The Journal of Emergency Medicine, Vol. 57, No. 1, pp. 59–65, 2019
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0736-4679/$ - see front matter

https://doi.org/10.1016/j.jemermed.2019.02.007

Selected Topics: Psychiatric Emergencies

VALIDATION OF THE O3DY FRENCH VERSION (O3DY-F) FOR THE SCREENING OF COGNITIVE IMPAIRMENT IN COMMUNITY SENIORS IN THE EMERGENCY DEPARTMENT

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☐ **Abstract—Background: It is recommended that older patients undergo systematic mental status screening when presenting to the emergency department (ED). However, the tools available are not necessarily adapted to the ED environment, therefore, quicker and easier tools are needed. Objectives: The purpose of this study is to validate the Ottawa 3DY-French (O3DY-F) Scale as a screening tool for delirium and cognitive impairment in a French-speaking cohort. Method: This multicenter prospective study was conducted in four hospitals across the province of Quebec. Inclusion criteria were: age ≥ 65 years, ED stay ≥ 8 h, awaiting admission to a care unit, and independent or semi-independent in their daily living activities. Cognitive status was assessed during the initial interview using the Telephone Interview for Cognitive Screening-modified (TICS-m) and the O3DY-F scale. Comparisons were made between the O3DY-F and the TICS-m and Confusion Assessment Method (CAM) to assess the sensitivity and specificity of the O3DY-F for the detection of cognitive impairment and delirium. Results: A total of 313 patients were included in this study, 139 of which had a positive O3DY-F. When compared with the CAM, the O3DY-F had a sensitivity of 84.2% (95% confidence interval [CI] 60.4–96.6) and a specificity of 58.2% (95% CI 52.3–63.9) for the detection of prevalent delirium. The O3DY-F had a sensitivity of 76.2% (95% CI 66.7–84.8) and a specificity of 67.6% (95% CI 61.0–73.6) for cognitive impairment (defined as a TICS-m < 27). Conclusion: The O3DY-F is a useful and effective tool to screen for delirium and undetected cognitive impairment among a French-speaking cohort in the ED.** **© 2019 Elsevier Inc. All rights reserved.**

☐ **Keywords—cognitive impairment; validation; screening tool; seniors; emergency department**

INTRODUCTION

Cognitive impairment, defined as a change in level of consciousness or cognitive ability, is prevalent and

RECEIVED: 23 July 2018; FINAL SUBMISSION RECEIVED: 7 February 2019;
ACCEPTED: 10 February 2019

often unrecognized in geriatric emergency department (ED) patients (1). This broad term generally includes delirium, different stages of dementia, and mild cognitive impairment (1). Older ED patients are at increased risk, as the incidence of cognitive impairment increases with age.

According to the *Diagnostic and Statistical Manual of Mental Disorders*, 5th edition, delirium is an acute and temporary neurocognitive disorder that can alter attention, orientation, perception, and level of consciousness (2). It is described as a severe condition, which can cause long-term cognitive and functional decline (3,4). It is generally caused by an underlying condition and should be detected and managed quickly to avoid potentially negative outcomes, including an increased early mortality rate (5,6). Cognitive impairment on the other hand, implies not only functional impairment, but can alter language, thinking, learning, and memory (2).

Both delirium and cognitive impairment are known to negatively impact patients, increasing the risk of unplanned ED visits, prolonged length of stay, hospitalization, and death (7). These conditions also have an impact on ED health professionals' ability to collect an accurate patient history and on the patient's ability to understand and follow postdischarge instructions (7).

Current geriatric ED guidelines recommend routine cognitive screening for patients aged 65 years and over that present to the ED (8,9). However, overcrowding and lack of resources in the ED setting make this recommendation difficult to follow. Furthermore, most validated screening tools for cognitive impairment, such as the Mini-Mental State Examination (MMSE), the Montreal Cognitive Assessment, and the Telephone Interview for Cognitive Screening-modified (TICS-m), require specific training and are too time-consuming for this fast-paced environment (10–12). Existing delirium screening tools, such as the Confusion Assessment Method (CAM) and its many variations have similar issues (13–16). As a result, it is estimated that between 50% and 75% of patients with delirium are unrecognized (17,18).

