians to tap into a rich resource of information in an efficient and structured manner, facilitating rapid identification of delirium and optimized patient outcomes.

LEGEND

Supplementary Table S1 presents the FAM-CAM data in relation to the CAM data for the overall sample, Supplementary Table S2, for patients with dementia and Supplementary Table S3 for patients without dementia.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Sociodemographic and Clinical Characteristics of Patients Stratified by CAM Delirium Status

Characteristics	**Overall** ***(N=108)***	**CAM positive** ***Delirium (N=30)***	**CAM negative** ***No Delirium (N=78)***	***P* value**
Sociodemographic				
Age, mean (SD) *years*	80.3 (±7)	82.3 (±6.3)	79.6 (±7)	0.06
Sex, *male*	54 (50)	17 (57)	37 (47)	0.39
Race, *Caucasian*	106 (98)	30 (100)	76 (97)	0.38
Marital Status [a]				
Married	59 (58)	18 (64)	41 (55)	0.75
Widowed	30 (29)	6 (21)	24 (32)	
Divorced or Separated	7 (7)	2 (7)	5 (7)	
Single/never married	6 (6)	2 (7)	4 (5)	
Clinical Characteristics				
Chief Complaint				
Altered Mental Status	20 (19)	12 (40)	8 (10)	
Chest Pain	18 (l7)	4 (13)	14 (18)	
Shortness of breath	9 (8)	0	9 (12)	
Weakness	7 (6)	2 (7)	5 (6)	0.01
Syncope	6 (6)	3 (10)	3 (4)	
Abdominal Pain	4 (4)	0	4 (5)	
Other	44 (41)	9 (30)	35 (45)	
Emergency severity at Triage [b]				
2	46 (44)	11 (39)	35 (46)	0.66
3	57 (55)	17 (61)	40 (51)	
4 or more	1 (1)	0	1 (1)	
Past episode of confusion or delirium	9 (19)	7 (47)	2 (6)	0.001
Pre-existing comorbidities				
Charlson Comorbidity Index [c] *mean (SD)*	3.2 (±2.2)	3.4 (±2.6)	3.2 (±2)	0.57
IQCODE score [d] *mean (SD)*	4.2 (±4.3)	3.9 (±.7)	4.4 (±.5.1)	0.66
Stroke/CVA	15 (14)	3 (10)	12 (15)	0.47
Depression	32 (30)	9 (30)	23 (20)	0.96
Anxiety	18 (17)	3 (10)	15 (19)	0.25
Coronary heart disease	49 (46)	13 (45)	36 (46)	0.90
Diabetes	36 (33)	12 (40)	24 (31)	0.36
Hypercholesterolemia and/or hyperlipidemia	71 (66)	19 (63)	52 (67)	0.74
Hypertension	94 (87)	27 (90)	67 (85)	0.57
Myocardial Infarction	20 (19)	4 (13)	16 (21)	0.39
Peripheral Vascular Disease	9 (8)	4 (13)	5 (6)	0.24
Chronic Lung Disease	20 (19)	6 (20)	14 (18)	0.81
Liver disease	9 (8)	3 (10)	6 (8)	0.70

Characteristics	**Overall** ***(N=108)***	**CAM positive** ***Delirium (N=30)***	**CAM negative** ***No Delirium (N=78)***	***P* value**
Renal disease	34 (32)	9 (30)	25 (32)	0.84

Note. Values are n (%) unless otherwise noted

[a] Missing n=6

[b] Missing n=4

[c] Charlson Comorbidity Index. [18]

[d] IQCODE score is the Informant Questionnaire on Cognitive Decline in the Elderly score.[16] A score of 3.5 or higher reflected dementia.

Table 2.

Demographic and Clinical Characteristics of Family Caregivers by patient CAM delirium status

Characteristics	**Overall** ***(N=108)***	**CAM positive** ***Delirium (N=30)***	**CAM negative** ***No Delirium (N=78)***	***P* value**
Age, *mean years (SD)*	80.3 (±6.9)	80.8 (±6.5)	80.1 (±7.1)	0.64
Sex [a], *male*	30 (28)	9 (31)	21 (27)	0.78
Race [b], *Caucasian*	101 (94)	29 (100)	72 (9)	0.67
Education [a]				
≤ Middle school	5 (5)	2 (7)	3 (10)	0.29
High school	17 (16)	5 (17)	12 (15)	
≥ College	83 (78)	21 (72)	56 (72)	
Relationship with patient [b]:				
Spouse	43 (40)	13 (45)	30 (39)	0.87
Son	15 (14)	5 (17)	10 (13)	
Daughter	37 (34)	8 (28)	29 (37)	
Other [c]	11 (10)	3 (1)	7 (9)	
Frequency of contact with patient:				
Daily or more	81 (76)	22 (76)	59 (76)	0.82
Weekly	23 (22)	6 (21)	17 (22)	
Monthly	2 (2)	1 (4)	1 (1)	
Living with the patient	55 (52)	15 (52)	40 (53)	0.82

Note. Values are n (%) unless otherwise noted

[a] missing n=2

[b] missing n=1

[c] Other includes daughter or son in law or friends.

Table 3.

Performance characteristics of the FAM-CAM Overall and Stratified by Dementia

	LR+ (95% CI)	LR− (95% CI)	Sensitivity	Specificity	PPV	NPV	False Negative[a]
				Percentage (95% CI)			*n (%)*
Overall							
FAM-CAM (N=108)	3.4 (1.4, 5.4)	0.5 (0.3, 0.7)	56.7 % (39%, 74%)	83.3 % (75%, 92%)	56.7% (37%, 75%)	83.3% (73%, 91%)	13 (12)
Stratified by dementia							
Dementia (N=55)	2.2 (0.7, 3.6)	0.6 (0.3, 0.9)	60.8% (41%, 81%)	74.3% (59%, 88%)	60.8% (41%, 81%)	74.3% (60%, 89%)	9 (16)
No Dementia (N=53)	5.6 (−1.1, 12.3)	0.6 (0.2, 0.9)	42.8% (6%, 80%)	90.7% (82%, 99%)	42.8% (6%, 80%)	90.7% (82%, 99%)	4 (8)

Note:

[a]with FAM-CAM against CAM, FAM-CAM: Family Confusion Assessment Method, CAM: Confusion Assessment Method, PPV: Positive predictive value, NPV: Negative predictive value

Table 4.

Clinical outcomes in the 6-months after study enrollment by FAM-CAM delirium status.

Characteristics	**Overall** ***(N=108)***	**FAM-CAM** ***Positive (N=30)***	**FAM-CAM** ***Negative (N=78)***	**Adjusted OR*** ***(95% Confidence Interval)***
Hospital admission	26 (24)	12 (40)	14 (18)	3.24 (1.2, 8.9)
ED Visit	42 (39)	13 (43)	29 (37)	1.11 (0.4, 2.8)
Mortality	6 (6)	4 (13)	2 (3)	6.24 (0.9, 41.0)

Note. All values are n (%) unless otherwise noted.

* Adjusted for age, sex, Charlson Comorbidity Index score, Emergency Severity Index score at triage, Informant Questionnaire on Cognitive Decline in Elders (IQCODE) score.