The Ottawa 3DYScale (O3DY: date, day, dlrow–world spelled backwards, year) was identified as a quicker and useful screening tool and has demonstrated excellent sensitivity and a moderate specificity when compared with the MMSE in older ED patients (19). Carpenter et al. concluded that the O3DY is a brief and practical method to assess geriatric cognitive impairment (1). The O3DY was derived and validated in English (18,19). Previous studies have stressed the importance of validating screening tools in other languages, as translation may impact overall results (20). The main objective of this study was to validate the O3DY-French version (O3DY-F) screening tool for cognitive impairment in a French-speaking ED patient population.

MATERIALS AND METHODS

Study Design and Setting

This multicenter prospective study was a planned substudy of the INcidence and impact measurement of DElirium induced by ED stay (INDEED) project, which was conducted in four EDs (two university-affiliated Level I trauma centers and two regional hospitals) across the province of Quebec: the Hôpital de l'Enfant-Jésus, the Hospitalier de l'Université Laval (CHUL); the Centre Hospitalier de Lanaudière and the Centre Hospitalier de Trois-Rivières (21). The Comité d'éthique du CHU de Québec-Université Laval acted as the centralized research ethics board and approved this study and consent was obtained for each study participant. Patient records were anonymized prior to analysis.

Selection of Participants

The study was conducted between February and May 2016. Inclusion criteria were: 1) age ≥ 65 years; 2) an ED length of stay ≥ 8 h; 3) awaiting admission to a care unit; and 4) independent or semi-independent for the activities of daily living (ADL). Patients were excluded for the following reasons: 1) had an unstable medical condition that could lead to intensive care; 2) inability to communicate in French; 3) unable to consent; 4) history of a severe psychiatric condition (e.g., schizophrenia, severe depression, or bipolar disorder); and 5) were living in a nursing home or another long-term care center. As described in the INDEED study, an 8-h cutoff was used, as upcoming guidelines from the Direction Nationale des Urgences will be recommending an ED length of stay for older adults < 8 h (21).

Data Collection and Processing

Research assistants (RA) with a background in health care were trained by an experienced member of the Centre d'Excellence sur le Vieillissement de Québec and by the study coordinator (22). They received a detailed training manual and personalized field training with an experienced research nurse. After their 8-h exposure to the ED environment, RAs screened patients for eligibility, obtained consent, and conducted the initial interview.

During this initial interview in the ED, patients' cognitive status was assessed using the CAM, the TICS-m, and the O3DY-F. The CAM is a standardized and structured instrument used to screen for delirium (23). It has shown a high sensitivity (86%) and specificity (100%) when performed by an RA (24). The sensitive method was used to interpret the CAM criteria for delirium (25,26). A CAM is positive according to the sensitive method if the following is present: 1) acute onset *or* fluctuation *and*

2) inattention, plus either 3) disorganized thinking *or* 4) altered level of consciousness (26). The TICS-m is a 50-point test developed to screen cognitive impairment and can be administered either in person or by telephone (12). In this study, a score cut-off < 27 was considered positive for cognitive impairment (27).

The O3DY, a simple four-item screening tool, was designed to quickly identify elderly patients at higher risk for cognitive impairment (1). The test consists of the following questions: 1) What *d*ay of the week is it? 2) What is today's *d*ate? 3) Spell WORL*D* backwards and 4) What is the *y*ear? Each correct answer is awarded one point and any incorrect answer constitutes a positive O3DY screen for cognitive impairment. The O3DY was converted into the O3DY-F by our research team. RAs were blinded to the CAM, TICS-m, and O3DY-F scores, as the total scores were calculated during data analysis.

An experienced research nurse and a medical student reviewed the study participants' medical records and collected medical and sociodemographic information using a standardized data collection form. The burden of comorbidities was quantified using the Charlson Risk Index and the severity of disease was classified using the Acute Physiology and Chronic Health Evaluation score (28,29). The Older American Resources and Services, a 28-point scale assessing the patients' ability to perform activities of daily living, was used to determine the overall functional status of our study participants (30).

Outcome Measures

The primary outcome was to determine the test characteristics (sensitivity, specificity, positive predictive value [PPV], negative predictive value [NPV]) of the O3DY-F to detect: 1) cognitive impairment (TICS-m as reference standard); 2) delirium (CAM as reference standard); and 3) cognitive impairment or delirium.

Primary Data Analysis

Patient demographics are described using means and frequency tables where appropriate. The sensitivity, specificity, and predictive values for the O3DY-F were calculated for three outcomes: prevalent delirium as defined by the initial CAM, cognitive impairment as measured by the TICS-m, and a combination of either delirium or cognitive impairment. Exact binomial confidence intervals (CI) are obtained for these quantities. The TICS-m scores were adjusted for patients' level of education, according to Gallo and Breitner's algorithm (27,31).

Table 1. Study Sample Description

	n = 313
Age, mean (SD)	76.8 (7.5)
Male, %	147 (47.0)
Level of education	
Elementary school (0 to 7 years)	81 (25.9)
High school (8 to 12 years)	134 (42.8)
Cegep or college (13 to 15 years)	44 (14.1)
University (16 + years)	54 (17.2)
TICS-m corrected for education, mean (SD)	30.8 (5.6)
TICS-m ≤27	84 (27.2)
Charlson, mean (SD)	1.85 (2.0)
APACHE, mean (SD)	12.3 (7.7)
OARS, mean (SD)	25.7 (2.5)
Known mild dementia,* %	10 (3.2)
Prevalent delirium, %	19 (6.0)

TICS-m = Telephone Interview for Cognitive Screening–modified; APACHE = Acute Physiologic Assessment and Chronic Health Evaluation; OARS = Older American Resources and Services scale.
* According to patient's medical record.

RESULTS

Characteristics of Study Subjects

A total of 2917 patients were screened across centers (Figure 1), and 313 patients were included, 166 of which were women (53%) (Table 1). Mean age was 76.8 years (SD 7.5). Ten (3%) of these participants had a previous history of dementia in their medical record. Nineteen participants (6%) were CAM positive for delirium and 84 (27.2%) had an adjusted TICS-m score lower than 27.

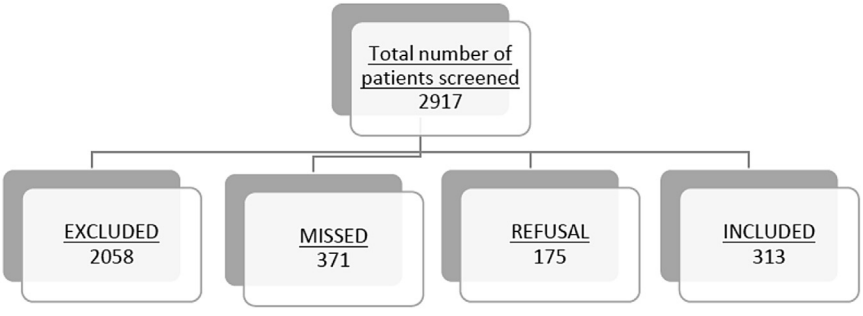

Figure 1. Flowchart.

Table 2. Predictive Capacities of the O3DY-F for Cognitive Impairment*

	TICS (>27)	TICS (≤27)	Total
O3DY-F (4/4)	152 (68%)	20 (24%)	174
O3DY-F (0–3/4)	73 (32%)	64 (76%)	139
Total	225	84	313

Psychometric properties	Rate	95% CI
Sensitivity	76.2%	66.7–84.8
Specificity	67.6%	61.0–73.6
Positive predictive value	46.7%	38.1–55.4
Negative predictive value	88.4%	82.6–92.8
Positive likelihood ratio	2.4	
Negative likelihood ratio	0.4	

O3DY-F = Ottawa 3 Day-Year Scale–French version; TICS = Telephone Interview for Cognitive Screening; CI = confidence interval.
* 4 missing data.

Table 4. Psychometric Values for Combined Measures

	Negative CAM or TICS > 27	Positive CAM or TICS ≤ 27	Total
O3DY-F (4/4)	153 (68%)	21 (24%)	174
O3DY-F (0–3/4)	71 (32%)	68 (76%)	139
Total	294	89	313

Psychometric properties	Rate	95% CI
Sensitivity	76.4%	66.2–84.8
Specificity	68.3%	61.8–74.3
Positive predictive value	48.9%	40.3–57.5
Negative predictive value	87.9%	82.1–92.4
Positive likelihood ratio	2.4	
Negative likelihood ratio	0.3	

CAM = Confusion Assessment Method; TICS = Telephone Interview for Cognitive Screening; O3DY-F = Ottawa 3 Day-Year Scale–French version; CI = confidence interval.

Main Results

The O3DY-F was positive for 139 (44%) participants. Among these patients, 64 participants had a low TICS-m score (<27), indicating possible cognitive impairment (Table 2). When compared with the TICS-m, the O3DY-F demonstrated a sensitivity of 76.2% (95% CI 66.7–84.8) and a specificity of 67.6% (95% CI 61.0–73.6) for cognitive impairment, with a PPV of 46.7% (95% CI 38.1–55.4) and an NPV of 88.3% (95% CI 82.6–92.8). Positive and negative likelihood ratios were 2.4 and 0.4, respectively.

Among the same 139 patients with a positive O3DY-F, 16 had a positive CAM for delirium (Table 3). When detecting prevalent delirium as defined by the CAM, the O3DY-F demonstrated a sensitivity of 84.2% (95% CI 60.4–96.6) and a specificity of 58.2% (95% CI 52.3–63.9) for prevalent delirium, with a PPV of 11.5% (95% CI 6.8–18.0) and an NPV of 98.3% (95% CI 95.0–99.6). Positive and negative likelihood ratios were 2.0 and 0.3, respectively.

Table 3. Predictive Capacities of the O3DY-F for Prevalent Delirium

	Negative CAM	Positive CAM	Total
O3DY-F (4/4)	171 (58%)	3 (16%)	174
O3DY-F (0–3/4)	123 (42%)	16 (84%)	139
Total	294	19	313

Psychometric properties	Rate	95% CI
Sensitivity	84.2%	60.4–96.6
Specificity	58.2%	52.3–63.9
Positive predictive value	11.5%	6.8–18.0
Negative predictive value	98.3%	95.0–99.6
Positive likelihood ratio	2.0	
Negative likelihood ratio	0.3	

O3DY-F = Ottawa 3 Day-Year Scale–French version; CAM = Confusion Assessment Method; CI = confidence interval.

Within the same sample of patients with a positive O3DY-F, 68 had either cognitive impairment (TICS-m < 27) or a prevalent delirium (positive CAM) (Table 4). For the detection of cognitive impairment or delirium, the O3DY-F demonstrated a sensitivity of 76.4% (95% CI 66.2–84.8) and a specificity of 68.3% (95% CI 61.8–74.3), with a PPV of 48.9% (95% CI 40.3–57.5) and an NPV of 87.9% (95% CI 82.1–92.4). Positive and negative likelihood ratios were 2.4 and 0.3, respectively. The O3DY took as little as 30 s to 2 min to administer.

DISCUSSION

This study is the first to evaluate the performance of the French version of the O3DY (O3DY-F) screening instrument to detect the presence of cognitive impairment. The high NPV for cognitive impairment and delirium suggests that, in the absence of errors to the O3DY-F, it is quite unlikely that there is any cognitive impairment. A perfect score to the O3DY-F suggests that the patient may not need further testing for the presence of delirium or cognitive impairment. In the presence of one or more errors, patients should undergo further cognitive testing, using instruments such as the CAM and TICS-m. The O3DY-F does not replace more detailed assessments of cognitive impairment; however, it may potentially save valuable time in the overcrowded and fast-paced ED environment. The moderate sensitivity of the O3DY-F for cognitive impairment and delirium suggests this instrument is suitable for use in the ED, as opposed to clinician gestalt.

Three other studies have used the O3DY with older patients in the ED setting. Carpenter et al., Wilding et al.,

and Barbic et al. assessed the capacity of the O3DY to predict the presence of cognitive impairment (1,7,19). Sensitivity ranged between 71.4% and 95%, and specificity ranged between 51% and 73%. The sensitivity of the O3DY-F measured in the present study (76%) performs similarly to prior studies using the original English version. Unfortunately, these studies did not report negative and positive predictive value, making a complete comparison difficult.

To our knowledge, this is the first study to assess the capacity of the French O3DY (O3DY-F) to predict the presence of delirium, using the CAM as a reference standard. The RAs who administered the O3DY-F required minimal training. The O3DY-F can be performed by a wide variety of ED health care professionals, which may help improve the detection of cognitive impairment to allow for earlier interventions.

We believe that the present study has a significant number of strengths that make our results interesting. For instance, the O3DY-F was administered by RAs with minimal training with regard to use of the tool, demonstrating its ease of use by any member of the health care team. The O3DY-F is easy, rapid to perform, and easy to interpret, as having less than a perfect score would be indicative of an abnormal test and the need for a more comprehensive mental evaluation. These more detailed assessments, such as with the CAM or the TICS-m, may then be reserved for a more appropriate smaller subset of patients. The O3DY-F could be an effective screening tool to be used by triage nurses in the ED, which could improve the identification of cognitive impairment and improve patient management (19). Cognitive impairment is known to have a negative impact on the patient's trajectory of care such as repeat ED visits, hospitalization, and death (7). Furthermore, delirium compromises patient safety and health (32). Geriatric competencies insist on the development of identification and treatment of the cognitive impairment in the ED (7).

It was pointed out that administrating multiple tests and questionnaires could decrease the performance of the already ill and stressed geriatric patients in the busy ED environment (1). In this sense, the O3DY is ideal for this population.

Limitations

Some methodological limitations must be recognized in the present study. First, our study population may not be representative of the ED population, as only community-dwelling older patients were included. We excluded people with an ED exposure of < 8 h, those who were not admitted to a care unit, and older adults who were dependent for their ADLs. These exclusion criteria may have led to a fewer number of cases with cognitive impairment or delirium. We observed a low rate of prevalent delirium (6%) and cognitive impairment (13%). These low ratios could induce a bias that may have a possible impact on our predictive values. Furthermore, we used the TICS-m instead of a more recognized reference for the screening of cognitive impairment within the ED literature, such as the MMSE. This could have decreased the validity of our results. However, considering the design of the original study, the TICS-m was the most appropriate tool (21). Even though this test could be a really useful tool for detection, it does not differentiate between dementia, delirium, or depression (19). Stress, fatigue, or somnolence and even exposure to the ED environment, could also have had an impact on the overall results for any of the four questions, even though the O3DY is designed to be used in the stressful ED environment to assess ill older patients.

CONCLUSION

In summary, among a French-speaking ED cohort, a normal O3DY-F screen suggests the absence of any cognitive impairment or altered mental status. These patients do not require further detailed assessments for the presence of delirium or cognitive impairment. The O3DY-F demonstrates an acceptable sensitivity to detect cognitive impairment and may be administered by a variety of ED health care professionals. For example, this tool can be administered by ED triage nurses, which may allow for earlier interventions to positively affect the patient's care trajectory. Furthermore, the O3DY-F possesses all of the attributes of an ideal ED screening tool: no equipment required, rapid, and easy to administer and interpret. In the future, it would be interesting to evaluate the predictive capacity of the O3DY-F in a more general population, that is, a population more dependent in their ADLs and those with an ED stay < 8 h.

Acknowledgments—We would like to thank Suzy Lavoie and the research assistants who recruited participants for this study. This study was funded by the Fond Québécois de Recherche en Santé (FQRS 29307).

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ARTICLE SUMMARY

1. Why is this topic important?

Current geriatric emergency department (ED) guidelines recommend that older patients consulting to the ED should undergo routine screening for cognitive impairment. Providing ED health care professionals with quick and easy-to-use validated screening tools is therefore of utmost importance. A positive external validation of the Ottawa 3DY (O3DY) would increase its utility in different ED populations.

2. What does this study attempt to show?

The purpose of this study was to validate the O3DY's efficiency to screen for cognitive impairment and delirium compared with other screening tools (the Telephone Interview for Cognitive Screening-modified [TICS-m] and the Confusion Assessment Method [CAM]) in a Francophone population.

3. What are the key findings?

The O3DY-F presents an 84.2% (95% confidence interval [CI] 60.4–96.6) sensitivity and a 58.2% (95% CI 52.3–63.9) specificity for the detection of prevalent delirium, compared with the CAM. A sensitivity of 76.2% (95% CI 66.7–84.8) and a specificity of 67.6% (95% CI 61.0–73.6) were obtained for cognitive impairment as defined by the TICS-m (<27). Therefore, the O3DY-F could be a useful and effective tool to screen for delirium and undetected cognitive impairment in a French-speaking cohort.

4. How is patient care impacted?

Our results show that a patient that has a perfect O3DY-F score is unlikely to suffer from undetected cognitive impairment. This avoids unnecessary testing and delays in ED patient care. Those who make one mistake or more on this test could benefit from further detailed assessments, which may lead to better patient care and management.